BIRLA INSTITUTE OF TECHNOLOGY
A Deemed University u/s 3 of UGC Act, 1956
MESRA, RANCHI – 835 215 (INDIA)

Phone : (EPBX) 0651 – 2275444/2275896, 2276002/2276006 FAX : 0651 – 2275401/2275351 Website : www.bitmesra.ac.in

Metric 1.1.3

Department/Section: Computer Science & Engineering

1.1.3 - Average percentage of courses having focus on employability/entrepreneurship/skill development during the last five years

Year of offering the course	Program code	Program name	Name of the Course	Course Code	Year of introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
2014-15	BE0106	B.E. (CSE)	Fundamentals of Data Structure	CS2301	2011	Lectures/Employability/ Skill development
2014-15	BE0106	B.E. (CSE)	Object Oriented Programming using Java	CS 3005	2011	Lectures/Skill Development
2014-15	BE0106	B.E. (CSE)	Digital Electronics	EC 3201	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Discrete Mathematical Structures	CS 4101	2011	Lectures/Skill Development
2014-15	BE0106	B.E. (CSE)	Design and Analysis of Computer Algorithms	CS 6101	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Probability, Statistics and Numerical Techniques	MA 4109	2011	Lectures/ Skill Development
2014-15	BE0106	B.E. (CSE)	Database Management Systems	CS 4205	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Computer System Architecture	CS 4109	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Operating System	CS 4107	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Foreign Languages	HU400 1	2011	Lectures/ Skill Development
2014-15	BE0106	B.E. (CSE)	Biological Sciences	BT 3021	2011	Lectures/ Skill Development
2014-15	BE0106	B.E. (CSE)	Formal Language & Automata Theory	CS 5101	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Artificial Intelligence and Expert Systems	CS 8101	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Compiler Design	CS 6105	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Computer Graphics and Multimedia	CS 6011	2011	Lectures/Employability/ Skill development
2014-15	BE0106	B.E. (CSE)	Software Engineering	CS 6109	2011	Lectures/ employability
2014-15	BE0106	B.E. (CSE)	System Programming	CS 6103	2011	Lectures/ employability
2014-15	BE0106	B.E. (CSE)	Soft Computing	CS 5105	2011	Lectures/Employability

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2014-15	BE0106	B.E. (CSE)	Project	CS 7014	2011	Project/Skill development
2014-15	BE0106	B.E. (CSE)	Data Mining & Data Warehousing	CS 8031	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Free/Open Source software	CS 7029	2011	Lectures/Employability/ skill development
2014-15	BE0106	B.E. (CSE)	Optimization Techniques	CS 7117	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Cryptography and Network Security	CS 7121	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Information Security and Assurance	CS 7029	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Principles of Programming Languages	CS 7101	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Digital Image Processing	CS 7107	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Mobile & Cellular Communication	EC 8201	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Digital Signal Processing	EE 4207	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Multimedia Technology	CS 7033	2011	Lectures/Skill Development
2014-15	BE0106	B.E. (CSE)	Parallel & Distributed Systems	CS 8029	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Natural Language Processing	CS 8111	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Pattern Recognition	CS 8121	2011	Lectures/Employability
2014-15	BE0106	B.E. (CSE)	Computational Geometry	CS 8113	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Fundamentals of Data Structures	CS 2301	2011	Lectures/Employability/ Skill development
2014-15	BE0206	B.E. (IT)	Discrete Mathematics and Graph Theory	IT 3021	2011	Lectures/Skill Development
2014-15	BE0206	B.E. (IT)	Java Programming	IT 3023	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Computer Organization and Architecture	IT 3025	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Database System Concepts	IT 4021	2011	Lectures,Project/Emplo yability
2014-15	BE0206	B.E. (IT)	Operating System Concepts	IT 4023	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Theory of Computations	IT 4025	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Scientific Computing	IT 4027	2011	Lectures/Skill Development

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2014-15	BE0206	B.E. (IT)	Data Communications	IT 5021	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Software Engineering Principles	IT 5023	2011	Lectures, Internship, Project/Employability
2014-15	BE0206	B.E. (IT)	Principles of Soft Computing	IT 5025	2011	Lectures, Project /Employability
2014-15	BE0206	B.E. (IT)	Design of Computer Algorithms	IT 5027	2011	Lectures/ Employability
2014-15	BE0206	B.E. (IT)	Communication Theory	IT 6021	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Computer Network and Security	IT 6023	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Information & Coding Theory	IT 6025	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Optimization Techniques	IT 6027	2011	Lectures, Project/ Skill development
2014-15	BE0206	B.E. (IT)	Data Mining Concepts and Techniques	IT 7021	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Parallel & Distributed Computing	IT 7041	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Compiler Design	IT 7043	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Simulation & Modeling	IT 7023	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Artificial Intelligence	IT 7025	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Digital Image Processing	IT 7027	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Object Oriented Design	IT 7029	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	System Programming	IT 7031	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Web Technology	IT 7033	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	PROJECT	IT 8020	2011	Project/ Skill Development
2014-15	BE0206	B.E. (IT)	Enterprise Resource Planning	IT 8025	2011	Lectures/Enterpreneurship
2014-15	BE0206	B.E. (IT)	Decision Support Systems	IT 8027	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Embedded Systems	IT 8029	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Pattern Recognition	IT 8031	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Computing & Complexity Theory	IT 8033	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Software Reliability & Testing	IT 8035	2011	Lectures/Employability

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2014-15	BE0206	B.E. (IT)	Distributed Database System	IT 8037	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Computer Graphics & Multimedia	IT 8039	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Information System Project Management	IT 8041	2011	Lectures/Enterpreneurship
2014-15	BE0206	B.E. (IT)	Distributed Systems	IT 8043	2011	Lectures/Enterpreneurship
2014-15	BE0206	B.E. (IT)	Advance Computer Graphics	IT 8045	2011	Lectures/Enterpreneurship
2014-15	BE0206	B.E. (IT)	Real Time Systems	IT 8047	2011	Lectures/Enterpreneurship
2014-15	BE0206	B.E. (IT)	Modern Telecommunication Systems	IT 8049	2011	Lectures/Employability
2014-15	BE0206	B.E. (IT)	Neural Networks & Applications	IT 8051	2011	Lectures/Skill Development
2014-15	BE0206	B.E. (IT)	E-Commerce	IT 8053	2011	Lectures/Enterpreneurship
2014-15	MT0106	M.TECH (CSE)	Database Modeling and Design	TCS1001	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Advanced Operating System Concepts	TCS1025	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Probability and Statistical Analysis	MSE1005	2011	Lectures/Skill Development
2014-15	MT0106	M.TECH (CSE)	Object Oriented Modeling and Design	MSE1003	2011	Lectures/Enterpreneurship
2014-15	MT0106	M.TECH (CSE)	Data and Computer Communication Networks	TCS2001	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	High Performance Computer Architecture	TCS2039	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Computability and Complexity Theory	MSE1023	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Digital Signal Processing	MEE1003	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Real Time Systems	MSE1025	2011	Lectures/Employability

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2014-15	MT0106	M.TECH (CSE)	Digital Image Processing Techniques	MEE1003	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Graph Theory & Applications	TCS1027	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Software Project Management	MSE2005	2011	Lectures/Enterpreneurship
2014-15	MT0106	M.TECH (CSE)	Pattern Recognition and Image Analysis	TCS2021	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Computational Geometry	TCS2023	2011	Lectures/Skill Development
2014-15	MT0106	M.TECH (CSE)	Mobile Computing	TCS2025	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Grid Computing	TCS2027	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Interconnection Networks	TCS2033	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Computer Communication Networks	MEC2009	2011	Lectures/Employability
2014-15	MT0106	M.TECH (CSE)	Design and Analysis of Parallel Algorithms	TCS2037	2011	Lectures/Employability
2014-15	MT0315	M.TECH (IT)	Computability & Complexity Theory	TIT 1101	2012	Lectures/Employability
2014-15	MT0315	M.TECH (IT)	Advanced Database	TIT 1003	2012	Lectures/Employability
2014-15	MT0315	M.TECH (IT)	Computational Intelligence	TIT 1005	2012	Lectures/Employability
2014-15	MT0315	M.TECH (IT)	Information Theory	TIT 2001	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Communication Theory	TIT 2003	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Data Compression and Data Hiding	TIT 2005	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Stochastic Processes and Simulation	TIT 1011	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Computer Algorithms	TIT 1013	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Cryptography	TIT 1015	2012	Lectures/Employability

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2014-15	MT0318	M.TECH (IT)	Mobile and Wireless Network	TIT 1017	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Mobile Computing	TIT 1019	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Cluster & Grid Computing	TIT 1021	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Distributed Computing	TIT 1023	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Speech Processing	TIT 1025	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Data Mining & Warehousing	TIT 1027	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Human Computer Interaction	TIT 1029	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Digital Signal Processing	TIT 1031	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Soft Computing	TIT 1033	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Wireless Adhoc and Sensor Network	TIT 2011	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Cloud Computing	TIT 2013	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Computational Biology	TIT 2015	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Software Metrics	TIT 2017	2012	Lectures/Enterpreneurship
2014-15	MT0318	M.TECH (IT)	Software Metrics (Revised)	TIT 2117	2012	Lectures/Enterpreneurship
2014-15	MT0318	M.TECH (IT)	Applied Computer Vision	TIT 2019	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Pattern Recognition & Application	TIT 2021	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Operation Research	TIT 2023	2012	Lectures/Skill development
2014-15	MT0318	M.TECH (IT)	Parallel Computing	TIT 2025	2012	Lectures/Employability
2014-15	MT0318	M.TECH (IT)	Natural Language Processing	TIT 2027	2012	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Mathematical Foundation of Information Security	TIS1101	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Coding and Information Theory	TIS1103	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Cryptography and Network Security	TIS1019	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Database Security	TIS2003	2011	Lectures/Employability

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2014-15	MT0206	M.TECH (IS)	Distributed Systems	TIS2105	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Data Compression and Data Hiding	TIS2031	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Security in Computing	TIS1007	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Mobile & Wireless Networks	TIS1009	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Security in Grid Computing	TIS1011	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Advanced Computer Networks	TIS1013	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Advanced Computer Architecture	TIS1015	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Standards and Evaluation Criteria	TIS2007	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Security Engineering	TIS2009	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Software Security	TIS2015	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Intrusion Detection	TIS2017	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Biometric Security	TIS2121	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Cyber Crime	TIS2025	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Digital Forensics	TIS2027	2011	Lectures/Employability
2014-15	MT0206	M.TECH (IS)	Security Management, Audit Assurance and Risk Management	TIS2029	2011	Lectures/Employability
2014-15	ME0106	M.E. (SE)	SOFTWARE PROJECT MGT.	MSE2005	2011	Lectures/Employability
2014-15	ME0106	M.E. (SE)	OBJECT ORIENTED MODELING & DESIGN	MSE1003	2011	Lectures/Employability
2014-15	ME0106	M.E. (SE)	PROBABILITY & STATISTICS ANALYSIS [MNAPK]	MSE1005	2011	Lectures/Employability
2014-15	ME0106	M.E. (SE)	COMPUTABILITY & COMPLEXITY THEORY	MSE1023	2011	Lectures/Employability
2014-15	ME0106	M.E. (SE)	SOFTWARE DESIGN & TESTING	MSE2001	2011	Lectures/Employability
2014-15	ME0106	M.E. (SE)	SOFTWARE RELIABILITY ENGG.	MSE2021	2011	Lectures/Employability

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2014-15	ME0106	M.E. (SE)	SYSTEM SIMULATION & MODELING	MSE2025	2011	Lectures/Employability
2014-15	ME0106	M.E. (SE)	REAL TIME SYSTEMS	MSE1025	2011	Lectures/Employability
2014-15	MA0106	MCA	Problem Solving and Program Design with C	MCA 1001	2011	Lectures/Employability
2014-15	MA0106	MCA	Numerical & Statistical Methods	MCA 1003	2011	Lectures/Skill development
2014-15	MA0106	MCA	Discrete Mathematics	MCA 1107	2011	Lectures/Skill development
2014-15	MA0106	MCA	Computer Organization and Architecture	MCA 1009	2011	Lectures/Employability
2014-15	MA0106	MCA	Data Structures	MCA 2001	2011	Lectures/Employability
2014-15	MA0106	MCA	Object Oriented Design and Programming	MCA 2003	2011	Lectures/Employability
2014-15	MA0106	MCA	Database Management Systems	MCA 2005	2011	Lectures/Employability
2014-15	MA0106	MCA	Operating System	MCA 2007	2011	Lectures/Employability
2014-15	MA0106	MCA	Java Programming	MCA 3001	2011	Lectures/Employability
2014-15	MA0106	MCA	Software Engineering	MCA 3003	2011	Lectures/Employability/ Enterpreurship
2014-15	MA0106	MCA	Fundamentals of Computer Algorithms	MCA 3005	2011	Lectures/Employability
2014-15	MA0106	MCA	Automata Theory	MCA 3007	2011	Lectures/Employability
2014-15	MA0106	MCA	Compiler Design	MCA 4001	2011	Lectures/Employability
2014-15	MA0106	MCA	Data Communications and Computer Networks	MCA 4103	2011	Lectures/Employability
2014-15	MA0106	MCA	Computerized Financial Accounting	MCA 4007	2011	Lectures/Skill development
2014-15	MA0106	MCA	Computer Graphics	MCA 5001	2011	Lectures/Employability
2014-15	MA0106	MCA	System Simulation and Modeling	MCA 5003	2011	Lectures/Employability
2014-15	MA0106	MCA	Optimization Theory	MCA 5005	2011	Lectures/Skill development
2014-15	MA0106	MCA	Distributed Databases	MCA 7101	2011	Lectures/Employability
2014-15	MA0106	MCA	Decision Support Systems	MCA 7103	2011	Lectures/Employability
2014-15	MA0106	MCA	Enterprise Resource Planning	MCA 7105	2011	Lectures/Enterpreneurship

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2014-15	MA0106	MCA	Data Mining and Ware Housing	MCA 7107	2011	Lectures/Employability
2014-15	MA0106	MCA	Multimedia Databases	MCA 7109	2011	Lectures/Employability
2014-15	MA0106	MCA	Advanced Java Programming	MCA 7201	2011	Lectures/Employability
2014-15	MA0106	MCA	Systems Programming	MCA 7203	2011	Lectures/Employability
2014-15	MA0106	MCA	Programming Language Design and Concepts	MCA 7205	2011	Lectures/Employability
2014-15	MA0106	MCA	Assembly Language Programming	MCA 7207	2011	Lectures/Employability
2014-15	MA0106	MCA	Web Programming	MCA 7209	2011	Lectures/Employability
2014-15	MA0106	MCA	Software Project Management	MCA 7211	2011	Lectures/Enterpreneurship
2014-15	MA0106	MCA	Natural Language Processing	MCA 7301	2011	Lectures/Employability
2014-15	MA0106	MCA	Genetic Algorithms and Swarm Intelligence	MCA 7303	2011	Lectures/Skill development
2014-15	MA0106	MCA	Artificial Intelligence	MCA 7305	2011	Lectures/Employability
2014-15	MA0106	MCA	Image Processing	MCA 7307	2011	Lectures/Employability
2014-15	MA0106	MCA	Soft Computing	MCA 7309	2011	Lectures/Employability
2014-15	MA0106	MCA	Cloud Computing	MCA 7311	2011	Lectures/Employability
2014-15	MA0106	MCA	Network Security and Cryptography	MCA 7401	2011	Lectures/Employability
2014-15	MA0106	MCA	Grid Computing	MCA 7403	2011	Lectures/Employability
2014-15	MA0106	MCA	Wireless Technology	MCA 7405	2011	Lectures/Employability
2014-15	MA0106	MCA	Parallel and Distributed Computing	MCA 7407	2011	Lectures/Employability
2014-15	MA0106	MCA	Mobile Computing	MCA 7409	2011	Lectures/Employability
2014-15	MA0106	MCA	Cloud Computing	MCA 7411	2011	Lectures/Employability
2014-15	MA0106	MCA	Bioinformatics	MCA 7501	2011	Lectures/Employability
2014-15	MA0106	MCA	Multimedia and Animation	MCA 7505	2011	Lectures/Skill development
2014-15	MA0106	MCA	Supply Chain Management	MCA 7507	2011	Lectures/Employability

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2015-16	BE0106	B.E. (CSE)	Fundamentals of Data Structure	CS2301	2011	Lectures/Employability/ Skill development
2015-16	BE0106	B.E. (CSE)	Object Oriented Programming using Java	CS 3005	2011	Lectures/Skill Development
2015-16	BE0106	B.E. (CSE)	Digital Electronics	EC 3201	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Discrete Mathematical Structures	CS 4101	2011	Lectures/Skill Development
2015-16	BE0106	B.E. (CSE)	Design and Analysis of Computer Algorithms	CS 6101	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Probability, Statistics and Numerical Techniques	MA 4109	2011	Lectures/ Skill Development
2015-16	BE0106	B.E. (CSE)	Database Management Systems	CS 4205	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Computer System Architecture	CS 4109	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Operating System	CS 4107	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Foreign Languages	HU400 1	2011	Lectures/ Skill Development
2015-16	BE0106	B.E. (CSE)	Biological Sciences	BT 3021	2011	Lectures/ Skill Development
2015-16	BE0106	B.E. (CSE)	Formal Language & Automata Theory	CS 5101	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Artificial Intelligence and Expert Systems	CS 8101	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Compiler Design	CS 6105	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Computer Graphics and Multimedia	CS 6011	2011	Lectures/Employability/ Skill development
2015-16	BE0106	B.E. (CSE)	Software Engineering	CS 6109	2011	Lectures/ employability
2015-16	BE0106	B.E. (CSE)	System Programming	CS 6103	2011	Lectures/ employability
2015-16	BE0106	B.E. (CSE)	Soft Computing	CS 5105	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Project	CS 7014	2011	Project/Skill development
2015-16	BE0106	B.E. (CSE)	Data Mining & Data Warehousing	CS 8031	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Free/Open Source software	CS 7029	2011	Lectures/Employability/ skill development
2015-16	BE0106	B.E. (CSE)	Optimization Techniques	CS 7117	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Cryptography and Network Security	CS 7121	2011	Lectures/Employability

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2015-16	BE0106	B.E. (CSE)	Information Security and Assurance	CS 7029	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Principles of Programming Languages	CS 7101	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Digital Image Processing	CS 7107	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Mobile & Cellular Communication	EC 8201	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Digital Signal Processing	EE 4207	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Multimedia Technology	CS 7033	2011	Lectures/Skill Development
2015-16	BE0106	B.E. (CSE)	Parallel & Distributed Systems	CS 8029	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Natural Language Processing	CS 8111	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Pattern Recognition	CS 8121	2011	Lectures/Employability
2015-16	BE0106	B.E. (CSE)	Computational Geometry	CS 8113	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Fundamentals of Data Structures	CS 2301	2011	Lectures/Employability/ Skill development
2015-16	BE0206	B.E. (IT)	Discrete Mathematics and Graph Theory	IT 3021	2011	Lectures/Skill Development
2015-16	BE0206	B.E. (IT)	Java Programming	IT 3023	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Computer Organization and Architecture	IT 3025	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Database System Concepts	IT 4021	2011	Lectures,Project/Emplo yability
2015-16	BE0206	B.E. (IT)	Operating System Concepts	IT 4023	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Theory of Computations	IT 4025	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Scientific Computing	IT 4027	2011	Lectures/Skill Development
2015-16	BE0206	B.E. (IT)	Data Communications	IT 5021	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Software Engineering Principles	IT 5023	2011	Lectures, Internship, Project/Employability
2015-16	BE0206	B.E. (IT)	Principles of Soft Computing	IT 5025	2011	Lectures, Project /Employability
2015-16	BE0206	B.E. (IT)	Design of Computer Algorithms	IT 5027	2011	Lectures/ Employability
2015-16	BE0206	B.E. (IT)	Communication Theory	IT 6021	2011	Lectures/Employability

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2015-16	BE0206	B.E. (IT)	Computer Network and Security	IT 6023	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Information & Coding Theory	IT 6025	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Optimization Techniques	IT 6027	2011	Lectures, Project/ Skill development
2015-16	BE0206	B.E. (IT)	Data Mining Concepts and Techniques	IT 7021	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Parallel & Distributed Computing	IT 7041	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Compiler Design	IT 7043	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Simulation & Modeling	IT 7023	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Artificial Intelligence	IT 7025	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Digital Image Processing	IT 7027	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Object Oriented Design	IT 7029	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	System Programming	IT 7031	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Web Technology	IT 7033	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	PROJECT	IT 8020	2011	Project/ Skill Development
2015-16	BE0206	B.E. (IT)	Enterprise Resource Planning	IT 8025	2011	Lectures/Enterpreneurship
2015-16	BE0206	B.E. (IT)	Decision Support Systems	IT 8027	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Embedded Systems	IT 8029	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Pattern Recognition	IT 8031	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Computing & Complexity Theory	IT 8033	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Software Reliability & Testing	IT 8035	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Distributed Database System	IT 8037	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Computer Graphics & Multimedia	IT 8039	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Information System Project Management	IT 8041	2011	Lectures/Enterpreneurship
2015-16	BE0206	B.E. (IT)	Distributed Systems	IT 8043	2011	Lectures/Enterpreneurship
2015-16	BE0206	B.E. (IT)	Advance Computer Graphics	IT 8045	2011	Lectures/Enterpreneurship

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2015-16	BE0206	B.E. (IT)	Real Time Systems	IT 8047	2011	Lectures/Enterpreneurship
2015-16	BE0206	B.E. (IT)	Modern Telecommunication Systems	IT 8049	2011	Lectures/Employability
2015-16	BE0206	B.E. (IT)	Neural Networks & Applications	IT 8051	2011	Lectures/Skill Development
2015-16	BE0206	B.E. (IT)	E-Commerce	IT 8053	2011	Lectures/Enterpreneurship
2015-16	MT0106	M.TECH (CSE)	Database Modeling and Design	TCS1001	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Advanced Operating System Concepts	TCS1025	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Probability and Statistical Analysis	MSE1005	2011	Lectures/Skill Development
2015-16	MT0106	M.TECH (CSE)	Object Oriented Modeling and Design	MSE1003	2011	Lectures/Enterpreneurship
2015-16	MT0106	M.TECH (CSE)	Data and Computer Communication Networks	TCS2001	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	High Performance Computer Architecture	TCS2039	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Computability and Complexity Theory	MSE1023	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Digital Signal Processing	MEE1003	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Real Time Systems	MSE1025	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Digital Image Processing Techniques	MEE1003	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Graph Theory & Applications	TCS1027	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Software Project Management	MSE2005	2011	Lectures/Enterpreneurship
2015-16	MT0106	M.TECH (CSE)	Pattern Recognition and Image Analysis	TCS2021	2011	Lectures/Employability

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2015-16	MT0106	M.TECH (CSE)	Computational Geometry	TCS2023	2011	Lectures/Skill Development
2015-16	MT0106	M.TECH (CSE)	Mobile Computing	TCS2025	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Grid Computing	TCS2027	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Interconnection Networks	TCS2033	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Computer Communication Networks	MEC2009	2011	Lectures/Employability
2015-16	MT0106	M.TECH (CSE)	Design and Analysis of Parallel Algorithms	TCS2037	2011	Lectures/Employability
2015-16	MT0315	M.TECH (IT)	Computability & Complexity Theory	TIT 1101	2012	Lectures/Employability
2015-16	MT0315	M.TECH (IT)	Advanced Database	TIT 1003	2012	Lectures/Employability
2015-16	MT0315	M.TECH (IT)	Computational Intelligence	TIT 1005	2012	Lectures/Employability
2015-16	MT0315	M.TECH (IT)	Information Theory	TIT 2001	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Communication Theory	TIT 2003	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Data Compression and Data Hiding	TIT 2005	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Stochastic Processes and Simulation	TIT 1011	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Computer Algorithms	TIT 1013	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Cryptography	TIT 1015	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Mobile and Wireless Network	TIT 1017	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Mobile Computing	TIT 1019	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Cluster & Grid Computing	TIT 1021	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Distributed Computing	TIT 1023	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Speech Processing	TIT 1025	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Data Mining & Warehousing	TIT 1027	2012	Lectures/Employability

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2015-16	MT0318	M.TECH (IT)	Human Computer Interaction	TIT 1029	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Digital Signal Processing	TIT 1031	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Soft Computing	TIT 1033	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Wireless Adhoc and Sensor Network	TIT 2011	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Cloud Computing	TIT 2013	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Computational Biology	TIT 2015	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Software Metrics	TIT 2017	2012	Lectures/Enterpreneurship
2015-16	MT0318	M.TECH (IT)	Software Metrics (Revised)	TIT 2117	2012	Lectures/Enterpreneurship
2015-16	MT0318	M.TECH (IT)	Applied Computer Vision	TIT 2019	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Pattern Recognition & Application	TIT 2021	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Operation Research	TIT 2023	2012	Lectures/Skill development
2015-16	MT0318	M.TECH (IT)	Parallel Computing	TIT 2025	2012	Lectures/Employability
2015-16	MT0318	M.TECH (IT)	Natural Language Processing	TIT 2027	2012	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Mathematical Foundation of Information Security	TIS1101	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Coding and Information Theory	TIS1103	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Cryptography and Network Security	TIS1019	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Database Security	TIS2003	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Distributed Systems	TIS2105	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Data Compression and Data Hiding	TIS2031	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Security in Computing	TIS1007	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Mobile & Wireless Networks	TIS1009	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Security in Grid Computing	TIS1011	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Advanced Computer Networks	TIS1013	2011	Lectures/Employability

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2015-16	MT0206	M.TECH (IS)	Advanced Computer Architecture	TIS1015	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Standards and Evaluation Criteria	TIS2007	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Security Engineering	TIS2009	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Software Security	TIS2015	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Intrusion Detection	TIS2017	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Biometric Security	TIS2121	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Cyber Crime	TIS2025	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Digital Forensics	TIS2027	2011	Lectures/Employability
2015-16	MT0206	M.TECH (IS)	Security Management, Audit Assurance and Risk Management	TIS2029	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	SOFTWARE PROJECT MGT.	MSE2005	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	OBJECT ORIENTED MODELING & DESIGN	MSE1003	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	PROBABILITY & STATISTICS ANALYSIS [MNAPK]	MSE1005	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	COMPUTABILITY & COMPLEXITY THEORY	MSE1023	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	SOFTWARE DESIGN & TESTING	MSE2001	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	SOFTWARE RELIABILITY ENGG.	MSE2021	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	SYSTEM SIMULATION & MODELING	MSE2025	2011	Lectures/Employability
2015-16	ME0106	M.E. (SE)	REAL TIME SYSTEMS	MSE1025	2011	Lectures/Employability
2015-16	MA0106	MCA	Problem Solving and Program Design with C	MCA 1001	2011	Lectures/Employability
2015-16	MA0106	MCA	Numerical & Statistical Methods	MCA 1003	2011	Lectures/Skill development
2015-16	MA0106	MCA	Discrete Mathematics	MCA 1107	2011	Lectures/Skill development
2015-16	MA0106	MCA	Computer Organization and Architecture	MCA 1009	2011	Lectures/Employability

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2015-16	MA0106	MCA	Data Structures	MCA 2001	2011	Lectures/Employability
2015-16	MA0106	MCA	Object Oriented Design and Programming	MCA 2003	2011	Lectures/Employability
2015-16	MA0106	MCA	Database Management Systems	MCA 2005	2011	Lectures/Employability
2015-16	MA0106	MCA	Operating System	MCA 2007	2011	Lectures/Employability
2015-16	MA0106	MCA	Java Programming	MCA 3001	2011	Lectures/Employability
2015-16	MA0106	MCA	Software Engineering	MCA 3003	2011	Lectures/Employability/ Enterpreurship
2015-16	MA0106	MCA	Fundamentals of Computer Algorithms	MCA 3005	2011	Lectures/Employability
2015-16	MA0106	MCA	Automata Theory	MCA 3007	2011	Lectures/Employability
2015-16	MA0106	MCA	Compiler Design	MCA 4001	2011	Lectures/Employability
2015-16	MA0106	MCA	Data Communications and Computer Networks	MCA 4103	2011	Lectures/Employability
2015-16	MA0106	MCA	Computerized Financial Accounting	MCA 4007	2011	Lectures/Skill development
2015-16	MA0106	MCA	Computer Graphics	MCA 5001	2011	Lectures/Employability
2015-16	MA0106	MCA	System Simulation and Modeling	MCA 5003	2011	Lectures/Employability
2015-16	MA0106	MCA	Optimization Theory	MCA 5005	2011	Lectures/Skill development
2015-16	MA0106	MCA	Distributed Databases	MCA 7101	2011	Lectures/Employability
2015-16	MA0106	MCA	Decision Support Systems	MCA 7103	2011	Lectures/Employability
2015-16	MA0106	MCA	Enterprise Resource Planning	MCA 7105	2011	Lectures/Enterpreneurship
2015-16	MA0106	MCA	Data Mining and Ware Housing	MCA 7107	2011	Lectures/Employability
2015-16	MA0106	MCA	Multimedia Databases	MCA 7109	2011	Lectures/Employability
2015-16	MA0106	MCA	Advanced Java Programming	MCA 7201	2011	Lectures/Employability
2015-16	MA0106	MCA	Systems Programming	MCA 7203	2011	Lectures/Employability
2015-16	MA0106	MCA	Programming Language Design and Concepts	MCA 7205	2011	Lectures/Employability
2015-16	MA0106	MCA	Assembly Language Programming	MCA 7207	2011	Lectures/Employability

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2015-16	MA0106	MCA	Web Programming	MCA 7209	2011	Lectures/Employability
2015-16	MA0106	MCA	Software Project Management	MCA 7211	2011	Lectures/Enterpreneurship
2015-16	MA0106	MCA	Natural Language Processing	MCA 7301	2011	Lectures/Employability
2015-16	MA0106	MCA	Genetic Algorithms and Swarm Intelligence	MCA 7303	2011	Lectures/Skill development
2015-16	MA0106	MCA	Artificial Intelligence	MCA 7305	2011	Lectures/Employability
2015-16	MA0106	MCA	Image Processing	MCA 7307	2011	Lectures/Employability
2015-16	MA0106	MCA	Soft Computing	MCA 7309	2011	Lectures/Employability
2015-16	MA0106	MCA	Cloud Computing	MCA 7311	2011	Lectures/Employability
2015-16	MA0106	MCA	Network Security and Cryptography	MCA 7401	2011	Lectures/Employability
2015-16	MA0106	MCA	Grid Computing	MCA 7403	2011	Lectures/Employability
2015-16	MA0106	MCA	Wireless Technology	MCA 7405	2011	Lectures/Employability
2015-16	MA0106	MCA	Parallel and Distributed Computing	MCA 7407	2011	Lectures/Employability
2015-16	MA0106	MCA	Mobile Computing	MCA 7409	2011	Lectures/Employability
2015-16	MA0106	MCA	Cloud Computing	MCA 7411	2011	Lectures/Employability
2015-16	MA0106	MCA	Bioinformatics	MCA 7501	2011	Lectures/Employability
2015-16	MA0106	MCA	Multimedia and Animation	MCA 7505	2011	Lectures/Skill development
2015-16	MA0106	MCA	Supply Chain Management	MCA 7507	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Fundamentals of Data Structure	CS2301	2011	Lectures/Employability/ Skill development
2016-17	BE0106	B.E. (CSE)	Object Oriented Programming using Java	CS 3005	2011	Lectures/Skill Development
2016-17	BE0106	B.E. (CSE)	Digital Electronics	EC 3201	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Discrete Mathematical Structures	CS 4101	2011	Lectures/Skill Development
2016-17	BE0106	B.E. (CSE)	Design and Analysis of Computer Algorithms	CS 6101	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Probability, Statistics and Numerical Techniques	MA 4109	2011	Lectures/ Skill Development

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2016-17	BE0106	B.E. (CSE)	Database Management Systems	CS 4205	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Computer System Architecture	CS 4109	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Operating System	CS 4107	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Foreign Languages	HU400 1	2011	Lectures/ Skill Development
2016-17	BE0106	B.E. (CSE)	Biological Sciences	BT 3021	2011	Lectures/ Skill Development
2016-17	BE0106	B.E. (CSE)	Formal Language & Automata Theory	CS 5101	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Artificial Intelligence and Expert Systems	CS 8101	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Compiler Design	CS 6105	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Computer Graphics and Multimedia	CS 6011	2011	Lectures/Employability/ Skill development
2016-17	BE0106	B.E. (CSE)	Software Engineering	CS 6109	2011	Lectures/ employability
2016-17	BE0106	B.E. (CSE)	System Programming	CS 6103	2011	Lectures/ employability
2016-17	BE0106	B.E. (CSE)	Soft Computing	CS 5105	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Project	CS 7014	2011	Project/Skill development
2016-17	BE0106	B.E. (CSE)	Data Mining & Data Warehousing	CS 8031	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Free/Open Source software	CS 7029	2011	Lectures/Employability/ skill development
2016-17	BE0106	B.E. (CSE)	Optimization Techniques	CS 7117	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Cryptography and Network Security	CS 7121	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Information Security and Assurance	CS 7029	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Principles of Programming Languages	CS 7101	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Digital Image Processing	CS 7107	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Mobile & Cellular Communication	EC 8201	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Digital Signal Processing	EE 4207	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Multimedia Technology	CS 7033	2011	Lectures/Skill Development

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2016-17	BE0106	B.E. (CSE)	Parallel & Distributed Systems	CS 8029	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Natural Language Processing	CS 8111	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Pattern Recognition	CS 8121	2011	Lectures/Employability
2016-17	BE0106	B.E. (CSE)	Computational Geometry	CS 8113	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Fundamentals of Data Structures	CS 2301	2011	Lectures/Employability/ Skill development
2016-17	BE0206	B.E. (IT)	Discrete Mathematics and Graph Theory	IT 3021	2011	Lectures/Skill Development
2016-17	BE0206	B.E. (IT)	Java Programming	IT 3023	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Computer Organization and Architecture	IT 3025	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Database System Concepts	IT 4021	2011	Lectures,Project/Employability
2016-17	BE0206	B.E. (IT)	Operating System Concepts	IT 4023	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Theory of Computations	IT 4025	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Scientific Computing	IT 4027	2011	Lectures/Skill Development
2016-17	BE0206	B.E. (IT)	Data Communications	IT 5021	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Software Engineering Principles	IT 5023	2011	Lectures, Internship, Project/Employability
2016-17	BE0206	B.E. (IT)	Principles of Soft Computing	IT 5025	2011	Lectures, Project /Employability
2016-17	BE0206	B.E. (IT)	Design of Computer Algorithms	IT 5027	2011	Lectures/ Employability
2016-17	BE0206	B.E. (IT)	Communication Theory	IT 6021	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Computer Network and Security	IT 6023	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Information & Coding Theory	IT 6025	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Optimization Techniques	IT 6027	2011	Lectures, Project/ Skill development
2016-17	BE0206	B.E. (IT)	Data Mining Concepts and Techniques	IT 7021	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Parallel & Distributed Computing	IT 7041	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Compiler Design	IT 7043	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Simulation & Modeling	IT 7023	2011	Lectures/Employability

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2016-17	BE0206	B.E. (IT)	Artificial Intelligence	IT 7025	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Digital Image Processing	IT 7027	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Object Oriented Design	IT 7029	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	System Programming	IT 7031	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Web Technology	IT 7033	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	PROJECT	IT 8020	2011	Project/ Skill Development
2016-17	BE0206	B.E. (IT)	Enterprise Resource Planning	IT 8025	2011	Lectures/Enterpreneurship
2016-17	BE0206	B.E. (IT)	Decision Support Systems	IT 8027	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Embedded Systems	IT 8029	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Pattern Recognition	IT 8031	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Computing & Complexity Theory	IT 8033	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Software Reliability & Testing	IT 8035	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Distributed Database System	IT 8037	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Computer Graphics & Multimedia	IT 8039	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Information System Project Management	IT 8041	2011	Lectures/Enterpreneurship
2016-17	BE0206	B.E. (IT)	Distributed Systems	IT 8043	2011	Lectures/Enterpreneurship
2016-17	BE0206	B.E. (IT)	Advance Computer Graphics	IT 8045	2011	Lectures/Enterpreneurship
2016-17	BE0206	B.E. (IT)	Real Time Systems	IT 8047	2011	Lectures/Enterpreneurship
2016-17	BE0206	B.E. (IT)	Modern Telecommunication Systems	IT 8049	2011	Lectures/Employability
2016-17	BE0206	B.E. (IT)	Neural Networks & Applications	IT 8051	2011	Lectures/Skill Development
2016-17	BE0206	B.E. (IT)	E-Commerce	IT 8053	2011	Lectures/Enterpreneurship
2016-17	MT0106	M.TECH (CSE)	Database Modeling and Design	TCS1001	2011	Lectures/Employability

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2016-17	MT0106	M.TECH (CSE)	Advanced Operating System Concepts	TCS1025	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Probability and Statistical Analysis	MSE1005	2011	Lectures/Skill Development
2016-17	MT0106	M.TECH (CSE)	Object Oriented Modeling and Design	MSE1003	2011	Lectures/Enterpreneurship
2016-17	MT0106	M.TECH (CSE)	Data and Computer Communication Networks	TCS2001	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	High Performance Computer Architecture	TCS2039	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Computability and Complexity Theory	MSE1023	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Digital Signal Processing	MEE1003	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Real Time Systems	MSE1025	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Digital Image Processing Techniques	MEE1003	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Graph Theory & Applications	TCS1027	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Software Project Management	MSE2005	2011	Lectures/Enterpreneurship
2016-17	MT0106	M.TECH (CSE)	Pattern Recognition and Image Analysis	TCS2021	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Computational Geometry	TCS2023	2011	Lectures/Skill Development
2016-17	MT0106	M.TECH (CSE)	Mobile Computing	TCS2025	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Grid Computing	TCS2027	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Interconnection Networks	TCS2033	2011	Lectures/Employability

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2016-17	MT0106	M.TECH (CSE)	Computer Communication Networks	MEC2009	2011	Lectures/Employability
2016-17	MT0106	M.TECH (CSE)	Design and Analysis of Parallel Algorithms	TCS2037	2011	Lectures/Employability
2016-17	MT0315	M.TECH (IT)	Computability & Complexity Theory	TIT 1101	2012	Lectures/Employability
2016-17	MT0315	M.TECH (IT)	Advanced Database	TIT 1003	2012	Lectures/Employability
2016-17	MT0315	M.TECH (IT)	Computational Intelligence	TIT 1005	2012	Lectures/Employability
2016-17	MT0315	M.TECH (IT)	Information Theory	TIT 2001	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Communication Theory	TIT 2003	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Data Compression and Data Hiding	TIT 2005	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Stochastic Processes and Simulation	TIT 1011	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Computer Algorithms	TIT 1013	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Cryptography	TIT 1015	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Mobile and Wireless Network	TIT 1017	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Mobile Computing	TIT 1019	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Cluster & Grid Computing	TIT 1021	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Distributed Computing	TIT 1023	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Speech Processing	TIT 1025	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Data Mining & Warehousing	TIT 1027	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Human Computer Interaction	TIT 1029	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Digital Signal Processing	TIT 1031	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Soft Computing	TIT 1033	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Wireless Adhoc and Sensor Network	TIT 2011	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Cloud Computing	TIT 2013	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Computational Biology	TIT 2015	2012	Lectures/Employability

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2016-17	MT0318	M.TECH (IT)	Software Metrics	TIT 2017	2012	Lectures/Enterpreneurship
2016-17	MT0318	M.TECH (IT)	Software Metrics (Revised)	TIT 2117	2012	Lectures/Enterpreneurship
2016-17	MT0318	M.TECH (IT)	Applied Computer Vision	TIT 2019	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Pattern Recognition & Application	TIT 2021	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Operation Research	TIT 2023	2012	Lectures/Skill development
2016-17	MT0318	M.TECH (IT)	Parallel Computing	TIT 2025	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Natural Language Processing	TIT 2027	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Big Data Analysis	TIT1035	2016	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Genetic Algorithms	TIT1037	2016	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Mathematical Foundation of Information Security	TIS1101	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Coding and Information Theory	TIS1103	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Cryptography and Network Security	TIS1019	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Database Security	TIS2003	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Distributed Systems	TIS2105	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Data Compression and Data Hiding	TIS2031	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Security in Computing	TIS1007	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Mobile & Wireless Networks	TIS1009	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Security in Grid Computing	TIS1011	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Advanced Computer Networks	TIS1013	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Advanced Computer Architecture	TIS1015	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Standards and Evaluation Criteria	TIS2007	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Security Engineering	TIS2009	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Software Security	TIS2015	2011	Lectures/Employability

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2016-17	MT0206	M.TECH (IS)	Intrusion Detection	TIS2017	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Biometric Security	TIS2121	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Cyber Crime	TIS2025	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Digital Forensics	TIS2027	2011	Lectures/Employability
2016-17	MT0206	M.TECH (IS)	Security Management, Audit Assurance and Risk Management	TIS2029	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	SOFTWARE PROJECT MGT.	MSE2005	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	OBJECT ORIENTED MODELING & DESIGN	MSE1003	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	PROBABILITY & STATISTICS ANALYSIS [MNAPK]	MSE1005	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	COMPUTABILITY & COMPLEXITY THEORY	MSE1023	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	SOFTWARE DESIGN & TESTING	MSE2001	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	SOFTWARE RELIABILITY ENGG.	MSE2021	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	SYSTEM SIMULATION & MODELING	MSE2025	2011	Lectures/Employability
2016-17	ME0106	M.E. (SE)	REAL TIME SYSTEMS	MSE1025	2011	Lectures/Employability
2016-17	MA0106	MCA	Problem Solving and Program Design with C	MCA 1001	2011	Lectures/Employability
2016-17	MA0106	MCA	Numerical & Statistical Methods	MCA 1003	2011	Lectures/Skill development
2016-17	MA0106	MCA	Discrete Mathematics	MCA 1107	2011	Lectures/Skill development
2016-17	MA0106	MCA	Computer Organization and Architecture	MCA 1009	2011	Lectures/Employability
2016-17	MA0106	MCA	Data Structures	MCA 2001	2011	Lectures/Employability
2016-17	MA0106	MCA	Object Oriented Design and Programming	MCA 2003	2011	Lectures/Employability
2016-17	MA0106	MCA	Database Management Systems	MCA 2005	2011	Lectures/Employability
2016-17	MA0106	MCA	Operating System	MCA 2007	2011	Lectures/Employability

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2016-17	MA0106	MCA	Java Programming	MCA 3001	2011	Lectures/Employability
2016-17	MA0106	MCA	Software Engineering	MCA 3003	2011	Lectures/Employability/ Enterpreurship
2016-17	MA0106	MCA	Fundamentals of Computer Algorithms	MCA 3005	2011	Lectures/Employability
2016-17	MA0106	MCA	Automata Theory	MCA 3007	2011	Lectures/Employability
2016-17	MA0106	MCA	Compiler Design	MCA 4001	2011	Lectures/Employability
2016-17	MA0106	MCA	Data Communications and Computer Networks	MCA 4103	2011	Lectures/Employability
2016-17	MA0106	MCA	Computerized Financial Accounting	MCA 4007	2011	Lectures/Skill development
2016-17	MA0106	MCA	Computer Graphics	MCA 5001	2011	Lectures/Employability
2016-17	MA0106	MCA	System Simulation and Modeling	MCA 5003	2011	Lectures/Employability
2016-17	MA0106	MCA	Optimization Theory	MCA 5005	2011	Lectures/Skill development
2016-17	MA0106	MCA	Distributed Databases	MCA 7101	2011	Lectures/Employability
2016-17	MA0106	MCA	Decision Support Systems	MCA 7103	2011	Lectures/Employability
2016-17	MA0106	MCA	Enterprise Resource Planning	MCA 7105	2011	Lectures/Enterpreneursh ip
2016-17	MA0106	MCA	Data Mining and Ware Housing	MCA 7107	2011	Lectures/Employability
2016-17	MA0106	MCA	Multimedia Databases	MCA 7109	2011	Lectures/Employability
2016-17	MA0106	MCA	Advanced Java Programming	MCA 7201	2011	Lectures/Employability
2016-17	MA0106	MCA	Systems Programming	MCA 7203	2011	Lectures/Employability
2016-17	MA0106	MCA	Programming Language Design and Concepts	MCA 7205	2011	Lectures/Employability
2016-17	MA0106	MCA	Assembly Language Programming	MCA 7207	2011	Lectures/Employability
2016-17	MA0106	MCA	Web Programming	MCA 7209	2011	Lectures/Employability
2016-17	MA0106	MCA	Software Project Management	MCA 7211	2011	Lectures/Enterpreneursh ip
2016-17	MA0106	MCA	Natural Language Processing	MCA 7301	2011	Lectures/Employability
2016-17	MA0106	MCA	Genetic Algorithms and Swarm Intelligence	MCA 7303	2011	Lectures/Skill development

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2016-17	MA0106	MCA	Artificial Intelligence	MCA 7305	2011	Lectures/Employability
2016-17	MA0106	MCA	Image Processing	MCA 7307	2011	Lectures/Employability
2016-17	MA0106	MCA	Soft Computing	MCA 7309	2011	Lectures/Employability
2016-17	MA0106	MCA	Cloud Computing	MCA 7311	2011	Lectures/Employability
2016-17	MA0106	MCA	Network Security and Cryptography	MCA 7401	2011	Lectures/Employability
2016-17	MA0106	MCA	Grid Computing	MCA 7403	2011	Lectures/Employability
2016-17	MA0106	MCA	Wireless Technology	MCA 7405	2011	Lectures/Employability
2016-17	MA0106	MCA	Parallel and Distributed Computing	MCA 7407	2011	Lectures/Employability
2016-17	MA0106	MCA	Mobile Computing	MCA 7409	2011	Lectures/Employability
2016-17	MA0106	MCA	Cloud Computing	MCA 7411	2011	Lectures/Employability
2016-17	MA0106	MCA	Bioinformatics	MCA 7501	2011	Lectures/Employability
2016-17	MA0106	MCA	Multimedia and Animation	MCA 7505	2011	Lectures/Skill development
2016-17	MA0106	MCA	Supply Chain Management	MCA 7507	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Fundamentals of Data Structure	CS2301	2011	Lectures/Employability/ Skill development
2017-18	BE0106	B.E. (CSE)	Object Oriented Programming using Java	CS 3005	2011	Lectures/Skill Development
2017-18	BE0106	B.E. (CSE)	Digital Electronics	EC 3201	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Discrete Mathematical Structures	CS 4101	2011	Lectures/Skill Development
2017-18	BE0106	B.E. (CSE)	Design and Analysis of Computer Algorithms	CS 6101	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Probability, Statistics and Numerical Techniques	MA 4109	2011	Lectures/ Skill Development
2017-18	BE0106	B.E. (CSE)	Database Management Systems	CS 4205	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Computer System Architecture	CS 4109	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Operating System	CS 4107	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Foreign Languages	HU4001	2011	Lectures/ Skill Development

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2017-18	BE0106	B.E. (CSE)	Biological Sciences	BT 3021	2011	Lectures/ Skill Development
2017-18	BE0106	B.E. (CSE)	Formal Language & Automata Theory	CS 5101	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Artificial Intelligence and Expert Systems	CS 8101	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Compiler Design	CS 6105	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Computer Graphics and Multimedia	CS 6011	2011	Lectures/Employability/ Skill development
2017-18	BE0106	B.E. (CSE)	Software Engineering	CS 6109	2011	Lectures/ employability
2017-18	BE0106	B.E. (CSE)	System Programming	CS 6103	2011	Lectures/ employability
2017-18	BE0106	B.E. (CSE)	Soft Computing	CS 5105	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Project	CS 7014	2011	Project/Skill development
2017-18	BE0106	B.E. (CSE)	Data Mining & Data Warehousing	CS 8031	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Free/Open Source software	CS 7029	2011	Lectures/Employability/ skill development
2017-18	BE0106	B.E. (CSE)	Optimization Techniques	CS 7117	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Cryptography and Network Security	CS 7121	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Information Security and Assurance	CS 7029	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Principles of Programming Languages	CS 7101	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Digital Image Processing	CS 7107	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Mobile & Cellular Communication	EC 8201	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Digital Signal Processing	EE 4207	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Multimedia Technology	CS 7033	2011	Lectures/Skill Development
2017-18	BE0106	B.E. (CSE)	Parallel & Distributed Systems	CS 8029	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Natural Language Processing	CS 8111	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Pattern Recognition	CS 8121	2011	Lectures/Employability
2017-18	BE0106	B.E. (CSE)	Computational Geometry	CS 8113	2011	Lectures/Employability

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2017-18	BE0206	B.E. (IT)	Fundamentals of Data Structures	CS 2301	2011	Lectures/Employability/ Skill development
2017-18	BE0206	B.E. (IT)	Discrete Mathematics and Graph Theory	IT 3021	2011	Lectures/Skill Development
2017-18	BE0206	B.E. (IT)	Java Programming	IT 3023	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Computer Organization and Architecture	IT 3025	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Database System Concepts	IT 4021	2011	Lectures,Project/Emplo yability
2017-18	BE0206	B.E. (IT)	Operating System Concepts	IT 4023	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Theory of Computations	IT 4025	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Scientific Computing	IT 4027	2011	Lectures/Skill Development
2017-18	BE0206	B.E. (IT)	Data Communications	IT 5021	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Software Engineering Principles	IT 5023	2011	Lectures, Internship, Project/Employability
2017-18	BE0206	B.E. (IT)	Principles of Soft Computing	IT 5025	2011	Lectures, Project /Employability
2017-18	BE0206	B.E. (IT)	Design of Computer Algorithms	IT 5027	2011	Lectures/ Employability
2017-18	BE0206	B.E. (IT)	Communication Theory	IT 6021	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Computer Network and Security	IT 6023	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Information & Coding Theory	IT 6025	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Optimization Techniques	IT 6027	2011	Lectures, Project/ Skill development
2017-18	BE0206	B.E. (IT)	Data Mining Concepts and Techniques	IT 7021	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Parallel & Distributed Computing	IT 7041	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Compiler Design	IT 7043	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Simulation & Modeling	IT 7023	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Artificial Intelligence	IT 7025	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Digital Image Processing	IT 7027	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Object Oriented Design	IT 7029	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	System Programming	IT 7031	2011	Lectures/Employability

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2017-18	BE0206	B.E. (IT)	Web Technology	IT 7033	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	PROJECT	IT 8020	2011	Project/ Skill Development
2017-18	BE0206	B.E. (IT)	Enterprise Resource Planning	IT 8025	2011	Lectures/Enterpreneurship
2017-18	BE0206	B.E. (IT)	Decision Support Systems	IT 8027	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Embedded Systems	IT 8029	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Pattern Recognition	IT 8031	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Computing & Complexity Theory	IT 8033	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Software Reliability & Testing	IT 8035	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Distributed Database System	IT 8037	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Computer Graphics & Multimedia	IT 8039	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Information System Project Management	IT 8041	2011	Lectures/Enterpreneurship
2017-18	BE0206	B.E. (IT)	Distributed Systems	IT 8043	2011	Lectures/Enterpreneurship
2017-18	BE0206	B.E. (IT)	Advance Computer Graphics	IT 8045	2011	Lectures/Enterpreneurship
2017-18	BE0206	B.E. (IT)	Real Time Systems	IT 8047	2011	Lectures/Enterpreneurship
2017-18	BE0206	B.E. (IT)	Modern Telecommunication Systems	IT 8049	2011	Lectures/Employability
2017-18	BE0206	B.E. (IT)	Neural Networks & Applications	IT 8051	2011	Lectures/Skill Development
2017-18	BE0206	B.E. (IT)	E-Commerce	IT 8053	2011	Lectures/Enterpreneurship
2017-18	MT0106	M.TECH (CSE)	Database Modeling and Design	TCS1001	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Advanced Operating System Concepts	TCS1025	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Probability and Statistical Analysis	MSE1005	2011	Lectures/Skill Development
2017-18	MT0106	M.TECH (CSE)	Object Oriented Modeling and Design	MSE1003	2011	Lectures/Enterpreneurship

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2017-18	MT0106	M.TECH (CSE)	Data and Computer Communication Networks	TCS2001	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	High Performance Computer Architecture	TCS2039	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Computability and Complexity Theory	MSE1023	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Digital Signal Processing	MEE1003	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Real Time Systems	MSE1025	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Digital Image Processing Techniques	MEE1003	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Graph Theory & Applications	TCS1027	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Software Project Management	MSE2005	2011	Lectures/Enterpreneurship
2017-18	MT0106	M.TECH (CSE)	Pattern Recognition and Image Analysis	TCS2021	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Computational Geometry	TCS2023	2011	Lectures/Skill Development
2017-18	MT0106	M.TECH (CSE)	Mobile Computing	TCS2025	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Grid Computing	TCS2027	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Interconnection Networks	TCS2033	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Computer Communication Networks	MEC2009	2011	Lectures/Employability
2017-18	MT0106	M.TECH (CSE)	Design and Analysis of Parallel Algorithms	TCS2037	2011	Lectures/Employability
2017-18	MT0315	M.TECH (IT)	Computability & Complexity Theory	TIT 1101	2012	Lectures/Employability

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2017-18	MT0315	M.TECH (IT)	Advanced Database	TIT 1003	2012	Lectures/Employability
2017-18	MT0315	M.TECH (IT)	Computational Intelligence	TIT 1005	2012	Lectures/Employability
2017-18	MT0315	M.TECH (IT)	Information Theory	TIT 2001	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Communication Theory	TIT 2003	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Data Compression and Data Hiding	TIT 2005	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Stochastic Processes and Simulation	TIT 1011	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Computer Algorithms	TIT 1013	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Cryptography	TIT 1015	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Mobile and Wireless Network	TIT 1017	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Mobile Computing	TIT 1019	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Cluster & Grid Computing	TIT 1021	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Distributed Computing	TIT 1023	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Speech Processing	TIT 1025	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Data Mining & Warehousing	TIT 1027	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Human Computer Interaction	TIT 1029	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Digital Signal Processing	TIT 1031	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Soft Computing	TIT 1033	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Wireless Adhoc and Sensor Network	TIT 2011	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Cloud Computing	TIT 2013	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Computational Biology	TIT 2015	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Software Metrics	TIT 2017	2012	Lectures/Enterpreneurship
2017-18	MT0318	M.TECH (IT)	Software Metrics (Revised)	TIT 2117	2012	Lectures/Enterpreneurship
2017-18	MT0318	M.TECH (IT)	Applied Computer Vision	TIT 2019	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Pattern Recognition & Application	TIT 2021	2012	Lectures/Employability

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2017-18	MT0318	M.TECH (IT)	Operation Research	TIT 2023	2012	Lectures/Skill development
2017-18	MT0318	M.TECH (IT)	Parallel Computing	TIT 2025	2012	Lectures/Employability
2017-18	MT0318	M.TECH (IT)	Natural Language Processing	TIT 2027	2012	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Big Data Analysis	TIT1035	2016	Lectures/Employability
2016-17	MT0318	M.TECH (IT)	Genetic Algorithms	TIT1037	2016	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Mathematical Foundation of Information Security	TIS1101	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Coding and Information Theory	TIS1103	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Cryptography and Network Security	TIS1019	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Database Security	TIS2003	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Distributed Systems	TIS2105	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Data Compression and Data Hiding	TIS2031	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Security in Computing	TIS1007	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Mobile & Wireless Networks	TIS1009	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Security in Grid Computing	TIS1011	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Advanced Computer Networks	TIS1013	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Advanced Computer Architecture	TIS1015	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Standards and Evaluation Criteria	TIS2007	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Security Engineering	TIS2009	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Software Security	TIS2015	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Intrusion Detection	TIS2017	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Biometric Security	TIS2121	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Cyber Crime	TIS2025	2011	Lectures/Employability
2017-18	MT0206	M.TECH (IS)	Digital Forensics	TIS2027	2011	Lectures/Employability

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2017-18	MT0206	M.TECH (IS)	Security Management, Audit Assurance and Risk Management	TIS2029	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	SOFTWARE PROJECT MGT.	MSE2005	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	OBJECT ORIENTED MODELING & DESIGN	MSE1003	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	PROBABILITY & STATISTICS ANALYSIS [MNAPK]	MSE1005	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	COMPUTABILITY & COMPLEXITY THEORY	MSE1023	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	SOFTWARE DESIGN & TESTING	MSE2001	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	SOFTWARE RELIABILITY ENGG.	MSE2021	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	SYSTEM SIMULATION & MODELING	MSE2025	2011	Lectures/Employability
2017-18	ME0106	M.E. (SE)	REAL TIME SYSTEMS	MSE1025	2011	Lectures/Employability
2017-18	MA0106	MCA	Problem Solving and Program Design with C	MCA 1001	2011	Lectures/Employability
2017-18	MA0106	MCA	Numerical & Statistical Methods	MCA 1003	2011	Lectures/Skill development
2017-18	MA0106	MCA	Discrete Mathematics	MCA 1107	2011	Lectures/Skill development
2017-18	MA0106	MCA	Computer Organization and Architecture	MCA 1009	2011	Lectures/Employability
2017-18	MA0106	MCA	Data Structures	MCA 2001	2011	Lectures/Employability
2017-18	MA0106	MCA	Object Oriented Design and Programming	MCA 2003	2011	Lectures/Employability
2017-18	MA0106	MCA	Database Management Systems	MCA 2005	2011	Lectures/Employability
2017-18	MA0106	MCA	Operating System	MCA 2007	2011	Lectures/Employability
2017-18	MA0106	MCA	Java Programming	MCA 3001	2011	Lectures/Employability
2017-18	MA0106	MCA	Software Engineering	MCA 3003	2011	Lectures/Employability/ Enterpreurship
2017-18	MA0106	MCA	Fundamentals of Computer Algorithms	MCA 3005	2011	Lectures/Employability
2017-18	MA0106	MCA	Automata Theory	MCA 3007	2011	Lectures/Employability

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2017-18	MA0106	MCA	Compiler Design	MCA 4001	2011	Lectures/Employability
2017-18	MA0106	MCA	Data Communications and Computer Networks	MCA 4103	2011	Lectures/Employability
2017-18	MA0106	MCA	Computerized Financial Accounting	MCA 4007	2011	Lectures/Skill development
2017-18	MA0106	MCA	Computer Graphics	MCA 5001	2011	Lectures/Employability
2017-18	MA0106	MCA	System Simulation and Modeling	MCA 5003	2011	Lectures/Employability
2017-18	MA0106	MCA	Optimization Theory	MCA 5005	2011	Lectures/Skill development
2017-18	MA0106	MCA	Distributed Databases	MCA 7101	2011	Lectures/Employability
2017-18	MA0106	MCA	Decision Support Systems	MCA 7103	2011	Lectures/Employability
2017-18	MA0106	MCA	Enterprise Resource Planning	MCA 7105	2011	Lectures/Enterpreneurship
2017-18	MA0106	MCA	Data Mining and Ware Housing	MCA 7107	2011	Lectures/Employability
2017-18	MA0106	MCA	Multimedia Databases	MCA 7109	2011	Lectures/Employability
2017-18	MA0106	MCA	Advanced Java Programming	MCA 7201	2011	Lectures/Employability
2017-18	MA0106	MCA	Systems Programming	MCA 7203	2011	Lectures/Employability
2017-18	MA0106	MCA	Programming Language Design and Concepts	MCA 7205	2011	Lectures/Employability
2017-18	MA0106	MCA	Assembly Language Programming	MCA 7207	2011	Lectures/Employability
2017-18	MA0106	MCA	Web Programming	MCA 7209	2011	Lectures/Employability
2017-18	MA0106	MCA	Software Project Management	MCA 7211	2011	Lectures/Enterpreneurship
2017-18	MA0106	MCA	Natural Language Processing	MCA 7301	2011	Lectures/Employability
2017-18	MA0106	MCA	Genetic Algorithms and Swarm Intelligence	MCA 7303	2011	Lectures/Skill development
2017-18	MA0106	MCA	Artificial Intelligence	MCA 7305	2011	Lectures/Employability
2017-18	MA0106	MCA	Image Processing	MCA 7307	2011	Lectures/Employability
2017-18	MA0106	MCA	Soft Computing	MCA 7309	2011	Lectures/Employability
2017-18	MA0106	MCA	Cloud Computing	MCA 7311	2011	Lectures/Employability

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2017-18	MA0106	MCA	Network Security and Cryptography	MCA 7401	2011	Lectures/Employability
2017-18	MA0106	MCA	Grid Computing	MCA 7403	2011	Lectures/Employability
2017-18	MA0106	MCA	Wireless Technology	MCA 7405	2011	Lectures/Employability
2017-18	MA0106	MCA	Parallel and Distributed Computing	MCA 7407	2011	Lectures/Employability
2017-18	MA0106	MCA	Mobile Computing	MCA 7409	2011	Lectures/Employability
2017-18	MA0106	MCA	Cloud Computing	MCA 7411	2011	Lectures/Employability
2017-18	MA0106	MCA	Bioinformatics	MCA 7501	2011	Lectures/Employability
2017-18	MA0106	MCA	Multimedia and Animation	MCA 7505	2011	Lectures/Skill development
2017-18	MA0106	MCA	Supply Chain Management	MCA 7507	2011	Lectures/Employability
2018-19	BE0106	B.Tech(CSE)	Programming for Problem Solving	CS 101	2018	Lectures/Employability
2018-19	BE0206	B.Tech(IT)	Programming for Problem Solving	CS 101	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Mathematical Foundations of Computer Science	CS501	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Advanced Data Structures	CS502	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Distributed Systems	CS504	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Advanced Computer Algorithm	CS509	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Advanced Database Management System	CS511	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Artificial Intelligence	CS512	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Machine Learning	CS506	2018	Lectures/skill development
2018-19	MT0106	M.TECH (CSE)	Wireless Sensor Networks	IT503	2018	Lectures/Employability

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2018-19	MT0106	M.TECH (CSE)	Computability and Complexity Theory	CS507	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Matlab Programming	IT509	2018	Lectures/skill development
2018-19	MT0106	M.TECH (CSE)	Advanced Operating System	CS515	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Data Mining and Data Analysis	IT516	2018	Lectures/Employability
2018-19	MT0106	M.TECH (CSE)	Design and Analysis of Parallel Algorithm	CS517	2018	Lectures/Employability
2018-19	MT0315	M.TECH (IT)	Mathematical Foundations of Computer Science	CS501	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Advanced Data Structures	CS502	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Information Theory and Coding	IT501	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Advanced Computer Algorithm	CS509	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Advanced Web Technology	IT512	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Big Data Analytics	IT513	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Machine Learning	CS506	2018	Lectures/skill development
2018-19	MT0318	M.TECH (IT)	Wireless Sensor Networks	IT503	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Computability and Complexity Theory	CS507	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Cloud Computing	IT508	2018	Lectures/Employability
2018-19	MT0315	M.TECH (IT)	Data Mining and Data Analysis	IT516	2018	Lectures/Employability
2018-19	MT0318	M.TECH (IT)	Internet of Things(IoT)	IT518	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Mathematical Foundations of Computer Science	CS501	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Advanced Data Structures	CS502	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Fundamentals of Information Security	IT502	2018	Lectures/Employability

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2018-19	MT0206	M.TECH (IS)	Advanced Computer Algorithm	CS509	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Cryptography	IT514	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Digital Forensics	IT515	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Applied Cryptography	IT504	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Mobile and Wireless security	IT505	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Multimedia Security	IT506	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Network Security	IT520	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Data Mining and Data Analysis	IT516	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Internet of Things(IoT)	IT518	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Software Metrics	CS514	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Pattern Recognition and Application	CS522	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Internet of Things	IT518	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Cyber Security and Digital Forensics	IT522	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Biometric Security	IT523	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Applied Cryptography	IT504	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Image Processing Techniques	IT524	2018	Lectures/Skill development
2018-19	MT0206	M.TECH (IS)	Soft Computing	CS524	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Artificial Intelligence	CS512	2018	Lectures/Employability
2018-19	MT0206	M.TECH (IS)	Data Mining and Data Analysis	IT516	2018	Lectures/Employability
2018-19	MA0106	MCA	Discrete Mathematical Structure	MA430	2018	Lectures/Skill development
2018-19	MA0106	MCA	Numerical and Statistical Methods	MA428	2018	Lectures/Skill development

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2018-19	MA0106	MCA	Business Communication	MT123	2018	Lectures/Skill development
2018-19	MA0106	MCA	Fundamentals of management & Organization Behaviour	MT114	2018	Lectures/Skill development
2018-19	MA0106	MCA	Programming with C	CA401	2018	Lectures/Employability
2018-19	MA0106	MCA	Computer Organization and Architecture	CA403	2018	Lectures/Employability
2018-19	MA0106	MCA	Fundamentals of Data Structures	CA455	2018	Lectures/Employability
2018-19	MA0106	MCA	Bioinformatics	BT417	2018	Lectures/Employability
2018-19	MA0106	MCA	Operating System	CA457	2018	Lectures/Employability
2018-19	MA0106	MCA	Object Oriented Design and Programming	CA459	2018	Lectures/Employability
2018-19	MA0106	MCA	Database Management System	CA461	2018	Lectures/Employability
2018-19	MA0106	MCA	Basics of Financial Accounting Management	MT117	2018	Lectures/Skill development

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Course Structure for BE(Computer Science)

	Course No	Subjects	L	T	P	CP
	GROUP-A					
	I- SEMESTER					
	HU-1101	Technical English	3	0	0	3
	PH1201	Physics	3	1	0	4
	MA1201	Engg. Mathematics	3	1	0	4
	EE2201	Principles of Electrical Engg	3	1	0	4
	CH1401	Engg. Chemistry	3	0	0	3
	ME1202	Engg. Graphics	1	0	3	3
	CS1302	Fundamental of Unix & C Programming	1	0	3	3
	PE1202	Workshop Practice	0	0	3	2
	PH1202	Physics lab	0	0	3	2
	GA1002/4/6/8	NCC / NSS / PT & Games / C. Arts	0	0	2	1
	Total 29					
	II- SEMESTER					
	EC2001	Principle of Electronics Engg	3	0	0	3
	MA2201	Advance Engg Mathematics	3	1	0	4
	CH2203	Environmental Science	3	0	0	3
	CS2301	Fundamentals of Data Structure	3	1	0	4

	ME2001	Principles of Mechanical Engg	3	0	0	3

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	AM1201	Engineering Mechanics	3	1	0	4
	CH1402	Chemistry Lab	0	0	3	2
	EE3202	Basic Electrical Engg Lab	0	0	3	2
	EC2002	Basic Electronics Engg Lab	0	0	3	2
	CS2302	Data Structure Lab	0	0	3	2
	GA2002/4/6/8	NCC / NSS / PT & Games / C. Arts	0	0	2	1
	Total 30					
	GROUP-B					
	I- SEMESTER					
	EC2001	Principle of Electronics Engg	3	0	0	3
	PH1201	Physics	3	1	0	4
	CH1401	Engg. Chemistry	3	0	0	3
	MA1201	Engg. Mathematics	3	1	0	4
	AM1201	Engineering Mechanics	3	1	0	4
	ME1202	Engg. Graphics	1	0	3	3
	CS1302	Fundamental of Unix & C Programming	1	0	3	3
	CH1402	Chemistry Lab	0	0	3	2
	EC2002	Basic Electronics Engg Lab	0	0	3	2
	GA1002/4/6/8	NCC / NSS / PT & Games / C. Arts	0	0	2	1
						Total 29

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II-SEMESTER						
	HU1101	Technical English	3	0	0	3
	MA2201	Advance Engg Mathematics	3	1	0	4
	CH2203	Environmental Science	3	0	0	3
	CS2301	Fundamentals of Data Structure	3	1	0	4
	ME2001	Principles of Mechanical Engg	3	0	0	3
	EE2201	Principles of Electrical Engg	3	1	0	4
	PH1202	Physics lab	0	0	3	2
	PE1202	Workshop Practice	0	0	3	2
	AM2202	Engineering Mechanics Lab	0	0	3	2
	CS2302	Data Structure Lab	0	0	3	2
	GA2002/4/6/8	NCC / NSS / PT & Games / C. Arts	0	0	2	1
	Total 30					
III- SEMESTER						
	CS 3005	Object Oriented Programming using Java	3	0	0	3
	EC 3201	Digital Electronics	3	1	0	4
	CS 4101	Discrete Mathematical Structures	3	0	0	3
	CS 6101	Design and Analysis of Computer Algorithms	3	0	0	3
	BT3021/HU4001	**Biological Science/Language *(Breadth Paper)***	3	0	0	3
	Sessionals					
	EE3202/AM2202	Basic Electrical Engg. lab/Engg. Mechanics lab	0	0	3	2
	CS 3006	Object Oriented Programming Lab.	0	0	3	2
	EC 3202	Digital Electronics Lab.	0	0	3	2

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	GA3002/ 4/6/8	NCC / NSS / PT & Games / C. Arts	0	0	2	1
		Total 23				
		IV- SEMESTER				
	MA 4109	Probability, Statistics and Numerical Techniques	3	0	0	3
	CS 4205	Database Management Systems	3	0	0	3
	CS 4109	Computer System Architecture	3	1	0	4
	CS 4107	Operating System	3	0	0	3
	HU4001/ BT 3021	Foreign Language/ Biological Sciences	3	0	0	3
	Sessionals					
	CS 4206	DBMS Lab.	0	0	3	2
	MA 4110	Numerical Techniques Lab.	0	0	3	2
	CS 4108	Operating System Lab.	0	0	3	2
	GA4002/ 4/6/8	NCC / NSS / PT & Games / C. Arts	0	0	2	1
		Total 23				
		V- SEMESTER				
	CS 6107	Computer Networks	3	0	0	3
	EC 4205	Microprocessor and Microcontroller	3	0	0	3
	CS 5101	Formal Language & Automata Theory	3	1	0	4
	CS 8101	Artificial Intelligence and Expert Systems	3	0	0	3
		Breadth Subject-V	3	0	0	3
	Sessionals					
	CS 6108	Computer Networking Lab.	0	0	3	2

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	EC 4206	Microprocessor Application Lab.	0	0	3	2
	CS 8102	Artificial Intelligence Lab.	0	0	3	2
						Total 22
		VI- SEMESTER				
	CS 6105	Compiler Design	3	0	0	3
	CS 6011	Computer Graphics and Multimedia	3	0	0	3
	CS 6109	Software Engineering	3	0	0	3
	CS 6103	System Programming	3	1	0	4
		Breadth Subject-VI	3	0	0	3
	Sessionals					
	CS 6106	Compiler Design Lab.	0	0	3	2
	CS 6110	Software Engg. Lab.	0	0	3	2
	CS 6012	Computer Graphics and Multimedia Lab.	0	0	3	2
						Total 22
		VII- SEMESTER				
	CS 5105	Soft Computing	3	0	0	3
	Departmental Elective - I	Departmental Elective - I	3	0	0	3
		Breadth Subject-VII	3	0	0	3
	Sessionals					
	CS 5106	Soft Computing Lab	0	0	3	2
	CS 7014	Project	0	0	0	4
						Total 15

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		VIII- SEMESTER				
	CS 8031	Data Mining & Data Warehousing	3	0	0	3
		Departmental Elective - II	3	0	0	3
		Departmental Elective – III	3	0	0	3
Sessionals						
CS 8014	Project	Project	**0**	**0**	**0**	**6**
					Total	**15**
					Total	**Credits=179**

Departmental Electives [Group I]

1.	CS 7029	Free/Open Source software	
2.	CS 7117	Optimization Techniques	
3.	CS 7121	Cryptography and Network Security	
4.	CS 7029	Information Security and Assurance	
5.	CS 7101	Principles of Programming Languages	
6.	CS 7107	Digital Image Processing	

Departmental Electives [Group II]

1.	EC 8201	Mobile & Cellular Communication	
2.	EE 4207	Digital Signal Processing	
3.	CS 7033	Multimedia Technology	
4.	CS 8029	Parallel & Distributed Systems	
5.	CS 8111	Natural Language Processing	
6.	CS 8121	Pattern Recognition	

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7.	CS 8113	Computational Geometry	
Departmental Electives [Group III]			
1.	CS 8123	Real Time Systems	
2.	CS 8125	Computer Vision	
3.	CS 8127	Computing and Complexity Theory	
4.	EC 4201	VLSI Design	
5.	CS 7127	Software Project Management	
6.	CS 7123	Bio Informatics	
7.	CS 7125	Object Oriented Analysis and Design	

Breadth - V(Elective)					
Course Code	**Subject**	**L**	**T**	**P**	**C**
	Principles of Management	3	0	0	3
PE 5009	Industrial Organization and Management	3	0	0	3
	Organisation Behavior	3	0	0	3
	Art and Culture	3	0	0	3
	Sociology and Environmental Psychology	3	0	0	3
PE 5011	Project Engineering	3	0	0	3
Breadth - VI(Elective)					
	Business Economics	3	0	0	3
PE 6009	Engineering Economy	3	0	0	3
	Financial Management	3	0	0	3

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Breadth - VII(Elective)					
	IPR	3	0	0	3
	Business and Industrial Laws	3	0	0	3
	Entrepreneurship	3	0	0	3
	Professional ethics	3	0	0	3

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Course Structure for BE (Information Technology)

BE(IT) - I SEMESTER		
CODE	***THEORY***	***CREDIT (L-T-P)***
	Technical English/Principles of Electronics Engineering	*3 (3-0-0)*
	Physics	4 (3-1-0)
	Engineering Chemistry	3 (3-0-0)
	Engineering Mathematics	4 (3-1-0)
	Engineering Mechanics/ Principles of Electrics Engineering	4 (3-1-0)
CODE	**SESSIONAL**	**CREDIT (L-T-P)**
	Engineering Graphics	3 (1-0-3)
CS 1302	Fundamentals of Unix & C Programming	3(1-0-3)
	Physics Lab. / Chemistry Lab	2 (0-0-3)
	Work Shop Practice	2 (0-0-3)
NCC/NSS/PT & Games/ Creative Arts		1(0-0-2)

Credit Hours *29*

BE(IT) - II SEMESTER

CODE	***THEORY***	***CREDIT (L-T-P)***
	Advanced Engineering Maths	4 (3-1-0)
	Principal of Electrical Engineering /Engineering Mechanics	4 (3-1-0)
	Environmental Science	3 (3-0-0)
CS 2301	Fundamentals of Data Structures	4 (3-1-0)
	Principles of Electronics Engineering/Technical English	3 (3-0-0)
	Principles of Mechanical Engineering	3 (3-0-0)
CODE	**SESSIONAL**	**CREDIT (L-T-P)**
	Physics Lab/Chemistry Lab	2 (0-0-3)
	Basic Electrical Engineering Lab/Engineering Mechanics Lab	2 (0-0-3)
	Fundamentals of Data Structure Lab	2(0-0-3)
	Basic Electronics Lab	2 (0-0-3)
	NCC/NSS/PT & Games/Creative Arts	1(0-0-2)

Credit Hours *30*

BE(IT) - III SEMESTER

CODE	***THEORY***	***CREDIT (L-T-P)***
	Biological Science/Language (French/German/ Russian etc)	3 (3-0-0)
IT 3021	Discrete Mathematics and Graph Theory	3 (3-0-0)
IT 3023	Java Programming	3 (3-0-0)
EC 3201	Digital Electronics	4 (3-1-0)

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IT 3025	Computer Organization and Architecture			4 (3-1-0)
CODE	**SESSIONAL**			**CREDIT (L-T-P)**
IT 3024	Java Programming Lab.			2.0 (0-0-3)
	Basic Electrical Engineering Lab/Engineering Mechanics Lab			2.0 (0-0-3)
	NCC.NSS/P.T. /Games/ Creative Arts			1.0 (0-0-2)

Credit Hours *22*

BE(IT) - IV SEMESTER

CODE	***THEORY***	***CREDIT (L-T-P)***
	Language (French/German/ Russian etc)/Biological Science	3 (3-0-0)
IT 4021	Database System Concepts	4 (3-1-0)
IT 4023	Operating System Concepts	3 (3-0-0)
IT 4025	Theory of Computations	3 (3-0-0)
IT 4027	Scientific Computing	3 (3-0-0)
CODE	**SESSIONAL**	**CREDIT (L-T-P)**
IT 4022	Database System Lab.	2 (0-0-3)
IT 4024	Operating System Lab.	2 (0-0-3)
IT 4028	Scientific Computing Lab.	2 (0-0-3)
	NCC.NSS/P.T. /Games/ Creative Arts	1 (0-0-2)

Credit Hours *23*

BE(IT) – V SEMESTER

CODE	***THEORY***				***CREDIT (L-T-P)***
	Principle of Management				3 (3-0-0)
IT 5021	Data Communications				3 (3-0-0)
IT 5023	Software Engineering Principles				4 (3-1-0)
IT 5025	Principles of Soft Computing				3 (3-0-0)
IT 5027	Design of Computer Algorithms				4 (3-1-0)
CODE	**SESSIONAL**				**CREDIT (L-T-P)**
IT 5024	Software Engineering Principles Lab.				2 (0-0-3)
IT 5026	Principles of Soft Computing Lab.				2 (0-0-3)
IT 5028	Computer Algorithms Lab.				2 (0-0-3)

Credit Hours ***23***

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BE(IT) – VI SEMESTER

CODE	*THEORY*	*CREDIT (L-T-P)*
	Business Economics	3 (3-0-0)
IT 6021	Communication Theory	4 (3-1-0)
IT 6023	Computer Network and Security	3 (3-0-0)
IT 6025	Information & Coding Theory	3 (3-0-0)
IT 6027	Optimization Techniques	3 (3-0-0)
CODE	**SESSIONAL**	**CREDIT (L-T-P)**
IT 6022	Communication System Lab	2 (0-0-3)
IT 6024	Network Security Lab.	2 (0-0-3)
IT 6026	Information & Coding Theory Lab	2 (0-0-3)
		_____ ***Credit Hours*** ***22***

BE(IT) – VII SEMESTER

CODE	*THEORY*	*CREDIT (L-T-P)*
	Project Management/ Entrepreneurship	3 (3-0-0)
IT 7021	Data Mining Concepts and Techniques	3 (3-0-0)
	Elective – I	3 (3-0-0)
IT 7041	Parallel & Distributed Computing	3 (3-0-0)
IT 7043	Compiler Design	3 (3-0-0)
CODE	**SESSIONAL**	**CREDIT (L-T-P)**
IT 7022	Data Mining Concepts and Techniques Lab	2 (0-0-3)
	Lab on Elective-I	2 (0-0-3)
IT 7044	Compiler Design Lab	2 (0-0-3)
		_____

Credit Hours 21

List of Electives-I

IT 7023 Simulation & Modeling
IT 7025 Artificial Intelligence
IT 7027 Digital Image Processing
IT 7029 Object Oriented Design
IT 7031 System Programming IT
7033 Web Technology

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List of Lab on Electives-I

IT 7024 Simulation & Modeling Lab
IT 7026 Artificial Intelligence Lab
IT 7028 Digital Image Processing Lab
IT 7030 Object Oriented Design Lab
IT 7032 System Programming Lab
IT 7034 Web Technology Lab

BE(IT) – VIII SEMESTER

CODE	***THEORY***							***CREDIT (L-T-P)***
	Elective-II							3 (3-0-0)
CODE	**SESSIONAL**							**CREDIT (L-T-P)**
IT 8020	Project							6(0-0-9)

Credit Hours 9

List of Electives-II

IT 8025 Enterprise Resource Planning
IT 8027 Decision Support Systems
IT 8029 Embedded Systems
IT 8031 Pattern Recognition
IT 8033 Computing & Complexity Theory
IT 8035 Software Reliability & Testing
IT 8037 Distributed Database System
IT 8039 Computer Graphics & Multimedia
IT 8041 Information System Project Management
IT 8043 Distributed Systems
IT 8045 Advance Computer Graphics
IT 8047 Real Time Systems
IT 8049 Modern Telecommunication Systems
IT 8051 Neural Networks & Applications IT
8053 E-Commerce

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M.Tech. (Computer Science)

Semester I					
Course Code		**Theory**			**Credit(L-T-P)**
TCS1001		Database Modeling and Design			3(3-0-0)
TCS1025		Advanced Operating System Concepts			4(3-1-0)
MSE1005		Probability and Statistical Analysis			3(3-0-0)
		Breadth Subject			3(3-0-0)
		Elective – I			3(3-0-0)
		Sessional			
TCS1002		Database Modeling Lab.			2(0-0-3)
TCS1026		Advanced Operating System Lab.			2(0-0-3)
					Total Credit : 20
Semester II					
Course Code		**Theory**			**Credit(L-T-P)**
MSE1003		Object Oriented Modeling and Design			3(3-0-0)
TCS2001		Data and Computer Communication Networks			3(3-0-0)
TCS2039		High Performance Computer Architecture			4(3-1-0)
		Breadth Subject			3(3-0-0)
		Elective – II			3(3-0-0)
		Sessional			
MSE1004		Object Oriented Modeling Lab.			2(0-0-3)
TCS2002		Network Design Lab.			2(0-0-3)

Total Credit : 20

Semester III

		Credit
TCS3050	Thesis	15

Total Credit : 15

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Semester IV

		Credit
TCS3050	Thesis	20

Total Credit : 20

List of Electives

Group I

1. Computability and Complexity Theory (MSE1023)
2. Digital Signal Processing* (MEE1003)
3. Real Time Systems (MSE1025)
4. Digital Image Processing Techniques* (MEE1003)
5. Graph Theory & Applications (TCS1027)
6. Software Project Management (MSE2005)

Group II

1. Pattern Recognition and Image Analysis (TCS2021)
2. Computational Geometry (TCS2023)
3. Mobile Computing (TCS2025) 4. Grid Computing (TCS2027)
5. Interconnection Networks (TCS2033)
6. Computer Communication Networks* (MEC2009)
7. Design and Analysis of Parallel Algorithms (TCS2037)

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Course Structure for M.Tech (Information Technology)

Course Code **Course** **Credit (L-T-P)**

Semester-I

TIT 1101	Computability & Complexity Theory		3 (3-0-0)
TIT 1003	Advanced Database		4 (3-1-0)
TIT 1005	Computational Intelligence		3 (3-0-0)
	Breadth Paper-I		3 (3-0-0)
	Elective-I		3 (3-0-0)
TIT 1004	Lab-I (Advanced Database)		2 (0-0-3)
TIT 1008	Lab-II (Programming Techniques)		2 (0-0-3)

Total: 20 **Semester-II**

TIT 2001	Information Theory	3 (3-0-0)
TIT 2003	Communication Theory	3 (3-0-0)
TIT 2005	Data Compression and Data Hiding	4 (3-1-0)
	Breadth Paper-II	3 (3-0-0)
	Elective-II	3 (3-0-0)
TIT 2006	Lab-III (Data Compression and Data Hiding)	2 (0-0-3)
TIT 2008	Lab-IV (Intelligence System)	2 (0-0-3)

Total: 20

Semester III

TIT 3050 Thesis **15**

Semester IV

TIT 3050 Thesis **20**

Grand Total: 75

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List of Electives

Elective-I

TIT 1011	Stochastic Processes and Simulation
TIT 1013	Computer Algorithms
TIT 1015	Cryptography
TIT 1017	Mobile and Wireless Network
TIT 1019	Mobile Computing
TIT 1021	Cluster & Grid Computing
TIT 1023	Distributed Computing
TIT 1025	Speech Processing
TIT 1027	Data Mining & Warehousing
TIT 1029	Human Computer Interaction
TIT 1031	Digital Signal Processing
TIT 1033	Soft Computing
TIT 1035	Big Data Analysis
TIT 1037	Genetic Algorithm
Elective –II	
TIT 2011	Wireless Adhoc and Sensor Network
TIT 2013	Cloud Computing
TIT 2015	Computational Biology
TIT 2017	Software Metrics
TIT 2117	Software Metrics (Revised)
TIT 2019	Applied Computer Vision
TIT 2021	Pattern Recognition & Application
TIT 2023	Operation Research
TIT 2025	Parallel Computing
TIT 2027	Natural Language Processing

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M.Tech (Information Security)

Course Code **Course** **Credit (L-T-P)**

Semester-I

TIS1101	Mathematical Foundation of Information Security	3 (3-0-0)
TIS1103	Coding and Information Theory	4 (3-1-0)
TIS1019	Cryptography and Network Security	3 (3-0-0)
	Breadth Paper-I	3 (3-0-0)
	Elective-I	3 (3-0-0)
TIS1020	Lab-I (Cryptography and Network Security)	2 (0-0-3)
TIS1008	Lab-II (Programming Techniques)	2 (0-0-3)

20

Semester-II

TIS2003	Database Security		3 (3-0-0)
TIS2105	Distributed Systems		4 (3-1-0)
TIS2031	Data Compression and Data Hiding		3 (3-0-0)
	Non-Departmental Elective		3 (3-0-0)
Elective-II			
TIS2032	Lab-III (Data Compression and Data Hiding)		2 (0-0-3)
TIS2004	Lab-IV (Database Security)		2 (0-0-3)

20

Semester III

Thesis - I **15**

Semester IV

Thesis - II **20**

Total Credits 75

List of Electives Elective-I

TIS1007	Security in Computing
TIS1009	Mobile & Wireless Networks
TIS1011	Security in Grid Computing
TIS1013	Advanced Computer Networks
TIS1015	Advanced Computer Architecture

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Elective –II

TIS2007	Standards and Evaluation Criteria
TIS2009	Security Engineering
TIS2015	Software Security
TIS2017	Intrusion Detection
TIS2121	Biometric Security
TIS2025	Cyber Crime
TIS2027	Digital Forensics
TIS2029	Security Management, Audit Assurance and Risk Management

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Semester I			**M.E. (Software Engineering)**	
Course Code			**Theory**	**Credit(L-T-P)**
MSE1101			Advanced Database Management Systems	3(3-0-0)
MSE1003			Object Oriented Modeling and Design	3(3-0-0)
MSE1005			Probability and Statistical Analysis	4(3-1-0)
			Breadth Subject	3(3-0-0)
			Elective – I	3(3-0-0)
			Sessional	
MSE1102			Advanced Database Management System Lab.	2(0-0-3)
MSE1004			Object Oriented Modeling and Design Lab.	2(0-0-3)
Semester II			Total Credit : 20	
Course Code			**Theory**	**Credit(L-T-P)**
MSE2001			Software Design and Testing	3(3-0-0)
MSE2025			System Simulation and Modeling	3(3-0-0)
MSE2005			Software Project Management	4(3-1-0)
			Breadth Subject	3(3-0-0)
			Elective – II	3(3-0-0)
			Sessional	
MSE2002			Software Design and Testing Lab.	2(0-0-3)
MSE2026			System Simulation and Modeling Lab.	2(0-0-3)
			Total Credit : 20	

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Semester III

									Credit
MSE3050			Thesis						15
Semester IV						Total Credit : 15			
									Credit
MSE3050			Thesis						20
List of Electives:						Total Credit : 20			
Group I									
1. Computability and Complexity Theory					(MSE1123)				
2. Distributed Operating Systems					(TCS 1005)				
3. Real Time Systems					(MSE 1025)				
4. Computer Communication Networks*					(MEC2009)				
Group II									
13. Software Reliability Engineering					(MSE2021)				
14. Software Architecture and Integration					(MSE2023)				
15. Embedded System Theory & Design *					(MEC2013)				
16. Service Oriented Architecture					(MSE2027)				

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MCA Course Structure

Course Code **Course** **Credit (L-T-P)**

SEMESTER – I

MCA 1001	Problem Solving and Program Design with C	3 (3-0-0)
MCA 1003	Numerical & Statistical Methods	4 (3-1-0)
MCA 1107	Discrete Mathematics	3 (3-0-0)
MCA 1009	Computer Organization and Architecture	3 (3-0-0)
	Breadth Paper-I	3 (3-0-0)
MCA 1002	C Programming Lab	2 (0-0-3)
MCA 1004	Numerical & Statistical Methods Lab	2 (0-0-3)

20

SEMESTER – II

MCA 2001	Data Structures	3 (3-0-0)
MCA 2003	Object Oriented Design and Programming	3 (3-0-0)
MCA 2005	Database Management Systems	3 (3-0-0)
MCA 2007	Operating System	3 (3-0-0)
MCA 2002	Data Structures Lab	2 (0-0-3)
MCA 2004	C++ Programming Lab	2 (0-0-3)
MCA 2006	RDBMS Lab	2 (0-0-3)
MCA 2008	Operating System Lab	2 (0-0-3)

20

SEMESTER – III

MCA 3001 Java Programming		3 (3-0-0)
MCA 3003	Software Engineering	3 (3-0-0)
MCA 3005	Fundamentals of Computer Algorithms	3 (3-0-0)
MCA 3007	Automata Theory	4 (3-1-0)
	Elective – I	3 (3-0-0)
MCA 3002	Java Programming Lab	2 (0-0-3)
MCA 3004	Software Engineering Lab	2 (0-0-3)

20

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SEMESTER – IV

MCA 4001	Compiler Design	4 (3-1-0)
MCA 4103	Data Communications and Computer Networks	3 (3-0-0)
MCA 4007	Computerized Financial Accounting Breadth Paper-II Elective – II	3 (3-0-0) 3 (3-0-0) 3 (3-0-0)
MCA 4002	Compiler Design Lab	2 (0-0-3)
MCA 4004	Computer Networks Lab	2 (0-0-3)

		20

Course Code **Course** **Credit (L-T-P)**

SEMESTER – V

MCA 5001	Computer Graphics	3 (3-0-0)
MCA 5003	System Simulation and Modeling	4 (3-1-0)
MCA 5005	Optimization Theory	3 (3-0-0)
	Breadth Paper Elective – III	3 (3-0-0) 3 (3-0-0)
MCA 5002	Computer Graphics Lab	2 (0-0-3)
MCA 5004	System Simulation and Modeling Lab	2 (0-0-3)

	20	

SEMESTER – VI

MCA 6001 Project **20**

Total Credits = 120

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List of Electives

Group I : Database Technology

MCA 7101	Distributed Databases
MCA 7103	Decision Support Systems
MCA 7105	Enterprise Resource Planning
MCA 7107	Data Mining and Ware Housing
MCA 7109	Multimedia Databases

Group II : Software Technology

MCA 7201	Advanced Java Programming
MCA 7203	Systems Programming
MCA 7205	Programming Language Design and Concepts
MCA 7207	Assembly Language Programming
MCA 7209	Web Programming
MCA 7211	Software Project Management

Group III : Cognitive Sciences and Intelligent Systems

MCA 7301	Natural Language Processing
MCA 7303	Genetic Algorithms and Swarm Intelligence
MCA 7305	Artificial Intelligence
MCA 7307	Image Processing
MCA 7309	Soft Computing
MCA 7311	Cloud Computing

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Group IV : Networking and Distributed Systems

MCA 7401	Network Security and Cryptography
MCA 7403	Grid Computing
MCA 7405	Wireless Technology
MCA 7407	Parallel and Distributed Computing
MCA 7409	Mobile Computing
MCA 7411	Cloud Computing

Group V : Applications of Information Technology

MCA 7501	Bioinformatics
MCA 7505	Multimedia and Animation
MCA 7507	Supply Chain Management
NOTE :-	**(i) Students are required to choose at least two electives from the same group.** **(ii) Students are advised to do their projects on the areas where major electives are chosen.**

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Course structure BE CSE CBCS								
BIRLA INSTITUTE OF TECHNOLOGY- MESRA, RANCHI								
NEWCOURSE STRUCTURE - To be effective from academic session 2018- 19								
Based on CBCS & OBE model								
Recommended scheme of study								
B.Tech. in Computer Science & Engineering								
Semester/ Session of Study	**Course Level**	**Category**	**Course Code**	**Courses**	**Mode of delivery & credits**			**Total**
(Recomended)		**of course**			***L-Lecture; T-Tutorial;P-Practicals***			**Credits**
								C-Credits
					L	**T**	**P**	**C**
					(*Periods/week*)	***(Periods/week)***	***(Periods/week)***	
GRAND TOTAL FOR FIRST YEAR								**43.5**
THIRD		**THEORY**						
Monsoon	FIRST	FS	BE101	Biological Science for Engineers	2	0	0	2

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	SECOND	GE	IT 201	Basics of Intelligent Computing	3	0	0	3
	THIRD	PC	MA205	Discrete Mathematics	3	1	0	4
	SECOND		EC203	Digital System Design	3	0	0	3
			CS201	Data Structures	3	1	0	4
		LABORATORIES						
	FIRST	GE	EE102	Electrical Engineering lab	0	0	3	1.5
	SECOND	MC	MC201/202/203/204	Choice of : NCC/NSS/	0	0	2	1

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				PT & Games/ Creative Arts (CA)				
		PC	EC204	Digital System Design Lab	0	0	3	1.5
			CS202	Data Structures Lab	0	0	3	1.5
TOTAL								**21.5**
FOURTH		**THEORY**						
Spring	SECOND	FS	MA203	Numerical Methods	2	0	0	2
	FIRST	FS	CE101	Environmental Science	2	0	0	2

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	SECOND	PC	CS203	Computer Organization and Architecture	3	1	0	4
			CS204	Object Oriented Programming and Design Pattern	3	0	0	3
			CS206	Design and Analysis of Algorithm	3	0	0	3
			CS211	Operating System	3	0	0	3
		LABORATORIES						
	SECOND	FS	MA204	Numerical Methods Lab	0	0	2	1

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		GE	IT202	Basic IT Workshop (Common Subject)	0	0	2	1
		MC	MC205/206/207/208	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
		PC	CS205	OOPDP Lab	0	0	3	1.5
			CS207	Design of Algorithm Lab	0	0	3	1.5
			CS212	Operating System Lab	0	0	3	1.5
TOTAL								**24.5**

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FIFTH			THEORY					
Monsoon	THIRD	PC	IT301	Data Comm. computer Network	3	1	0	4
			CS301	Database Management System	3	0	0	3
			CS310	Formal Language and Automata theory	3	0	0	3
			IT305	Software Engineering	3	0	0	3
		PE	**	PROGRAM ELCTIVE-I	3	0	0	3
		OE	*	OPEN ELCTIVE-I	3	0	0	3

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		LABORATORIES						
	THIRD	PC	IT302	DCCN Lab	0	0	3	1.5
			CS302	DBMS Lab	0	0	3	1.5
			IT310	Shell and Kernel Lab	0	0	3	1.5
			IT306	Software Engg. Lab	0	0	3	1.5
TOTAL								**25**
SIXTH		PC	**THEORY**					
Spring	THIRD		CS305	Compiler Design	3	0	0	3
			CS307	Graph Theory	3	0	0	3
		PE	**	PROGRAM ELECTIVE-II	3	0	0	3
		OE	*	OPEN ELECTIVE-II	3	0	0	3

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	FIRST	HSS	MT123	Business Communications	3	0	0	3
	THIRD	MC	MC300	Summer training - Mandatory				3
	SECOND	HSS	MT204	Constitution of India	2	0	0	Non-credit
		LABORATORIES						
	THIRD	PC	CS306	Compiler Design Lab	0	0	3	1.5
			CS308	Mobile Interface Lab	0	0	3	1.5
		PE	**	PROGRAM ELECTIVE LAB-I	0	0	3	1.5
TOTAL								**22.5**

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SEVENTH		PC	**THEORY**					
Monsoon	FOURTH		IT404	Professional Practice	2	0	0	2
				Law & Ethics				
		OE	*	OPEN ELECTIVE-III/MOOC-I	3	0	0	3
			*	OPEN ELECTIVE-IV / MOOC-II	3	0	0	3
		PE	**	PROGRAM ELECTIVE-III	3	0	0	3

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			**	PROGRAM ELECTIVE-IV	3	1	0	4
		LABORATORIES						
		PE	**	PROGRAM ELECTIVE LAB-II	0	0	3	1.5
			**	PROGRAM ELECTIVE LAB-III	0	0	3	1.5
TOTAL								**18**
EIGTH	FOURTH	PC	CS400	Research project / Industry Internship	*NOT APPLICABLE*			12
Spring								
GRAND TOTAL								**167**
Minimum requirement for Degree award								

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Programme Elective and Open Elective may include one or two Massive Open Online Course (MOOC)								
	** indicates program elective (PE)							
	* indicates Open Elective (OE)							

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OPEN ELECTIVES (OE)*

OFFERED FOR LEVEL 1-4

OE / LEVEL		Code no.	Name of the courses	Prerequisites/ Corequisites cources with code	L	T	P	C
2	OE1	CS270	Fundamentals of Computer Science	NIL	3	0	0	3
		CS271	Fundamentals of Computer Science Lab	NIL	0	0	3	1.5
		CS201	Data Structures	Programming for Problem Solving CS101	3	1	0	4
		CS202	Data Structures Lab	Data Structures CS201	0	0	3	1.5
		CA201	Object Oriented Programming using JAVA	NIL	3	0	0	3
		CA202	Object Oriented Programming using JAVA Lab	NIL	0	0	3	1.5
		CS204	Object Oriented Programming and Design Patterns	Programming for Problem Solving CS101	3	0	0	3
	OE2	CS206	Design and Analysis of Algorithm	Data Structures CS201	3	0	0	3
		CS275	Bio Informatics	Programming for Problem Solving CS101	3	0	0	3
		IT270	Introduction to R	NIL	3	0	0	3
		IT271	Introduction to Python	NIL	3	0	0	3
		CS276	Cyber Law and Security	NIL	3	0	0	3
3	OE3	CS301	Database Management System	NIL	3	0	0	3
		CS302	Database Management System Lab	Database Management System CS301				

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					3	0	0	3
		IT305	Software Engineering	NIL	3	0	0	3
		CS325	Database Modelling	Database Management System CS301	3	0	0	3

		IT330	Cryptography & Network Security	Mathematics-I MA 103/Mathematics-II MA 107	3	0	0	3
		IT331	Bio Metric Security	Data Structures CS201,Design and Analysis of Algorithm CS206	3	0	0	3
		CS370	Cyber Crime and Investigation	Design and Analysis of Algorithm CS206	3	0	0	3
		CS371	Genetic Algorithm	Design and Analysis of Algorithm CS206,Mathematics-II MA 107	3	0	0	3
4	**OE4**	IT402	.NET Programming	NIL	0	0	3	1.5
		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	0	0	3
		IT490	Natural Language Processing	Compiler design CS305	0	0	3	1.5
		IT423	Internet of Things(IoT)	Basics of Intelligent Computing IT 201	3	0	0	3
		IT420	Artificial Intelligence	Basics of Intelligent Computing IT 201	3	0	0	3
		CS436	High Performance Computing	NIL	3	0	0	3
		CS470	Wireless communication	Data communication and computer networks IT301	3	0	0	3

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		CS471	Medical Image Processing	NIL	3	0	0	3
		CS472	Programming for Bio Informatics	NIL	3	0	0	3
		IT470	Genomic Data Science	Design and Analysis of Algorithm CS206	3	0	0	3
		CS473	Deep Learning	Machine Learning IT429	3	0	0	3
		IT426	Data Mining Concepts and Techniques	Database Management System CS301	3	0	0	3
		IT427	Data Mining Concepts	Data Mining				
			and Techniques Lab	Concepts and				
				Techniques IT426	0	0	3	1.5
*** OPEN ELECTIVES TO BE OPTED ONLY BY OTHER DEPARTMENT STUDENTS**								

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PROGRAMME ELECTIVES (PE)* OFFERED FOR LEVEL 1-4								
PE / LEVEL		**Code no.**	**Name of the PE Courses**	**Prerequisites/ Corequisites Courses with code**	**L**	**T**	**P**	**C**
3	**PE 1**	IT320	UI Design	OOPDP CS204	3	0	0	3
3		IT321	Bio Inspired Computing	Data Structure CS201	3	0	0	3
3		CS320	Optimization Technique	Design and Analysis of Algorithm CS206	3	0	0	3
3		IT321	Soft Computing	Discrete Mathematics MA205	3	0	0	3
3		CS322	Simulation and Modelling	Data Structure CS201, Mathematics-II MA 107	3	1	0	4
3		CS323	Simulation Modelling Lab	Simulation Modelling CS322	0	0	3	1.5
3		IT322	Cloud Computing	Basics of Intelligent Computing IT 201	3	0	0	3
3		IT323	Software Project Management	Software Engineering IT305	3	0	0	3
3		CS324	System Programming	NIL	3	0	0	3
3		CS325	Database Modelling	Database Management System CS301	3	0	0	3
3		CS326	Database Modelling Lab	Database Modelling CS325	0	0	3	1.5
3		IT324	Software Testing	Software Engineering IT305	3	1	0	4
3		IT325	Software Testing Lab	Software Testing IT324	0	0	3	1.5
3	**PE 2**	IT326	Wireless Sensor Network	Data communication and Computer networks IT301	3	0	0	3
3		IT327	Wireless Sensor Lab	Wireless Sensor Network IT326	0	0	3	1.5
3		IT328	Pattern Recognition	Image Processing IT307	3	1	0	4
3		IT329	Pattern Recognition Lab	Pattern Recognition IT328	0	0	3	1.5
3		CS327	Computer Graphics	Design and Analysis of Algorithm CS206	3	0	0	3
3		CS328	Computer Graphics Lab	Computer Graphics CS327	3	0	0	3
3		IT330	Cryptography & Network Security	Mathematics-I MA 103/Mathematics-II MA 107	3	0	0	3
3		CS391	Introduction to Distributed System	NIL	3	0	0	3
4	**PE 3**	IT401	Data Analysis and Interpretation	NIL	3	0	0	3

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4		IT420	Artificial Intelligence	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT421	Artificial Intelligence Lab	Artificial Intelligence IT420	0	0	3	1.5
4		IT422	Principles of Multimedia	NIL	3	0	0	3
4		IT423	Internet of Things(IoT)	Basics Of intelligent Computing IT 201	3	1	0	4
4		IT424	Internet of Things(IoT) Lab	Internet of Things(IoT) IT423	0	0	3	1.5
4		CS420	Advanced Data Structure	Data Structure CS201	3	0	0	3
4		CS421	Parallel Computing	Design and Analysis of Algorithm CS206	3	0	0	3
4		CS422	Parallel Computing Lab	Parallel Computing CS421	0	0	3	1.5
4		IT425	Image Analysis	Image Processing IT307	3	0	0	3
4		CS423	Advanced Algorithm	Design and Analysis of Algorithm CS206	3	0	0	3
4		CS494	Big Data Analytics	Database Management System CS301	3	0	0	3
		CS495	Big Data Analytics Lab	Database Management System CS301	0	0	3	1.5
4		IT426	Data Mining Concepts and Techniques	Database Modelling CS325	3	1	0	4
4		IT427	Data Mining Concepts and Techniques Lab	Data Mining Concepts and Techniques IT426	0	0	3	1.5
4		CS425	Advanced Operating System	Operating System CS303	3	0	0	3
4		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT430	Machine Learning Lab	Machine Learning IT429	0	0	3	1.5
		IT428	Information Retrieval	Data Structure CS201	3	1	0	4
4	**PE 4**	CS429	Information and Coding Theory	Discrete Mathematics MA205	3	0	0	3
4		CS430	Information and Coding Theory Lab	Information and Coding Theory CS429	0	0	3	1.5
4		CS431	Computational Network Analysis	Data Communication and Computer Network IT301	3	1	0	4
4		IT431	Emerging Storage Technologies	Database Management System CS301	3	1	0	4
4		IT433	Computer Vision	Computer Graphics CS327	3	0	0	3

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4		CS436	High Performance Computing	Parallel Computing CS421	3	1	0	4
4		CS437	High Performance Computing Lab	High Performance Computing CS430	0	0	3	1.5
4		IT402	.NET Programming	NIL	3	0	0	3
4		IT434	Mobile Computing	NIL	3	0	0	3
4		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT430	Machine Learning Lab	Machine Learning IT429	0	0	3	1.5
4		IT490	Natural Language Processing	Compiler Design CS305	3	0	0	3
4		CS494	Big Data Analytics	Database Management System CS301	3	0	0	3
4		CS490	3D Simulation	Computer Graphics CS327	3	0	0	3
4		CS493	GP-GPU Programming	Operating System CS303	3	0	0	3
4								

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
MINOR* REQUIREMENT FOR OTHER BRANCHES
OFFERED FOR LEVEL 2-4

LEVEL	Code no.	Name of the Courses	Prerequisites Courses with code	L	T	P	C
2	CS201	Data Structures	NIL	3	1	0	4
3	CS301	Database Management System	NIL	3	0	0	3
2	CS206	Design and Analysis of Algorithm	NIL	3	1	0	4
3	CS303	Operating System	NIL	3	0	0	3
2	CS203	Computer Organization Architecture	NIL	3	1	0	4
LABORATORIES							
2	CS202	Data Structures Lab	NIL	0	0	3	1.5
3	CS302	Database Management System Lab	NIL	0	0	3	1.5

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SPECIALIZATION

LEVEL	Specialization area	Code No	Name of the courses	Pre requisites / Co requisites	L	T	P	C
4	**Computational Intelligence**	IT420	Artificial Intelligence	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT426	Data Mining Concepts and Techniques	Database Modelling CS325	3	0	0	3
4		IT490	Natural Language Processing	Compiler Design CS305	3	1	0	4
3		IT322	Cloud Computing	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT427	Data Mining Concepts and Techniques Lab	Data Mining Concepts and Techniques IT426	0	0	3	2
4		IT421	Artificial Intelligence Lab	Artificial Intelligence IT420	0	0	3	2
3	**Internet of things**	IT326	Wireless Sensor Networks	Data communication and Computer networks IT301	3	1	0	4
3		IT322	Cloud Computing	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT423	Internet of Things(IoT)	Basics Of intelligent Computing IT 201	3	0	0	3
4		IT426	Data Mining Concepts and Techniques	Database Modelling CS325	3	1	0	4
3		CS391	Introduction to Distributed System	NIL	3	0	0	3
4		IT424	Internet of Things(IoT) Lab	Internet of Things(IoT) IT423	0	0	3	2
4		IT427	Data Mining Concepts and Techniques Lab	Data Mining Concepts and Techniques IT426	0	0	3	2

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3	**Image Processing & Computer Vision**	CS327	Computer Graphics	Design and Analysis of Algorithm CS206	3	0	0	3
3		IT307	Image Processing	NIL	3	0	0	3
4		CS447	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT433	Computer Vision	Computer Graphics CS327	3	0	0	3
4		CS490	3D Simulation		3	1	0	4
3		IT308	Image Processing Lab	Image Processing IT307	0	0	3	2
4		CS491	3D Simulation Lab	NIL	0	0	3	2
4	**High Performance Computing**	CS436	High Performance Computing	Parallel Computing CS421	3	0	0	3
4		CS421	Parallel Computing	Design and Analysis of Algorithm CS206	3	0	0	3
3		CS391	Introduction to Distributed System	Operating System CS303	3	0	0	3
4		CS493	GP-GPU Programming	Operating System CS303	3	1	0	4
4		CS494	Big Data Analytics	Database Management System CS301	3	1	0	4
4		CS422	Parallel Computing Lab	Parallel Computing CS421	0	0	3	2
4		CS495	Big Data Analytics Lab	Big Data Analytics CS494	0	0	3	2

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Course structure BE IT CBCS

BIRLA INSTITUTE OF TECHNOLOGY- MESRA, RANCHI
NEWCOURSE STRUCTURE - To be effective from academic session 2018- 19
Based on CBCS & OBE model
Recommended scheme of study
B.Tech. in Computer Science & Engineering

Semester/ Session of Study (Recomended)	Course Level	Category of course	Course Code	Courses	Mode of delivery & credits *L-Lecture; T-Tutorial;P-Practicals*			Total Credits *C-Credits*
					L (*Periods/week*)	**T *(Periods/week)***	**P *(Periods/week)***	**C**
GRAND TOTAL FOR FIRST YEAR								**43.5**
THIRD Monsoon		**THEORY**						
	FIRST	FS	BE101	Biological Science for Engineers	2	0	0	2

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	SECOND	GE	IT 201	Basics of Intelligent Computing	3	0	0	3
	THIRD	PC	MA205	Discrete Mathematics	3	1	0	4
	SECOND		EC203	Digital System Design	3	0	0	3
			CS201	Data Structures	3	1	0	4
		LABORATORIES						
	FIRST	GE	EE102	Electrical Engineering lab	0	0	3	1.5
	SECOND	MC	MC201/202/203/204	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
		PC	EC204	Digital System Design Lab	0	0	3	1.5
			CS202	Data Structures Lab	0	0	3	1.5
TOTAL								**21.5**
FOURTH Spring		**THEORY**						
	SECOND	FS	MA203	Numerical Methods	2	0	0	2
	FIRST	FS	CE101	Environmental Science	2	0	0	2
	SECOND	PC	CS203	Computer Organization and Architecture	3	1	0	4
			CS204	Object Oriented Programming and Design Pattern	3	0	0	3
			CS206	Design and Analysis of Algorithm	3	0	0	3
			CS211	Operating System	3	0	0	3

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		LABORATORIES						
	SECOND	FS	MA204	Numerical Methods Lab	0	0	2	1
		GE	IT202	Basic IT Workshop (Common Subject)	0	0	2	1
		MC	MC205/206/207/208	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
		PC	CS205	OOPDP Lab	0	0	3	1.5
			CS207	Design of Algorithm Lab	0	0	3	1.5
			CS212	Operating System Lab	0	0	3	1.5
TOTAL								**24.5**
FIFTH Monsoon		PC	**THEORY**					
	THIRD		IT301	Data Comm. computer Network	3	1	0	4
			CS301	Database Management System	3	0	0	3
			CS310	Formal Language and Automata theory	3	0	0	3
			IT303	Internet and Web Technology	3	0	0	3
		PE	**	PROGRAM ELCTIVE-I	3	0	0	3
		OE	*	OPEN ELCTIVE-I	3	0	0	3
		LABORATORIES						
	THIRD	PC	IT302	DCCN Lab	0	0	3	1.5
			CS302	DBMS Lab	0	0	3	1.5

Head of Department

			IT310	Shell and Kernel Programming Lab	0	0	3	1.5
			IT308	Internet and Web Technology Lab	0	0	3	1.5
TOTAL								**25**
SIXTH Spring			**THEORY**					
	THIRD	PC	IT305	Software Engineering	3	0	0	3
			IT307	Image Processing	3	0	0	3
		PE	**	PROGRAM ELECTIVE-II	3	0	0	3
		OE	*	OPEN ELECTIVE-II	3	0	0	3
	FIRST	HSS	MT123	Business Communications	3	0	0	3
	THIRD	MC	MC300	Summer training - Mandatory				3
	SECOND	HSS	MT204	Constitution of India	2	0	0	Non-credit
		LABORATORIES						
	THIRD	PC	IT306	Software Engg. Lab	0	0	3	1.5
			IT308	Image Processing Lab	0	0	3	1.5
			CS308	Mobile Interface Lab	0	0	3	1.5
		PE	**	PROGRAM ELECTIVE LAB-I	0	0	3	1.5
TOTAL								**24**

Head of Department

SEVENTH Monsoon		PC	**THEORY**					
	FOURTH		IT404	Professional Practice Law & Ethics	2	0	0	2
		OE	*	OPEN ELECTIVE-III/MOOC-I	3	0	0	3
			*	OPEN ELECTIVE-IV / MOOC-II	3	0	0	3
		PE	**	PROGRAM ELECTIVE-III	3	0	0	4
			**	PROGRAM ELECTIVE-IV	3	1	0	3
		LABORATORIES						
		PE	**	PROGRAM ELECTIVE LAB-II	0	0	3	1.5
TOTAL								**16.5**
EIGTH Spring	FOURTH	PC	CS400	Research project / Industry Internship	*NOT APPLICABLE*			12
GRAND TOTAL *Minimum requirement for Degree award*								**167**

Programme Elective and Open Elective may include one or two Massive Open Online Course (MOOC)

** indicates program elective (PE)

* indicates Open Elective (OE)

Head of Department

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
OPEN ELECTIVES (OE)*
OFFERED FOR LEVEL 1-4

OE / LEVEL		Code no.	Name of the courses	Prerequisites/ Corequisites cources with code	L	T	P	C
2	OE1	CS270	Fundamentals of Computer Science	NIL	3	0	0	3
		CS271	Fundamentals of Computer Science Lab	NIL	0	0	3	1.5
		CS201	Data Structures	Programming for Problem Solving CS101	3	1	0	4
		CS202	Data Structures Lab	Data Structures CS201	0	0	3	1.5
		CA201	Object Oriented Programming using JAVA	NIL	3	0	0	3
		CA202	Object Oriented Programming using JAVA Lab	NIL	0	0	3	1.5
		CS204	Object Oriented Programming and Design Patterns	Programming for Problem Solving CS101	3	0	0	3
	OE2	CS206	Design and Analysis of Algorithm	Data Structures CS201	3	0	0	3
		CS275	Bio Informatics	Programming for Problem Solving CS101	3	0	0	3
		IT270	Introduction to R	NIL	3	0	0	3
		IT271	Introduction to Python	NIL	3	0	0	3
		CS276	Cyber Law and Security	NIL	3	0	0	3
3	OE3	CS301	Database Management System	NIL	3	0	0	3
		CS302	Database Management System Lab	Database Management System CS301				

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					3	0	0	3
		IT305	Software Engineering	NIL	3	0	0	3
		CS325	Database Modelling	Database Management System CS301	3	0	0	3

		IT330	Cryptography & Network Security	Mathematics-I MA 103/Mathematics-II MA 107	3	0	0	3
		IT331	Bio Metric Security	Data Structures CS201,Design and Analysis of Algorithm CS206	3	0	0	3
		CS370	Cyber Crime and Investigation	Design and Analysis of Algorithm CS206	3	0	0	3
		CS371	Genetic Algorithm	Design and Analysis of Algorithm CS206,Mathematics-II MA 107	3	0	0	3
4	**OE4**	IT402	.NET Programming	NIL	0	0	3	1.5
		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	0	0	3
		IT490	Natural Language Processing	Compiler design CS305	0	0	3	1.5
		IT423	Internet of Things(IoT)	Basics of Intelligent Computing IT 201	3	0	0	3
		IT420	Artificial Intelligence	Basics of Intelligent Computing IT 201	3	0	0	3
		CS436	High Performance Computing	NIL	3	0	0	3

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		CS470	Wireless communication	Data communication and computer networks IT301				
					3	0	0	3
		CS471	Medical Image Processing	NIL	3	0	0	3
		CS472	Programming for Bio Informatics	NIL	3	0	0	3
		IT470	Genomic Data Science	Design and Analysis of Algorithm CS206	3	0	0	3
		CS473	Deep Learning	Machine Learning IT429	3	0	0	3
		IT426	Data Mining Concepts and Techniques	Database Management System CS301	3	0	0	3
		IT427	Data Mining Concepts and Techniques Lab	Data Mining Concepts and Techniques IT426	0	0	3	1.5

*** OPEN ELECTIVES TO BE OPTED ONLY BY OTHER DEPARTMENT STUDENTS**

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING PROGRAMME ELECTIVES (PE)* OFFERED FOR LEVEL 1-4								
PE / LEVEL		**Code no.**	**Name of the PE Courses**	**Prerequisites/ Corequisites Courses with code**	**L**	**T**	**P**	**C**
3	**PE 1**	IT320	UI Design	OOPDP CS204	3	0	0	3
3		IT321	Bio Inspired Computing	Data Structure CS201	3	0	0	3
3		CS320	Optimization Technique	Design and Analysis of Algorithm CS206	3	0	0	3
3		IT321	Soft Computing	Discrete Mathematics MA205	3	0	0	3
3		CS322	Simulation and Modelling	Data Structure CS201, Mathematics-II MA 107	3	1	0	4
3		CS323	Simulation Modelling Lab	Simulation Modelling CS322	0	0	3	1.5
3		IT322	Cloud Computing	Basics of Intelligent Computing IT 201	3	0	0	3
3		IT323	Software Project Management	Software Engineering IT305	3	0	0	3
3		CS324	System Programming	NIL	3	0	0	3
3		CS325	Database Modelling	Database Management System CS301	3	0	0	3
3		CS326	Database Modelling Lab	Database Modelling CS325	0	0	3	1.5
3		IT324	Software Testing	Software Engineering IT305	3	1	0	4
3		IT325	Software Testing Lab	Software Testing IT324	0	0	3	1.5
3	**PE 2**	IT326	Wireless Sensor Network	Data communication and Computer networks IT301	3	0	0	3
3		IT327	Wireless Sensor Lab	Wireless Sensor Network IT326	0	0	3	1.5
3		IT328	Pattern Recognition	Image Processing IT307	3	1	0	4
3		IT329	Pattern Recognition Lab	Pattern Recognition IT328	0	0	3	1.5
3		CS327	Computer Graphics	Design and Analysis of Algorithm CS206	3	0	0	3
3		CS328	Computer Graphics Lab	Computer Graphics CS327	3	0	0	3
3		IT330	Cryptography & Network Security	Mathematics-I MA 103/Mathematics-II MA 107	3	0	0	3
3		CS391	Introduction to Distributed System	NIL	3	0	0	3
4	**PE 3**	IT401	Data Analysis and Interpretation	NIL	3	0	0	3

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4		IT420	Artificial Intelligence	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT421	Artificial Intelligence Lab	Artificial Intelligence IT420	0	0	3	1.5
4		IT422	Principles of Multimedia	NIL	3	0	0	3
4		IT423	Internet of Things(IoT)	Basics Of intelligent Computing IT 201	3	1	0	4
4		IT424	Internet of Things(IoT) Lab	Internet of Things(IoT) IT423	0	0	3	1.5
4		CS420	Advanced Data Structure	Data Structure CS201	3	0	0	3
4		CS421	Parallel Computing	Design and Analysis of Algorithm CS206	3	0	0	3
4		CS422	Parallel Computing Lab	Parallel Computing CS421	0	0	3	1.5
4		IT425	Image Analysis	Image Processing IT307	3	0	0	3
4		CS423	Advanced Algorithm	Design and Analysis of Algorithm CS206	3	0	0	3
4		CS494	Big Data Analytics	Database Management System CS301	3	0	0	3
		CS495	Big Data Analytics Lab	Database Management System CS301	0	0	3	1.5
4		IT426	Data Mining Concepts and Techniques	Database Modelling CS325	3	1	0	4
4		IT427	Data Mining Concepts and Techniques Lab	Data Mining Concepts and Techniques IT426	0	0	3	1.5
4		CS425	Advanced Operating System	Operating System CS303	3	0	0	3
4		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT430	Machine Learning Lab	Machine Learning IT429	0	0	3	1.5
		IT428	Information Retrieval	Data Structure CS201	3	1	0	4
4	**PE 4**	CS429	Information and Coding Theory	Discrete Mathematics MA205	3	0	0	3
4		CS430	Information and Coding Theory Lab	Information and Coding Theory CS429	0	0	3	1.5
4		CS431	Computational Network Analysis	Data Communication and Computer Network IT301	3	1	0	4
4		IT431	Emerging Storage Technologies	Database Management System CS301	3	1	0	4
4		IT433	Computer Vision	Computer Graphics CS327	3	0	0	3

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4		CS436	High Performance Computing	Parallel Computing CS421	3	1	0	4
4		CS437	High Performance Computing Lab	High Performance Computing CS430	0	0	3	1.5
4		IT402	.NET Programming	NIL	3	0	0	3
4		IT434	Mobile Computing	NIL	3	0	0	3
4		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT430	Machine Learning Lab	Machine Learning IT429	0	0	3	1.5
4		IT490	Natural Language Processing	Compiler Design CS305	3	0	0	3
4		CS490	3D Simulation	Computer Graphics CS327	3	0	0	3
4		CS493	GP-GPU Programming	Operating System CS303	3	0	0	3

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
MINOR* REQUIREMENT FOR OTHER BRANCHES
OFFERED FOR LEVEL 2-4

LEVEL	Code no.	Name of the Courses	Prerequisites Courses with code	L	T	P	C
2	CS201	Data Structures	NIL	3	1	0	4
3	CS301	Database Management System	NIL	3	0	0	3
2	CS206	Design and Analysis of Algorithm	NIL	3	1	0	4
3	CS303	Operating System	NIL	3	0	0	3
2	CS203	Computer Organization Architecture	NIL	3	1	0	4
LABORATORIES							
2	CS202	Data Structures Lab	NIL	0	0	3	1.5
3	CS302	Database Management System Lab	NIL	0	0	3	1.5

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SPECIALIZATION

LEVEL	Specialization area	Code No	Name of the courses	Pre requisites / Co requisites	L	T	P	C
4	**Computational Intelligence**	IT420	Artificial Intelligence	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT429	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT426	Data Mining Concepts and Techniques	Database Modelling CS325	3	0	0	3
4		IT490	Natural Language Processing	Compiler Design CS305	3	1	0	4
3		IT322	Cloud Computing	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT427	Data Mining Concepts and Techniques Lab	Data Mining Concepts and Techniques IT426	0	0	3	2
4		IT421	Artificial Intelligence Lab	Artificial Intelligence IT420	0	0	3	2
3	**Internet of things**	IT326	Wireless Sensor Networks	Data communication and Computer networks IT301	3	1	0	4
3		IT322	Cloud Computing	Basics of Intelligent Computing IT 201	3	0	0	3
4		IT423	Internet of Things(IoT)	Basics Of intelligent Computing IT 201	3	0	0	3
4		IT426	Data Mining Concepts and Techniques	Database Modelling CS325	3	1	0	4
3		CS391	Introduction to Distributed System	NIL	3	0	0	3
4		IT424	Internet of Things(IoT) Lab	Internet of Things(IoT) IT423	0	0	3	2
4		IT427	Data Mining Concepts and Techniques Lab	Data Mining Concepts and Techniques IT426	0	0	3	2

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3	**Image Processing & Computer Vision**	CS327	Computer Graphics	Design and Analysis of Algorithm CS206	3	0	0	3
3		IT307	Image Processing	NIL	3	0	0	3
4		CS447	Machine Learning	Design and Analysis of Algorithm CS206	3	1	0	4
4		IT433	Computer Vision	Computer Graphics CS327	3	0	0	3
4		CS490	3D Simulation		3	1	0	4
3		IT308	Image Processing Lab	Image Processing IT307	0	0	3	2
4		CS491	3D Simulation Lab	NIL	0	0	3	2
4	**High Performance Computing**	CS436	High Performance Computing	Parallel Computing CS421	3	0	0	3
4		CS421	Parallel Computing	Design and Analysis of Algorithm CS206	3	0	0	3
3		CS391	Introduction to Distributed System	Operating System CS303	3	0	0	3
4		CS493	GP-GPU Programming	Operating System CS303	3	1	0	4
4		CS494	Big Data Analytics	Database Management System CS301	3	1	0	4
4		CS422	Parallel Computing Lab	Parallel Computing CS421	0	0	3	2
4		CS495	Big Data Analytics Lab	Big Data Analytics CS494	0	0	3	2

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Course structure M.Tech CS CBCS

BIRLA INSTITUTE OF TECHNOLOGY- MESRA, RANCHI
NEW COURSE STRUCTURE - To be effective from academic session 2018- 19
Based on CBCS & OBE model
Recommended scheme of study for M.Tech(Computer Science & Engineering)

SEMESTER / Session of Study (Recomended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery & credits *L-Lecture; T-Tutorial;P-Practicals*			Total Credits *C-Credits*
					L (*Periods/ week*)	T *(Periods/ week)*	P *(Periods/ week)*	C
	THEORY							
FIRST / Monsoon	Fifth	Programme Core (PC)	CS501	Mathematical Foundations of Computer Science	3	0	0	3
			CS502	Advanced Data Structures	3	0	0	3
			CS504	Distributed Systems	3	0	0	3
		Programme Elective (PE)	**	PE 1	3	0	0	3
		Open Elective (OE)	*	OE 1	3	0	0	3
		LABORATORIES						
	Fifth	Programme Core (PC)	CS503	Advanced Data Structures Lab	0	0	4	2
		Programme Elective (PE)	**	PE LAB 1	0	0	4	2
		TOTAL						19
SECOND/ Spring	Fifth	Programme Core (PC)	CS509	Advanced Computer Algorithm	3	0	0	3
			CS511	Advanced Database Management System	3	0	0	3
			CS512	Artificial Intelligence	3	0	0	3

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		Programme Elective (PE)	**	PE 2	3	0	0	3
		Open Elective (OE)	*	OE 2	3	0	0	3
		LABORATORIES						
	Fifth	Programme Core (PC)	CS510	Advanced Computer Algorithm Lab	0	0	4	2
		Programme Elective (PE)	**	PE LAB 2	0	0	4	2
								19
TOTAL FOR FIFTH LEVEL								38
THIRD /Monsoon	Sixth	Programme Core (PC)	CS600	Thesis Part I				8
			CS601	Graph Theory	3	0	0	3
		Programme Elective (PE)	**	PE 3	3	0	0	3
		LABORATORIES						
	Sixth	Programme Elective (PE)	**	PE LAB 3	0	0	4	2
		TOTAL						16
FOURTH/ Spring	Sixth	Programme Core (PC)	CS650	Thesis Part II				16
		TOTAL						16
TOTAL FOR SIXTH LEVEL								32
GRAND TOTAL FOR M.TECH PROGRAMME (38 + 32)								70

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Programme Elective List for M.Tech

(Computer Science & Engineering)

SEMESTER / Session of Study (Recomended)	Course Level		Course Code	Courses	Mode of delivery & credits *L-Lecture; T-Tutorial;P-Practicals*			Total Credits *C-Credits*
					L (*Periods/week*)	T *(Periods/ week)*	P *(Periods/ week)*	C
FIRST / Monsoon	5		CS506	Machine Learning	3	0	0	3
	5		IT503	Wireless Sensor Networks	3	0	0	3
	5		CS507	Computability and Complexity Theory	3	0	0	3
		LABORATORIES						
	5	PE LAB 1	IT509	Matlab Programming	0	0	4	2
	5		IT510	Java Programming	0	0	4	2
	5		IT511	R Programming	0	0	4	2
SECOND/ Spring	5	PE 2	CS515	Advanced Operating System	3	0	0	3
	5		IT516	Data Mining and Data Analysis	3	0	0	3
	5		CS517	Design and Analysis of Parallel Algorithm	3	0	0	3
		LABORATORIES						
	5	PE LAB 2	IT517	Data Mining and Data Analysis Lab	0	0	4	2
	5		CS518	Parallel Computing Lab	0	0	4	2
	5		CS516	Advanced Operating System Lab	0	0	4	2
THIRD / Monsoon	6	PE 3	CS605	High Performance Computing Architecture	3	0	0	3
	6		IT508	Cloud Computing	3	0	0	3
	5		IT518	Internet of Things(IoT)	3	0	0	3
		LABORATORIES						
	5	PE LAB 3	IT519	Internet of Things(IoT) Lab	0	0	4	2
	6		IT603	Python Programming	0	0	4	2

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	6		IT604	Web App Development Lab	0	0	4	2

Open Elective List for M. Tech Program

SEMESTER / Session of Study (Recomended)		Category of Course	Course Code	Subjects	Mode of delivery & credits *L-Lecture; T-Tutorial;P-Practicals*			Total Credits *C-Credits*
					L (*Periods/week*)	T *(Periods/ week)*	P *(Periods/ week)*	C
FIRST / Monsoon		OE 1	CS514	Software Metrics	3	0	0	3
			CS522	Pattern Recognition and Application	3	0	0	3
			IT518	Internet of Things	3	0	0	3
			IT570	Basics of Python Programming	0	1	2	3
			IT522	Cyber Security and Digital Forensics	3	0	0	3
SECOND/ Spring	5	OE 2	IT523	Biometric Security	3	0	0	3
	5		IT504	Applied Cryptography	3	0	0	3
	5		IT524	Image Processing Techniques	3	0	0	3
	5		CS524	Soft Computing	3	0	0	3
			IT571	Introduction to R Programming	0	1	2	3
	5		CS512	Artificial Intelligence	3	0	0	3
	5		IT516	Data Mining and Data Analysis	3	0	0	3

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Course structure M.Tech IT CBCS

NEW COURSE STRUCTURE - To be effective from academic session 2018- 19
Based on CBCS & OBE model
Recommended scheme of study for M.Tech (Information Technology)

SEMESTER / Session of Study (Recomended)	Course Level	Category of course	Course Code	Courses	Mode of delivery & credits L-Lecture; T-Tutorial;P-Practicals			Total Credits C-Credits
					L (Periods/ week)	T (Periods/ week)	P (Periods/ week)	C
	THEORY							
FIRST / Monsoon	Fifth	Programme Core (PC)	CS501	Mathematical Foundations of Computer Science	3	0	0	3
			CS502	Advanced Data Structures	3	0	0	3
			IT501	Information Theory and Coding	3	0	0	3
		Programme Elective (PE)	**	PE 1	3	0	0	3
		Open Elective (OE)	*	OE 1	3	0	0	3
	LABORATORIES							
	Fifth	Programme Core (PC)	CS503	Advanced Data Structures Lab	0	0	4	2
		Programme Elective (PE)	**	PE LAB 1	0	0	4	2
		TOTAL						**19**

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	THEORY							
SECOND/ Spring	Fifth	Programme Core (PC)	CS509	Advanced Computer Algorithm	3	0	0	3
			IT512	Advanced Web Technology	3	0	0	3
			IT513	Big Data Analytics	3	0	0	3
		Programme Elective (PE)	**	PE 2	3	0	0	3
		Open Elective (OE)	*	OE 2	3	0	0	3
		LABORATORIES						
	Fifth	Programme Core (PC)	CS510	Advanced Computer Algorithm Lab	0	0	4	2
		Programme Elective (PE)	**	PE LAB 2	0	0	4	2
								19
								38
THIRD / Monsoon	Sixth	Programme Core (PC)	CS600	Thesis Part I				8
			CS601	Graph Theory	3	0	0	3
		Programme Elective (PE)	**	PE 3	3	0	0	3
		LABORATORIES						
	Sixth	Programme Elective (PE)	**	PE LAB 3	0	0	4	2
		TOTAL						**16**
FOURTH/ Spring	Sixth	Programme Core (PC)	CS650	Thesis Part II				16
		TOTAL						**16**
TOTAL FOR SIXTH LEVEL								**32**
GRAND TOTAL FOR M.TECH PROGRAMME (38 + 32)								**70**

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Programme Elective List for M.Tech (Information Technology)

SEMESTER / Session of Study (Recomended)	Course Level	Category of Course	Course Code	Cources	Mode of delivery & credits L-Lecture; T-Tutorial;P-Practicals			Total Credits C-Credits
					L (Periods/week)	T (Periods/week)	P (Periods/week)	C
FIRST / Monsoon	5	PE 1	CS506	Machine Learning	3	0	0	3
	5		IT503	Wireless Sensor Networks	3	0	0	3
	5		CS507	Computability and Complexity Theory	3	0	0	3
		LABORATORIES						
	5	PE LAB 1	IT509	Matlab Programming	0	0	4	2
	5		IT510	Java Programming	0	0	4	2
SECOND/ Spring	5	PE 2	IT508	Cloud Computing	3	0	0	3
	5		IT516	Data Mining and Data Analysis	3	0	0	3
	5		IT518	Internet of Things(IoT)	3	0	0	3
		LABORATORIES						
	5	PE LAB 2	IT517	Data Mining and Data Analysis Lab	0	0	4	2
	5		IT519	Internet of Things(IoT) Lab	0	0	4	2
	5		IT511	R Programming	0	0	4	2
THIRD / Monsoon	6	PE 3	CS607	Intelligent Systems	3	0	0	3
	6		CS605	High Performance Computing Architecture	3	0	0	3
	5		IT507	Data Communication and Computer Networks	3	0	0	3
		LABORATORIES						

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	5	PE LAB 3	IT521	Data Communication and Computer Networks Lab	0	0	4	2
	6		IT603	Python Programming	0	0	4	2
	6		IT604	Web App Development Lab	0	0	4	2

Open Elective List for M. Tech Program

SEMESTER / Session of Study (Recomended)	**Course Level**	**Category of Course**	**Course Code**	**Cources**	Mode of delivery & credits L-Lecture; T-Tutorial;P-Practicals			Total Credits C-Credits
					L (Periods/ week)	T (Periods/week)	P (Periods /week)	**C**
FIRST / Monsoon	5	OE1	CS514	Software Metrics	3	0	0	3
	5		CS522	Pattern Recognition and Application	3	0	0	3
			IT570	Basics of python programming	0	1	2	3
	5		IT518	Internet of Things	3	0	0	3
	5		IT522	Cyber Security and Digital Forensics	3	0	0	3
SECOND/ Spring	5	OE 2	IT523	Biometric Security	3	0	0	3
	5		IT504	Applied Cryptography	3	0	0	3
	5		IT524	Image Processing Techniques	3	0	0	3
	5		CS524	Soft Computing	3	0	0	3
			IT571	Introduction to R Programming	0	1	2	3
	5		CS512	Artificial Intelligence	3	0	0	3
	5		IT516	Data Mining and Data Analysis	3	0	0	3

** indicates program elective (PE)
* indicates Open Elective (OE)

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Course structure M.Tech IS CBCS

BIRLA INSTITUTE OF TECHNOLOGY- MESRA, RANCHI
NEW COURSE STRUCTURE - To be effective from academic session 2018- 19
Based on CBCS & OBE model
Recommended scheme of study for M.Tech(Information Security)

SEMESTER / Session of Study (Recommended)	**Course Level**	**Category of Course**	**Course Code**	**Courses**	**Mode of delivery & credits** *L-Lecture; T-Tutorial;P-Practicals*			**Total Credits** *C-Credits*
					L(Periods/week)	*T(Periods/week)*	*P (Periods/week)*	**C**
	THEORY							
FIRST / Monsoon	Fifth	Programme Core (PC)	CS501	Mathematical Foundations of Computer Science	3	0	0	3
			CS502	Advanced Data Structures	3	0	0	3
			IT502	Fundamentals of Information Security	3	0	0	3
		Programme Elective (PE)	**	PE 1	3	0	0	3
		Open Elective (OE)	*	OE 1	3	0	0	3

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	LABORATORIES							
	Fifth	Programme Core (PC)	CS503	Advanced Data Structures Lab	0	0	4	2
		Programme Elective (PE)	**	PE LAB 1	0	0	4	2
		TOTAL						**19**

	THEORY							
SECOND/ Spring	Fifth	Programme Core (PC)	CS509	Advanced Computer Algorithm	3	0	0	3
			IT514	Cryptography	3	0	0	3
			IT515	Digital Forensics	3	0	0	3
		Programme Elective (PE)	**	PE 2	3	0	0	3
		Open Elective (OE)	*	OE 2	3	0	0	3
	LABORATORIES							
	Fifth	Programme Core (PC)	CS510	Advanced Computer Algorithm Lab	0	0	4	2
		Programme Elective (PE)	**	PE LAB 2	0	0	4	2
								19
LEVEL							**TOTAL FOR FIFTH**	**38**

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	THEORY							
THIRD /Monsoon	Sixth	Programme Core (PC)	CS600	Thesis Part I				8
			CS602	Data Compression	3	0	0	3
		Programme Elective (PE)	**	PE 3	3	0	0	3
	LABORATORIES							
	Sixth	Programme Elective (PE)	**	PE LAB 3	0	0	4	2
		TOTAL						**16**
FOURTH/ Spring	Sixth	Programme Core (PC)	CS650	Thesis Part II				16
		TOTAL						**16**
TOTAL FOR SIXTH LEVEL								**32**
GRAND TOTAL FOR M.TECH PROGRAMME (38 + 32)								**70**

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Programme Elective List for M.Tech (Information Security)

SEMESTER / Session of Study (Recommended)	**Course Level**	**Category of Course**	**Course Code**	**Courses**	**Mode of delivery & credits** *L-Lecture; T-Tutorial;P-Practicals*			**Total Credits** *C-Credits*
					L (*Periods /week*)	**T *(Periods/week)***	**P *(Periods/ week)***	**C**
FIRST / Monsoon	5	PE 1	IT504	Applied Cryptography	3	0	0	3
	5		IT505	Mobile and Wireless security	3	0	0	3
	5		IT506	Multimedia Security	3	0	0	3
	LABORATORIES							
	5	PE LAB 1	IT509	Matlab Programming	0	0	4	2
	5		IT510	Java Programming	0	0	4	2
SECOND/ Spring	5	PE 2	IT520	Network Security	3	0	0	3
	5		IT516	Data Mining and Data Analysis	3	0	0	3
	5		IT518	Internet of Things(IoT)	3	0	0	3
		LABORATORIES						
	5	PE LAB 2	IT517	Data Mining and Data Analysis Lab	0	0	4	2
	5		IT519	Internet of Things(IoT) Lab	0	0	4	2
	5		IT511	R Programming	0	0	4	2
THIRD / Monsoon	5	PE 3	IT507	Data Communication and Computer Networks	3	0	0	3

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	6		IT601	Cloud Security	3	0	0	3
	6		IT602	Cyber Security	3	0	0	3
		LABORATORIES						
	5	PE LAB 3	IT521	Data Communication and Computer Networks Lab	0	0	4	2
	6		IT603	Python Programming	0	0	4	2
	6		IT604	Web App Development Lab	0	0	4	2
Open Elective List for M. Tech Program								
SEMESTER / Session of Study (Recommended)	**Course Level**	**Category of Course**	**Course Code**	**Courses**	**Mode of delivery & credits** *L-Lecture; T-Tutorial;P-Practicals*			**Total Credits** *C-Credits*
					L (*Periods /week*)	**T *(Periods/week)***	**P *(Periods/ week)***	**C**
FIRST / Monsoon	5	OE 1	CS514	Software Metrics	3	0	0	3
	5		CS522	Pattern Recognition and Application	3	0	0	3
	5		IT518	Internet of Things	3	0	0	3
			IT570	Basics of Python Programming	0	1	2	3
	5		IT522	Cyber Security and Digital Forensics	3	0	0	3
SECOND/ Spring	5	OE 2	IT523	Biometric Security	3	0	0	3
	5		IT504	Applied Cryptography	3	0	0	3
	5		IT524	Image Processing Techniques	3	0	0	3
	5		CS524	Soft Computing	3	0	0	3

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			IT571	Introduction to R Programming	0	1	2	3
	5		CS512	Artificial Intelligence	3	0	0	3
	5		IT516	Data Mining and Data Analysis	3	0	0	3
	** indicates program elective (PE)							
	* indicates Open Elective (OE)							

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Course structure M.Tech MCA CBCS

BIRLA INSTITUTE OF TECHNOLOGY- MESRA, RANCHI
NEWCOURSE STRUCTURE - ***To be effective from academic session 2018- 19***
Based on CBCS & OBE model
Recommended scheme of study for MCA Programme

SEMESTER / Session of Study (Recomended)	**Course Level**	**Category of Course**	**Course Code**	**Courses**	**Mode of delivery & credits** *L-Lecture; T-Tutorial;P-Practicals*			**Total Credits** *C-Credits*
					L (*Periods/week*)	**T (*Periods/week*)**	**P (*Periods/week*)**	**C**
THEORY								
FIRST / Monsoon	**FOURTH**	Fundamental Science (FS)	MA430	Discrete Mathematical Structure	3	0	0	3
			MA428	Numerical and Statistical Methods	3	0	0	3
	FIRST	Humanities & Social Sciences (HSS)	MT123	Business Communication	2	0	2	3
			MT114	Fundamentals of management & Organization Behaviour	3	0	0	3
	FOURTH	Programme Core (PC)	CA401	Programming with C	3	0	0	3
			CA403	Computer Organization and Architecture	3	0	0	3
		LABORATORIES						
	FOURTH	Programme Core (PC)	CA402	Programming Lab in C	0	0	3	1.5
			MA429	Numerical and Statistical Methods Lab	0	0	3	1.5
		TOTAL						**21**
THEORY								

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SECOND/ Spring	**FOURTH**	Fundamental Science (FS)	CA455	Fundamentals of Data Structures	3	1	0	4
	FIRST		BT417	Bioinformatics	3	0	0	3
	FOURTH	Programme Core (PC)	CA457	Operating System	3	0	0	3
			CA459	Object Oriented Design and Programming	3	0	0	3
			CA461	Database Management System	3	1	0	4
	FIRST	HSS	MT117	Basics of Financial Accounting Management	3	0	0	3
		LABORATORIES						
	FOURTH	Programme Core (PC)	CA456	Data Structures Lab	0	0	3	1.5
			CA458	Operating System Lab	0	0	3	1.5
			CA460	C++ Programming Lab	0	0	3	1.5
			CA412	RDBMS Lab	0	0	3	1.5
		TOTAL						**26**
THEORY								
THIRD/ Monsoon	**FIFTH**	Programme Core (PC)	CA501	Java Programming	3	0	0	3
			CA503	Computer Algorithm Design	3	1	0	4
			CA504	Automata Theory	3	1	0	4
			CA505	Software Engineering	3	1	0	4
	FIRST	HSS	MT121	Corporate Social Responsibility	2	0	0	2
		Programme Elective (PE)		Programme Elective-I	3	0	0	3
				Programme Elective-I	3	0	0	3
		LABORATORIES						
	FIFTH	Programme Core (PC)	CA502	Java Programming Lab	0	0	3	1.5
			CA506	Software Engineering Lab	0	0	3	1.5
		TOTAL						**26**
THEORY								

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FOURTH/Spring	**FIFTH**	Programme Core (PC)	CA557	Front end Design	3	1	0	4
			CA559	Data Communication and Computer Network	3	1	0	4
			CA561	Software Project Management	3	0	0	3
		Programme Elective(PE)		Programme Elective- II	3	0	0	3
				Programme Elective- II	3	0	0	3
		MOOC		Massive Online Courses and Assignments	4	0	0	4
		LABORATORIES						
	FIFTH	Programme Core (PC)	CA558	Front end Design Lab	0	0	3	1.5
			CA560	Data Communication and Computer Network Lab	0	0	3	1.5
		TOTAL						**24**
THEORY								
FIFTH/Monsoon	**FIEST**	Humanities & Social Sciences (HSS)	MT116	Quantitative methods for Business Decision	3	0	0	3
	SIXTH	Programme Core (PC)	CA601	Computer Graphics	3	0	0	3
			CA603	System Simulation and Modeling	3	0	0	3
			CA605	Optimization Techniques	3	0	0	3
		Programme Elective(PE)		Programme Elective-III	3	0	0	3
				Programme Elective-IV	3	1	0	4
		SIT / Soft Skill Course / Extra OE		Small Industrial Training/ Small Project /	0	0	6	6
		LABORATORIES						

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	SIXTH	Programme Core (PC)	CA602	Computer Graphics Lab	0	0	3	1.5
			CA604	System Simulation and Modeling Lab	0	0	3	1.5
		TOTAL						**28**
PROJECT								
SIXTH/ Spring	**SIXTH**	Project(P)	CA656	Project				**15**
TOTAL								**15**
GRAND TOTAL								**140**

List of Program Electives:							
PE/ LEVEL		**Code No.**	**Name of the PE cources**	**L**	**T**	**P**	**C**
5	**PE1**	CA530	Distributed Databases	3	0	0	3
5		CA531	Decision Support Systems	3	0	0	3
5		CA532	Data Mining and Warehousing	3	0	0	3
5		CA533	Multimedia Databases	3	0	0	3
5	**PE2**	CA580	Advanced Java Programming	3	0	0	3
5		CA581	Systems Programming	3	0	0	3
5		CA582	Compiler Design	3	0	0	3
5		CA583	Programming Language Design and Concepts	3	0	0	3
5		CA584	Web Programming	3	0	0	3
6	**PE3**	CA635	Natural Language Processing	3	0	0	3
6		CA636	Artificial Intelligence	3	0	0	3
6		CA637	Image Processing	3	0	0	3

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6		CA638	Soft Computing	3	0	0	3
6		CA639	Cloud Computing	3	0	0	3
6		CA640	Machine Learning	3	0	0	3
6		CA641	In-Memory Computing	3	0	0	3
6	**PE4**	CA630	Network Security and Cryptography	3	1	0	4
6		CA631	Internet of Things(IoT)	3	1	0	4
6		CA632	Mobile Computing	3	1	0	4
6		CA634	Multimedia and Animation	3	1	0	4

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Syllabus BE CSE Non-CBCS

SEMESTER - I

CS 1302 FUNDAMENTALS OF UNIX & C PROGRAMMING Credit-3

MODULE – I [6 lectures]
The Free Software Movement, Open source definition, Open source business strategy, Problem Solving and its tools, Flow chart, Pseudo code, Modular programming. Fundamentals of Unix Operating System, Login & Password, Different Commands, Unix directory, Structure and working with directories, Vi-editor, Basic Structure and execution of C programmes, Constants, Variables, and Data Types and various type of declarations, Different type operators and Expressions, Evaluation of Expressions, Operator Precedence and Associability, Mathematical Functions.

MODULE –II [4 lectures]
Managing Input and Output operations, Decision Making and Branching Decision Making and Looping.

MODULE – III [5 lectures]
One – dimensional Arrays and their declaration and Initialisations, Two-dimensional Arrays and their initialisations, Multidimensional Arrays, String Variables, Reading and Writing Strings, Arithmetic Operations on characters, Putting Strings together, Comparison of Two Strings, String – handling functions.

MODULE –IV [5 lectures]
Need and Elements for user –defined Functions, Definition of Functions, Return values and their types, Function calls and Declaration, Arguments and corresponding return values, Functions that return multiple values, Nesting of functions, Recursion, Passing arrays and strings to functions, The Scope, Visibility and Life time of variables.

MODULE –V [5 lectures]
Defining Structure, Declaring Structure Variable and Accessing Structure Members, Initialisation of Structure, Comparing Structure Variables, Operation on Individual Members, Arrays of Structures, Structures within structures, Structures and Functions, Unions, Size of Structures, Bit Fields.

MODULE – VI [6 lectures]
Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialisation of Pointer Variables, Accessing a Variable through its Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Arrays of Pointers, Pointers and Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures,

MODULE – VII [4 lectures]
File Management in C. use of fopen(), fclose(), Formatted file I/O, Searching through files using fseek(), ftell(), rewind().

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Text Book :

1. Kernighan K. R., Ritchie D. M. - The C Programming Language, Ansi C Edition, Prentice Hall, India

Reference:

- E. Balagurusamy – Programming in ANSI C, 3rd Edn. , TMH, New Delhi ; 2004
- A. N. Kanthane – Programming with ANSI and TURBO C, Pearson Education, New Delhi; 2004
- Y. Kanetkar – Let us C, 4th Edition, BPB Publication , New Delhi; 2002
- Chris DiBona, Sam Ockman , Open Sources : Voices from the Open Source Revolution (Web book), Oreilly Press, 2nd edition, 1999

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SEMESTER II

CS 2301 FUNDAMENTALS OF DATA STRUCTURES Credit-4

MODULE – I [5 lectures]
Algorithms and Analysis of Algorithms: Definition, Structure and Properties of Algorithms, Development of an Algorithm, Data Structures and Algorithms, Data Structure – Definition and Classification, Efficiency of Algorithms, Apriory Analysis, Asymptotic Notations, Time Complexity of an Algorithm using *O* Notation, Polynomial Vs Exponential Algorithms, Average, Best and Worst case Complexities, Analyzing Recursive Programs, Open source software development process.

MODULE – II [5 lectures]
Arrays, Stacks and Queues: Array Operations, Number of Elements in an Array, Representation of Arrays in Memory, Applications of Array, Stack-Introduction, Stack Operations, Applications of Stack, Queues-Introduction, Operations on Queues, Circular Queues, Other Types of Queues, Applications of Queues.

MODULE – III [5 lectures]
Linked List, Linked Stacks and Linked Queues: Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Multiply Linked Lists, Applications of Linked Lists, Introduction to Linked Stack and Linked Queues, Operations on Linked Stacks and Linked Queues, Dynamic Memory Management and Linked Stack, Implementations of Linked Representations, Applications of Linked Stacks and Linked Queues.

MODULE – IV [6 lectures]
Trees, Binary Trees, BST, AVL Trees and B Trees: Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees: Basic Terminologies and Types, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Applications, BST & AVL Trees: Introduction, BST: Definition and Operations, AVL Trees: Definition and Operations, B Trees: Introduction, m-way search trees: Definition and Operations, B Trees: Definition and Operations.

MODULE – V [5 lectures]
Graphs: Introduction, Definitions and Basic Terminologies, Representations of Graphs, Graph Traversals, Single-Source Shortest-Path Problem, Minimum Cost Spanning Trees.

MODULE – VI [5 lectures]
Sorting: Introduction, Shell Sort, Quick Sort, Heap Sort.

MODULE – VII [4 lectures]
Searching: Introduction, Binary Search, Transpose Sequential Search, Interpolation Search.

Text Book:

1. G A V Pai – Data Structures and Algorithms: Concepts, Techniques and Applications, 2nd Edn, Tata McGraw-Hill, 2008

Head of Department

2. Horowitz E.Sahni, S., Susan A., Fundamentals of Data Structures in C, 2nd Edition, University Press, 2010

Reference Books:

1. J. P. *Tremblay* **,** P. G. *Sorenson – An Introduction to Data Structures With Applications, 2nd Edn*, McGraw-Hill, Inc. New York, NY, USA.
2. Seymour Lipschutz – Data Structures, 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
3. Adam Drozdek – Data Structures and Algorithms in C++, Thomson Learning, New Delhi – 2007.
4. J. Feller, B. Fitzgerald -Understanding Open Source Software Development, Pearson Education Ltd. New Delhi

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BT3001 **Biological Sciences*** **Credit-3**

Nature of living things: Definition of life, Miller's experiment, theories and evidences about origin of life, levels of biological organization, classification of living world.

Biomolecules: composition of living matter, water, carbohydrates, lipids, proteins, nucleic acids, vitamins and minerals.

Biochemistry: Bioenergetics and thermodynamics, biological oxidation-reduction reactions, glycolysis, citric acid cycle, fatty acid metabolism, electron transport chain, aerobic and anaerobic respiration

Molecular organization of cell: Viruses, cellular structure of microorganism, animal and plant, salient features of intracellular organelles, cell division and cell cycle, structure of chromosomes, difference between prokaryotes and eukaryotes.

Molecular biology: Structure of DNA and RNA, DNA as genetic material, central dogma of molecular biology, DNA replication, transcription and translation, Introduction to bioinformatics and drug designing.

Enzymology:, Mechanism of enzyme action, Lock and key model and induced fit model, active site, MichaelisMenten equation, reversible and irreversible inhibitors, competitive, non-competitive and uncompetitive inhibition.

Techniques in biological sciences: Centrifugation, chromatography, gel electrophoresis, spectroscopy, thermal analysis,.

Books Recommended

1. Purves et al, Life: The Science of Biology
2. R. Dulbecco, The Design of Life.
3. Lehninger A, Principals of Biochemistry
4. Stryer L, Biochemistry
5. K. Wilson & K.H. Goulding, A biologist's guide to Principles and Techniques of Practical Biochemistry.

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SEMESTER-III

CS 6101 DESIGN AND ANALYSIS OF COMPUTER ALGORITHMS
Credit-3

MODULE –I [6Lecture]

Basic Tools on Designing Algorithms: What is an algorithm? Algorithm specification and performance analysis, randomized algorithms.

MODULE –II [7L]
Divide-and-Conquer: The general method, application to binary search, finding the maximum and minimum, merge sort, quick sort, the problem of selection and Strassen's matrix multiplication.

MODULE –III [5L]

The Greedy Method: The general method, application to optimal storage on tapes, job sequencing with deadlines, optimal merge patterns and minimum weight spanning trees.

MODULE –IV & V [12L]

Dynamic Programming: The general method, application to multistage graphs, all pairs shortest paths, optimal binary search trees,0/1-Knapsack and traveling salesman problem, Flow shop scheduling

Backtracking: The general method, application to 8- puzzle problem, 8- queen problem and sum of subsets.

MODULE –VI [6L]

Branch and Bound: The method, application to 0/1 Knapsack traveling salesman problems, and efficiency considerations.

MODULE –VII [6L]

NP-Hard and NP-Complete Problems: Introduction and basic concepts, non-deterministic turing machine, the classes of P and NP, NP-hard graph problems, NP-completeness of the satisfiability problem, and polynomial- space-bounded problem.

Text Book:

1. E. Horowitz. et.al., Fundamentals of computer Algorithms, Universities Press, 2008, 2nd Edition

Reference Books:

2. J.Kleinberg & E. Tardos – Algorithm Design, Pearson Education, New Delhi, 2006
3. G.Brassard & P. Bratley – Fundamentals of Algorithms, PHI, New Delhi, 2005
4. T.H. Cormen et.al. – Introduction to Algorithms – PHI, New Delhi, 2005
4. S.Dasgupta et.al. – Algorithms, TMH, New Delhi - 2007

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EC3201 Digital Electronics Credit- 4

MODULE – I

Simplification of Boolean Expressions: Gate-level minimization, NAND and NOR implementation, POS & SOP simplification, Karnaugh map, Quine McCluskey method

Text Books:

1. "Digital Logic and Design", M. Mano. PHI
2. "Modern Digital Electronics", 3/e, R.P.Jain, TMH

MODULE – II

Design of Combinational Circuits: Adders, Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, magnitude comparator, Parity Generators and Checkers, Signed number system, BCD adder/subtractor, carry look ahead adder

Text Books:

1. "Digital Logic and Design", M. Mano. PHI
2. "Modern Digital Electronics", 3/e, R.P.Jain, TMH

MODULE – III

Sequential Circuits: Basic Concepts, Flip-Flop, RS, JK, Master Slaves, T and D Flip-Flops, Controlled Registers, Shift Registers and their applications, Synchronous and asynchronous counters, Controlled Counters, Up/Down counters, Ring counter

Text Books:

1. "Digital Logic and Design", M. Mano. PHI
2. "Modern Digital Electronics", 3/e, R.P.Jain, TMH

MODULE – IV

Analysis of Clocked Sequential Circuits: State equation**,** state table and state diagram, input equations, Analysis with various flip flop, State reduction and assignment, Design of clocked sequential circuits

Text Books:

1. "Digital Logic and Design", M. Mano. PHI

MODULE – V

Introduction to Various Logic Families: Electrical characteristics of logic gates TTL gates, CMOS gates, Static CMOS Design; Dynamic hazards, Ratioed Logic, Pass-transistor logic, Transmission gate logic

Text Books:

1. "Digital Logic and Design", M. Mano. PHI
2. "Modern Digital Electronics", 3/e, R.P.Jain, TMH

MODULE – VI

Multivibrators: Types of multivibrators, AMV, MMV and BMV using transistors, AMV and MMV using OP-AMP, Schmitt Trigger

Text Books:

1. "Modern Digital Electronics", 3/e, R.P.Jain, TMH

MODULE – VI I

Memories and Programmable Logic Devices: Memory organization and operation, write and read operations, Read only memories, PROMs, EPROMs, EEPROMs, RAMs: Static RAM, Dynamic RAM, Design of an 8x4 ROM, PLA, PAL, Generic array logic, CPLD, FPGA

Text Books:

1. "Modern Digital Electronics", 3/e, R.P.Jain, TMH

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SEMESTER-III

CS 4101 DISCRETE MATHEMATICAL STRUCTURES Credits-4

Module – I & II

Logic and Mathematical Reasoning: Logic, Propositional Equivalences, Predicates and Quantifiers, Methods of Proof, Mathematical Induction, Recursive Definition and Algorithms, Program Correctness.

Module – III & IV

Functions and Relations: Functions, Sequences and Summations, The Growth Functions, Relations and Their Properties, Non- array Relations & Their Applications, Representing Relations, Closures of Relations, Equivalence Reloans, Partial Orderings.

Module – V

Graphs: Introduction to Graphs, Graph Terminology and Representation, Connectivity, Euler and Hamiltonian Paths, Shortest Path Programs.

Module – VI

Trees: Introduction and applications of trees, Tree Traversal, Spanning Trees, Minimum Spanning trees.

Module –VII

Semi groups, Groups and Coding: Binary Operations, Semigroups, Products and Quotients of Semigroups, Groups, Product and Quotients of Groups, Coding of Binary Information and Error Correction, Decoding and Error Correction.

Text Books:

1. B.Kolman et.al- Discrete mathematical Structures, 5th Edn, Pearson Education, New - Delhi - 2004.

2. K.H. Rosen – Discrete Mathematics and Its Applications – 4th Edn, Tata McGraw-Hill, New Delhi - 2001

Reference Books:

1. J.P. Tremblay et.al – Discrete Mathematical Structures with Applications to Computer Science, TMH, New Delhi – 2004.

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SEMESTER III

CS 3005 Object Oriented Programming using Java

Credit -3

Module 1 **[Lectures - 2]**

Introduction to OOP, Objects and classes, Characteristics of OOP, Difference between OOP and Procedure oriented programming. Introduction to Java Programming, Features of Java, Applications and Applets, JDK, Source File Structure

Module 2 **[Lectures - 4]**

Java language fundamentals, Building blocks of Java, Data Types, Variable declaration, Wrapper classes, Operators and Assignment, Control Structures, Arrays, Strings, StringBuffer class

Module 3 **[Lectures - 10]**

Java as an OOP Language, Defining classes, Modifiers, Packages, Interfaces, Exception Handling, Exception hierarchy, Constructors and methods of Throwable class, Unchecked and Checked Exceptions, Handling Exceptions in Java, Exception and Inheritance, Throwing user defined exceptions, Redirecting and rethrowing exceptions.

Module 4 **[Lectures - 4]**

Multithreading, Overview of threading, Creating threads, Thread Life-cycle, Thread priorites and Thread scheduling, Thread synchronization, Daemon Threads, Thread groups, Communication of Threads

Module 5 **[Lectures - 5]**

Files and I/O Streams, Java I/O, File Streams, File Input Stream and File Output Streams, Filter streams, Random Access files, Serialization

Module 6 **[Lectures - 4]**

Applets, Java Applications versus Java Application, Applet Life cycle, Working with Applets, The HTML APPLET Tag, java.Applet package

Module 7 **[Lectures - 6]**

AWT, Basic classes in AWT, Drawing with Graphics Class, Class hierarchy of AWT, Event Handling, Adapter classes, AWT Controls, Layout Managers, Swings, Swings packages, Hierarchy of Swing classes, Advanced layout Managers, Additional Swing Components.

Text Book

1. Krishna P. R., Object Oriented Programming through JAVA, 1st Edition, Universities Press, 2008

Reference Books

1. Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi.
2. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi.
3. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi.
4. Patrick Naghton & H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.

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SEMESTER-IV

CS 4109 COMPUTER SYSTEM ARCHITECTURE
Credit- 4

MODULE I
(DESIGN METHODOLOGY)
System Design, System Representation, Design Process, the Gate level
The Register Level Register-Level Components, Programmable Logic Devices, Register-Level Devices.
The Processor Level Processor- level Components, Processor-level Design

MODULE II
PROCESSOR BASICS
CPU Organization Fundamentals, Additional Floating-Point Numbers
Data Representation Basic Format, Fixed-Point Numbers, Floating-Point Numbers
Instruction Sets Instruction Formats and Types

MODULE III
DATAPATH DESIGN
Fixed-Point Arithmetic Addition, Subtraction, Multiplication and Division
Arithmetic Logic Units Combinational ALUs, Sequential ALUs

MODULE IV
CONTROL DESIGN
Basic Concepts Introduction, Hardwired Control
Microprogrammed Basic Concepts, Multiplier Control Unit
Control Pipeline Control Instruction Pipeline, Arithmetic Pipeline

MODULE V
MEMORY ORGANIZATION
Memory Technology Memory Device Characteristics, Random Access Memories, Serial Access Memories
Memory Systems Multilevel Memories, Address Translation, Memory Allocation
Cache Main Features, Address Mapping

MODULE VI
SYSTEM ORGANIZATION
Communication Methods Basic concepts Bus Control
System Control DMA and Interrupts

MODULE VII
ADVACED TOPICS
Pipeline Processing, Parallel Processing

Text Book

1. Hayes, J.P., "Computer Architecture and Organization", 3rd ed McGraw-Hill, London , 2000

Reference Books

1. Mano, M.M., "Computer System Architecture" , Prentice Hall of India, New Delhi, 1995
2. Heuring V.P., etal., " Computer System Design and Architecture", Addision Wesley Indian Reprint, 2000
3. Hamacher.V., etal, (Computer Organzation" ,4th edition, McGraw Hill, Singapore, 1996
4. Ram. B."Computer Fundamentals: Architecture and Organization",3rd ed New Age International Publication, New Delhi, 2000

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SEMESTER-IV

CS 4205 DATABASE MANAGEMENT SYSTEM

Credit - 3

Module – I

Introduction: Purpose of Database System; View of Data, Database Languages, Transaction Management, Database architecture, Database Users Administrator

Database Design and Entity - Relational Model: Overview of Design process, E-R model, Constraints, E-R diagrams, Week Entity Sets, Extended E – R Features.

Module – II

Relational Model: Structure of Relational Database, Fundamental Relational Algebra, Operation, Additional Operations, , Tuple Relational, Calculus.

Module – III

SQL and Advanced SQL: Data definition, Basic structure of SQL queries, Set Operations, Aggregate Functions, NULL values, Nested Sub-queries, complex queries, views, modification of database, SQL data types & schemas, Integrity constraints, Authorization, Embedded SQL.

Module – IV

Relational Database Design: Atomic domains and First Normal form, Decompositions using functional dependencies, Functional dependencies, Decomposition using multivalued dependencies, more normal forms.

Module – V

Indexing and Hashing: Basic concepts, Ordered Indices, B+ Tree Index Files, B Tree Index files, Multiple Key Access, Hashing, Comparison of Ordered Indexing and Hashing

Module VI

Query processing- Overview, measures of query cost, selection operation, sorting join operations

Module – VII

Transaction & Concurrency Control: Transaction Concepts & ACID Properties, Transaction States, Concurrent Executions, Serializability & Its Testing, Recoverability, Introduction to Concurrency Control, Locked Base Protocol & Deadlock Handling. Timestamp-Based Protocols. Validation-Based Protocols. Multiple Granularity.

Text Book:

1. A.Silberschatz et.al - Database System Concepts, 5th Edn, Tata Mc-Graw Hill, New Delhi – 2000.

Reference Books:

1. Date C.J. - An Introduction to Database System, Pearson Education, New Delhi, 2005
2. R.Elmasri, Fundamentals of Database Systems, Pearson Education, New Delhi, 2005.

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MA 4109 Probability, Statistics and Numerical Techniques

Module – I

High Speed Computation: Introduction, Computer Arithmetic, Errors, Machine Computation.
Transcendental and Polynomial Equations: Introduction, Bisection Method, Iterative Methods, Rate of Convergence, Methods for Complex Roots, Polynomial Equations. [5L]

Module –II

System of Linear Algebraic Equations and Eigen value Problems: Introduction, Direct Methods, Error analysis, Iteration Methods, Eigen values and Eigen Vectors. Interpolation and Approximation: Introduction to Lagrange and Newton Interpolations, Finite difference operators, Interpolating polynomial using finite differences, Hermit interpolations, Piecewise and spine interpolation. [5L]

Module – III

Differentiation and Integration: Introduction, Numerical differentiation, Numerical integration, Methods based on interpolation. Ordinary Differential Equations: Introduction, Euler methods, Single and Multistep methods, Predictor-corrector methods. [5L]

Module– IV

Graphical Statistics-histogram, scatter plot, ogive, bar diagrams (including multiple and percentage), average, dispersion, skewness and kurtosis and their statistical measures, Exploratory Data Analysis, Empirical and classical definitions of Probability, Addition theorem, Conditional Probability, multiplication theorem, Independent Events, Bayes Theorem. [5L]

Module – V

Random variables and Probability distributions, Discrete, Continues & Multivariable Distributions: Mathematical Expectation, Bernoulli Trials and the Binomial Distribution, The Moment – Generating Function, The Poisson Distribution, The Uniform and Exponential Distributions, The Normal Distribution, Distributions of Functions of a Random Variable, Distributions of Two Random Variables. [5L]

Module VI

Sampling Distribution Theory: Independent Random Variables, Distributions of Sums of Independent Random Variables, Random Functions Associated with Normal Distributions, The Central Limit Theorem, Approximations for Discrete Distributions, The t and F Distribution. The Gamma and Chi-Square Distributions. [5L]

Module – VII

Estimation & Tests of Statistical Hypotheses: Point Estimation, test of significance and Confidence Intervals for Means, Confidence Intervals for Difference of Two Means, Sample Size, Tests about Proportions, Tests of the Equality of Two Normal Distributions, Chi-Square Goodness of Fit Tests, Contingency Tables, Tests of the Equality of Several Means, F test for equality of two population variances [5L]

Text Books:

1. Jain, M.K., et. al: Numerical Methods for Scientific and Engineering Computation, 3rd Edn. New Age Publication, New Delhi , 1999
2. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Reference Books:-

1. Sastrty, S.S. – Introductory Methods of Numerical Analysis, 4th Edn., PHI, New Delhi, 2005
2. Hines, W.W. et al – Probability and Statististics in Engineering, 4th edn., John Witey, Singapore (Indian Reprint), 2003.
3. Veerarajan, T. – Probability, Statististics and Random Processes, 2nd Edn., TMH, New Delhi, 2003.

Head of Department

SEMESTER-IV

CS 4107 OPERATING SYSTEM

Credit-3

MODULE – I

Introduction: What is an Operating System? Simple Monitor, Performance, Multiprogramming, time-sharing, Real Time systems, Protection.
(5)

File Systems: File Concept and support, Access and allocation methods, directory systems, File protection.
(3)

MODULE – II

CPU Scheduling: Scheduling concepts and algorithms, Algorithms evaluation, and Multiple processor scheduling.
(6)

MODULE – III

Memory Management: Preliminaries, Bare Machine, Resident Monitor, Swapping, Multiple partitions, Paging, Segmentation, Combined systems.
(8)

MODULE – IV

Virtual Memory : Overlays, Demand paging, Performance of demand paging, Page replacement, Virtual memory concepts, Page replacement algorithms, Allocation algorithms, and Thrashing.
(8)

MODULE – V

Disk Scheduling: Physical characterization, Disk Management, Swap-Space Management, RAID structure, FCFS scheduling and Shortest-Seek-Time-First. (6)

MODULE – VI

Deadlocks: The deadlock problem, Deadlock characterization, Deadlock prevention, Deadlock avoidance; Deadlock detection, Recovery from deadlock, and combined approach to deadlock handling. (4)

MODULE – VII

Process Synchronization: Semaphores, OS Synchronization, Atomic Transaction.

Security: The Security Problem, User Authentication, Cryptography.

Text Book:

1. Silver Schatz, A and Golvin, P.B. 'Operating System Concepts', 5th Edn. John Wiley, New Yark, 2000

Reference Books:

1. Deitel H.M., 'An Introduction to Operating System', Addison Wesley, Inc., London, 1995.
2. Mandinck S.E., 'Operating System' McGraw Hill., London, 1993.

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EC4205 MICROPROCESSOR AND MICROCONTROLLER

Module – 1:
Revision of logic circuits with emphasis on control lines, SAP concepts with stress on timing diagrams, Microinstructions, Microprogramming, Variable machine cycle, Architecture of 8085 Processor , Functions of all signals, Bus concepts, Multiplexed and De-multiplexed Bus, Minimum system.

Text Books:

1. "Digital Computer Electronics", 2/e. by A. P. Malvino.
2. "Microprocessor Architecture, Programming and Applications with 8085" by R. S. Gaonkar.

Module – 2:
Instruction set, Addressing modes, Stack operation, Timing diagrams, Programming examples like Time delay, Looping, Sorting, Code conversions like BCD to Binary, Binary to BCD, HEX to ASCII, ASCII to HEX, BCD Arithmetic etc.

Text Books:

1. "Digital Computer Electronics", 2/e. by A. P. Malvino.
2. "Microprocessor Architecture, Programming and Applications with 8085" by R. S. Gaonkar.

Module – 3:
8085 based Microcomputer system, Memory Organization, Memory Interfacing, Memory Mapped I/O, I/O Mapped I/O, Interrupts, Hardware and Software Interrupts, Interrupt instructions, Programmed I/O, Interrupt driven I/O, DMA.

Text Books:

1. "Digital Computer Electronics", 2/e. by A. P. Malvino.
2. "Microprocessor Architecture, Programming and Applications with 8085" by R. S. Gaonkar.

Module – 4:
Architecture of 8255 I/O peripheral chip, Modes of operation, Hand shake mode operation, BSR mode, ADC 0801 and ADC 0808 Interfacing with 8085 microprocessor, Analogue multiplexed ADC, DAC 0808 specifications, DAC Interfacing, Programming examples for Generation of square wave, positive and negatives ramps, triangular and sine waves, Sample and Hold circuit, LF 398 and its applications in Data Acquisition.

Text Books:

1. "Digital Computer Electronics", 2/e. by A. P. Malvino.
2. "Microprocessor Architecture, Programming and Applications with 8085". by R. S. Gaonkar.
3. "Microprocessor and Interfacing, Programming of Hardware" by Douglas Hall.
4. "Microprocessor and Peripherals" by S. P. Chowdhury and Sunetra Chowdhury.

Module – 5:
8253 timer, Modes of operation, Applications, 8279 Keyboard/Display Interface, Different modes of operation, Interfacing, Programming examples, 8237 DMA Controller

Text Books:

1. "Microprocessor and Interfacing, Programming of Hardware" by Douglas Hall.
2. "Microprocessor and Peripherals" by S. P. Chowdhury and Sunetra Chowdhury.
3. "The INTEL 8086/8088 Microprocessor, Architecture, Programming, Design and Interfacing", 3/e. by Bhupendra Singh Chhabra.

Module – 6:
Introduction to 8086 microprocessor, Architecture of 8086, pins description and memory bank interfacing. Addressing modes and instruction sets of 8086. Interfacing examples with PPI 8255 and ADC 0801 and ADC 0808

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Text Books:

1. "Microprocessor, Microcomputer and their Applications", 2/e. by A, K. Mukhopadhyay.
2. "Advanced Microprocessor" by Y. Rajasree.
3. "The INTEL 8086/8088 Microprocessor, Architecture, Programming, Design and Interfacing", 3/e. by Bhupendra Singh Chhabra.

Module - 7:

Evolutionary steps and Additional features of 80186, 80286, 80386, 80486 and Pentium Processors, Concept of CISC and RISC processors

Text Books:

1. "Microprocessor, Microcomputer and their Applications", 2/e. by A, K. Mukhopadhyay.
2. "Advanced Microprocessors" by Y. Rajasree.
3. "Microprocessor and Peripherals" by S. P. Chowdhury and Sunetra Chowdhury.

Head of Department

SEMESTER-V

CS 6107 COMPUTER NETWORKS

MODULE -I

Foundation: Applications, Requirements, Network Architecture, Implementing Network Software, Performance.

MODULE –II

Direct Link Networks: Hardware Building Blocks, Encoding (NRZ, NRZI, Manchester, 4B/5B), Framing, Error Detection, Reliable Detection, Reliable Transmission,

MODULE III

Ethernet (802.3), Token Rings (802.5, FDDI), Wireless (802.11), Network adaptors.

MODULE –IV

Internetworking: Simple Internetworking (IP), Routing, Global Internet,

MODULE V

Multicast, Multiprotocol Label Switching (MPLS).

MODULE -VI

End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream (TCP), Remote Procedure Call.

MODULE -VII

Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP Congestion Control, Congestion-Avoidance Mechanisms, Quality of Service.

Text Book:

1. L.L. Peterson & B.S. Davie- Computer Networks: A Systems Approach, 3rd Edition, Morgan Kaufman Publication, New Delhi, 2006

Reference Books:

1. A. Forouzan - Data communications and Networking, 4th Edn., TMH, New Delhi, 2006
2. P.C. Gupta- Data Communications and Computer Networks, PHI, New Delhi, 2006.

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SEMESTER-V

CS 8101 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM

Module I

Overview of Artificial Intelligence: Definition & Importance of AI.

Knowledge: General Concepts: Introduction, Definition and Importance of Knowledge, Knowledge-Based Systems, And Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, And Acquisition of Knowledge.

Module II

LISP and Other AI Programming Languages: Introduction to LISP : Syntax and Numeric Function, Basic List Manipulation Functions in LISP, Functions, Predicates and Conditionals, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays, Miscellaneous Topics, PROLOG and Other AI Programming Languages.

Module III

Knowledge Representation: Introduction, Syntax and Semantics for Propositional logic, Syntax and Semantics for FOPL, Properties of Wffs, Conversion to Clausal Form, Inference Rules, The Resolution Principle, No deductive Inference Methods, Representations Using Rules.

Module IV

Dealing with Inconsistencies and Uncertainties: Introduction, Truth Maintenance Systems, Default Reasoning and the Closed World Assumption, Predicate Completion and Circumscription, Modal and Temporal Logics.

Probabilistic Reasoning: Introduction, Bayesian Probabilistic Inference, Possible World Representations, Dumpster-Shafer Theory, Ad-Hoc Methods.

Module V

Structured Knowledge: Graphs, Frames and Related Structures: Introduction, Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.

Object-Oriented Representations: Introduction, Overview of Objects, Classes, Messages and Methods, Simulation Example using an OOS Program.

Module VI

Search and Control Strategies: Introduction, Preliminary Concepts, Examples of Search Problems, Uninformed or Blind Search, Informed Search, Searching And-Or Graphs.

Matching Techniques: Introduction, Structures Used in Matching, Measures for Matching, Matching Like Patterns, Partial Matching.

Module VII

Knowledge Organization and Management: Introduction, Indexing and Retrieval Techniques, Integrating Knowledge in Memory, Memory Organization Systems.

Expert Systems Architectures: Introduction, Rule Based System Architecture, Non-Production System Architecture, Dealing with uncertainty, Knowledge Acquisition and Validation, Knowledge System Building Tools.

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Text Book:

1. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

Reference Books:

1. E. Rich & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2005.
2. P.H. Winston - Artificial Intelligence, 3/e, Pearson Edition, New Delhi, 2006.
3. D.W. Rolston,- Principles of AI & Expert System Development, TMH, New Delhi.

Head of Department

SEMESTER-V

CS 5101 FORMAL LANGUAGES AND AUTOMATA THEORY

MODULE - I
Introduction to Automata: Study and Central concepts of automata theory, An informal picture of finite automata, deterministic and non-deterministic finite automatas, applications of finite automata, finite automata with epsilon – transitions.

MODULE - II
Regular expression and languages: Regular expressions, finite automata and regular expressions, applications of regular expressions, algebraic laws of regular expressions.

MODULE - III
Properties of Regular Languages: Proving languages not to be regular, closure properties of regular languages, equivalence and minimization of automata.

MODULE - IV
Context – free Grammars and Languages: Parse trees, Applications of context free grammars, Ambiguity in grammars and languages.

MODULE - V
Pushdown Automata: Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

MODULE - VI
Properties of Context – Free Languages: Normal forms of context free grammars, pumping lemma for context free languages, close properties of context free languages.

MODULE - VII
Introduction to Turing Machine: The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, restricted Turing Machines, Turing Machines and Computers.

Text Books:
1. J.E. Hopcroft , et.al. - Introduction to Automata Theory, Languages and Computation, 2nd Edn. Pearson Education , New Delhi 2001

Reference Books:
1. K.L.P. Misra – et.al. - Theory of Computer Science, 2nd Edn. PHI, New Delhi, 2000
2. J.C. Martin - Introduction to Languages and the Theory of Computation 2nd Edn, TMH, New Delhi, 2000.

Head of Department

SEMESTER-VI

CS 6105 COMPILER DESIGN

MODULE -I

Introduction to Compiling: Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.

MODULE -II

A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.

MODULE-III

Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator.

MODULE –IV

Syntax Analysis: The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.

MODULE V

Syntax-Directed Translation: Syntax-direct definitions, Constraction of syntax trees, Bottom-up evaluation of S-**,** attributed definitions, L-attributed definitions, and Top-down translation.
Type Checking: Type systems, Specification of a simple type checker.

MODULE VI

Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.

MODULE VII

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions.
Code Generation: Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs.
Code Optimization: Introduction, The Principle sources of optimization.

Text Book:

1. A.V.Aho, R. Sethi et.al.- Compilers Principles, Techniques, and Tools, 2nd Edition, Pearson Education,
New Delhi, 2006

Reference Books:

1. A.I.Holub -Compiler Design in C, Prentice Hall of India, New Delhi, 1995
2. J.P. Tremblay - The Theory and Practical of Compiler Writing, McGraw Hill, Singapore, 1993.
3. K.C. Louden- Compiler Construction: Principles and Practice, Thomson Learning, New Delhi, 2005.

Head of Department

SEMESTER-VI

CS 6011 COMPUTER GRAPHICS AND MULTIMEDIA

Module-I [6L]
Introduction and Overview of Graphics Systems:- Use of Computer graphics, Video Display Devices, Refresh Cathode-Ray Tubes, Raster and Random Scan Displays, Colour CRT Monitors, Direct View Storage Tubes, Flat Panel Displays, Three-Dimensional Viewing Devices, Stereoscopic & Virtual Reality Systems, Raster and Random Scan Systems, Different Input and Hard Copy Devices, Graphics Softwares.

Module-II [6L]
Output Primitives: - Points and Lines, Line Drawing Algorithms (DDA & Bresenham's), Circle and Ellipse Generating Algorithms, Conic Sections.

Module-III [6L]
Two-Dimensional Geometric Transformations:- Different types of transformations and their matrix representations, Homogeneous Coordinates, Composite Transformations, transformations between Coordinate Systems, Affine transformations, Window-to-Viewport Coordinate transformation, Clipping-Point, Line, Polygon, Curve and Text Clipping.

Module-IV [6L]
Three-Dimensional Concepts and Object Representation:- Three Dimensional Display Methods, Polygon Surfaces, Curved Lines & Surfaces, Quadric Surfaces, Spline Representations, Cubic Spline interpolation methods, Bezier Curves and Surfaces.

Module-V [6L]
Three Dimensional Transformations and Viewing: Translation, Rotation, Scaling, Reflection, Shears, Composite Transformations, Projections- Parallel and Perspective, Projection Transformations, Clipping.

Module-VI [6L]
Visible Surface Detection Methods: Classification of Visible Surface Detection Algorithms, Back Face Detection, Depth Buffer Method, A-Buffer Method, Scan-Line Method, Depth Sorting Method, BSP-Tree Method & Area Subdivision Method. Polygon- Rendering Methods.

Module-VII [6L]
Introduction to Multimedia Systems Design:
An Introduction – Multimedia applications – Multimedia System Architecture – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases
Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – video image and animation – Full motion video – Multimedia Authoring & User Interface – Hypermedia messaging -

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Text Book:

1. D. Hearn & M.P. Baker - Computer Graphics, 2/e , Pearson Education, New Delhi, 2005
2. Prabat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2005

Reference Books:

1. W.M. Newman. et. al.- Principle of Interactive Computer Graphics, Mc Graw Hill Publication, New Delhi, 1995.
2. S. Harrington -Computer Graphics- A Programming Approach, Mc Graw Hill Publication, New Delhi, 1994.
3. J.D. Foley et. al- A Fundamental of Computer Graphics Addition Wesley, London, 1993.

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SEMESTER-VI

CS 6103 SYSTEM PROGRAMMING

MODULE – I

Background: Introduction, System Software and Machine Architecture, The Simplified Instructional Computer (SIC), Traditional (CISC) machines, RISC Machines.

MODULE – II & III

Assemblers: Basic Assembler Functions, Machine – Dependent Assembler Features, Machine – Independent Assembler Features, Assembler Design Options, Implementation Examples.

MODULE – IV & V

Loaders and Linkers: Basic Loader Functions, Machine - Dependent Loader Features, Machine – Independent Loader Features, Loader Design Options, Implementation Examples.

MODULE – VI

Macro Processors: Basic Macro Processor Functions, Machine – Independent Macro Processor Features, Macro Processor Design Options, Implementation Examples.

MODULE – VII

Software Engineering Issues: Introduction to Software Engineering Concepts, System Specifications, Procedural System Design, Object – Oriented Design, System Testing Strategies.

Text Book:

1. L. L. Beck – System Software – An Introduction to Systems Programming, 3rd Edn., Pearson Education, New Delhi, 2004

Reference Book:

1. J.J. Donovan – System Programming, McGraw Hill , New Delhi, 1993.
2. D.M. Dhamdhere – System Programming and Operating Systems, 2nd Edn., Tata McGraw Hill , New Delhi, 2000

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SEMESTER-VI

CS 6109 SOFTWARE ENGINEERING

MODULE – I
Introduction: Some Definitions, FAQs about software engineering, the evolving role of software, Software characteristics, SW applications
Software Processes: Software process models, Waterfall model, the prototyping model, spiral model, RAD and Incremental model.

MODULE – II
Project Management: Management activities, Project planning, Project scheduling, Risk Management.

MODULE – III
Software Requirements: Functional and non functional requirements, User requirements, System requirements, the software requirements document. IEEE standard of SRS, Quality of good SRS.
Requirement Engineering Process: Feasibility study, Requirements elicitation and analysis, Requirements

validation, Requirement management.

MODULE – IV
Software Design: Design Concepts and Principles, Architectural Design, Object oriented Design, User interface design
UML: Class diagram, Sequence diagram, Collaboration diagram

MODULE – V
Verification and Validation: Verification and Validation Planning, S/W inspection, static analysis.
Software Testing : Testing functions, Test care design, White Box testing, Black box testing, Unit testing, Integration Testing, System testing, Reliability.

MODULE – VI
Management: SW cost estimation: Estimation techniques, Algorithmic cost modeling, Project duration and staffing.
Quality Management: Quality assurance and standards, Quality planning, Quality control.

MODULE – VII
Software Change: Program Evolution Dynamic, S/W Maintenance in detail.

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Text Book:

1. I. Sommerville : Software Engineering, Pearson Education Publication, 7th ed.

Reference Book:

1. R. S. Pressman: Software Engineering: A Practiioners Approach, 5th Edn., TMA, New Delhi.
2. J. F. Peters & W. Pedrycz– Software Engineering, John Wiley & Sons,Inc. 2000
3. A.Behforooz & F.J. Hudson – Software Engineering Fundamentals, Oxford Univ. Press, New York, 2000.

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SEMESTER-VII

CS 5105 SOFT COMPUTING

FUZZY LOGIC
MODULE -I
Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement.

MODULE -II
Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning.

MODULE –III
Fuzzy Inference System Introduction, Mamdani Fuzzy Models, Other Variants, Sugeno Fuzzy Models, Tekamoto Fuzzy Models.

GENETIC ALGORITHMS
MODULE –IV
Fundamentals of Genetic Algorithms: Basic Concepts Creation, Offspring's Encoding, Fitness functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.

ARTIFICIAL NEURAL NETWORKS
MODULE -V
Introduction, Architecture, Back Propagation and feed Forward Networks, Offline Learning, Online Learning.

MODULE -VI
Supervised Learning of Neural Networks: Introduction, Perceptrons, Adaline, Back Propagation Multilayer Perceptrons, Back Propagation Learning Rules, Methods of Speeding. Radical Basis Function Networks, Functional Expansion Networks.

MODULE -VII
Unsupervised Learning : Competitive Learning Networks, Kohonen self-organising networks, Hebbian Learning, The Hopfield Network

Text Book :

1. J.S.R. Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi
2004.
2. S. Rajasekaran & G.A. Vijayalakshmi Pai, PHI, New Delhi 2003

Reference Books:

1. T. J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997.

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SEMESTER-VII

CS 7121 CRYPTOGRAPHY & NETWORK SECURITY

Module I

Security Services, Mechanisms and Attacks, The OSI Security Architecture, A Model for Network Security. Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotol Machines, Steganography.

Module II

Simplified DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

Module III

Finite Fields and Confidentiality : Groups, Rings, and Fields, Modular Arithmetic, Euclid's Algorithm, Finite Fields of the Form GF (p), Polynomial arithmetic, Finite Fields of the Form GF(2"), Placement of Encryption Function, Traffic Confidentially, Key Distribution, Random Number Generation.

Module IV

Encryption Standard and Ciphers : Evaluation criteria for AES, AES cipher, Multiple encryption and Triple DES, Block ciper Modes of operation, Stream ciphers and RCG.

Module V

Number Theory and Public-Key Cryptography: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms, Principles of Public-Key Cryptosystems, The RSA Algorithm,

Module VI

Message Authentication, Function, Algorithms and Digital System :Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions,

MODULE VII

Security of Hash Functions and MACs, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols.

Text Book:

1. W.Stallings : Cryptography and Network Security : Principles and Practice, 4/e

Pearson Education, New Delhi, 2006.

Reference Books:

1. B.A. Forouzan – Cryptography and Network Security, TMH, New Delhi, 2007
2. B. Schneier – Applied Cryptography, John Wiley, Indian Edition, 2006.

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SEMESTER-VII

CS 7101 PRINCIPLES OF PROGRAMMING LANGUAGES

Module-I

Introduction: Programming Linguistics, Historical Development.

DATA ABSTRACTION: Program units, packages, and encapsulation, Abstract types, Objects and classes, Implementation notes.

Module-II

GENERIC ABSTRACTION: Generic units and instantiation, Type and class parameters, Implementation notes.

TYPE SYSTEMS: Inclusion polymorphism, Parametric polymorphism, Overloading, Type conversions, Implementation notes.

Module-III & IV

CONTROL FLOW: Sequencers, Jumps, Escapes, Exceptions, Implementation notes

CONCURRENCY: Why concurrency, Programs and processes, Problems with concurrency, Process interactions, Concurrency primitives, Concurrent control abstractions.

IMPERATIVE PROGRAMMING: Imperative programming: Key concepts, Pragmatics, Case study: C, Case study: ADA.

Module-V

OBJECT-ORIENTED PROGRAMMING: Key concepts, Pragmatics, Case study: C++, Case study: JAVA, Case study: ADA95.

Module-VI +VII

CONCURRENT PROGRAMMING: Key concepts, Pragmatics, Case study: ADA95, Case study: JAVA, Implementation notes.

FUNCTIONAL PROGRAMMING: Key concepts, Pragmatics, Case study: HASKELL.

LOGIC PROGRAMMING: Key concepts, Pragmatics, Case study: PROLOG

SCRIPTING: Pragmatics Key concepts, Case study: PYTHON.

Text Book:

1. David A. Watt – Programming Language Design Concepts, John Wiley, India Edition, 2004.

Reference Books:

1. R. Sethi and K.V. Viswanatha – Programming Languages: Conupt & Constructs, 2/e, New Delhi-2007.
2. D.Appleby & J.J.Vanda Kopple – Programming Languages : Paradigm and Practice 2/e, TMH, New Delhi – 2005.
3. K.C. Louden – Programming Languages : Principles and Practice, 2/e, Thomson Learning India Edition, 2005.

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SEMESTER-VII

CS 7107 DIGITAL IMAGE PROCESSING

Module I

Introduction: Background, Digital Image Representation, Fundamental Steps in Image Processing, Elements of a Digital Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels, Imagining Geometry.

Module II

Image Transforms: Introduction to the Fourier Transform, The Discrete Fourier Transform, Some Properties of the Two-Dimensional Fourier Transform, Other Separable Image Transforms.

Module III

Image Enhancement : Spatial Domain Methods, Frequency Domain Methods, Some Simple Intensity Transformations, Histogram Processing, Image Subtraction, Image Averaging, Background, Smoothing Filters, Sharpening Filters, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications.

Module IV & V

Image Restoring: Degradations Model - Definitions, Degradation Model for Continuous Functions, Diagonalization of Circulant and Block-Circulant Matrices, Circulant Matrices, Block Circulant Matrices, Effects of Diagonalization on the Degradation Model, Algebraic Approach to Restoration, Unconstrained Restoration, Constrained Restoration, Inverse Filtering – Formulation, Removal of Blur Caused by Uniform Linear Motion, Restoration in the Spatial Domain, Geometric Transformation.

Module VI & VII

Image Compression: Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. Image Compression Models – The Source Encoder and Decoder, The Channel Encoder and Decoder. Elements of Information Theory – Measuring Information, The Information Channel, Fundamental Coding Theorems, Using Information Theory. Error-Free Compression – Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.

Text Book:

1. Rafael. C. Gonzalez & Richard E.Woods.- Digital Image Processing, 2/e Pearson Education, New Delhi - 2006

Reference Books:

1. W.K.Pratt.-Digital Image Processing ,3/e Edn., John Wiley & sons, Inc. 2006
2. M. Sonka et.al Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007.

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SEMESTER-VII

CS 7029 FREE/OPEN SOURCE SOFTWARE

Module 1:
Open Standards for Enterprise Applications Application examples from Banking and e-Governance, Enterprise level requirements, Layered Architecture applications

Module 2:
Open Standards, Royalties, FOSS Licensing & Business models

Module 3:
FOSS Development Methodology & Tools,Collaborative Software Development : FOSS Community structu re & dynamics,

Module 4:
Mailing lists, chat, wiki, messaging, Integrated Development Environments, Version Control (tagging, branching, merging), Issue tracking (bugs, new features), Documentation.

Module 5:
Presentation Layer, Client Environment : Browsers (extensions, cookies, applets), Handheld devices, Thin clients, Web page design & Clientside scripting (XHTML, WML, AJAX, CSS, XSL).

Module 6:
Datastore Layer, Data modeling refresher : RDBMS fundamentals, Dublincore, Database Administration, Access control, Security; Disaster recovers (Backups, Replication)

Module 7:
Business Logic Layer Model View Controller (MVC) Framework, Serverside programming (CGI, page tempaltes), Data access, database connectivity , Report generation.

Text Book:

"Understanding Open Source Software Development", J Feller and B Fitzgerald, Addison Wesley, 2002

"Enterprise Application Development using FOSS", ed. NRCFOSS Team, An NRCFOSS (Anna University) Publication.

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SEMESTER – VII

CS 7029 INFORMATION SECURITY AND ASSURANCE

Module 1 : Network Security
Introduction, Network Attacks and Security Issues, Network Communications, Some Example Security Attacks, Security Attacks, Services, and Architecture, Protection and Prevention, Firewalls and Perimeter Security, Cryptographic Protocols, Detection, Assessment and Response

Module 2
Introduction, Identification and Authentication, Password-Based Authentication, Insecure Communication Channels, Challenge-Response Systems, Authentication in Distributed Systems, Access Control, Access Control Based on Subject–Object, Relationships, Protection Matrix Model,

Module 3:
An Information Flow Policy for Confidentiality, Bell-LaPadula Model, Clark-Wilson Model, Role-Based Access Control, Access Control in Distributed Systems, Overview of Relevant Standards, Advanced Approaches, Digital Identity Management, Shibboleth, CardSpace, Higgins Trust Framework

Module 4 Network Survivability
Introduction, Prevention Techniques, Survivable Network Design and Traffic Restoration Concepts,
Typical Network Architecture, Basic Survivability Concepts, Basic Network Management Concepts , Protection versus Restoration, Other Issues, Transport Network Recovery Techniques, Automatic Protection Switching, Ring-Based Survivability, Span Restoration, Shared Path Protection, Shared Path Restoration, p-Cycles, Survivable Network Design Techniques, Multilayer Issues.

Module 5 System Survivability
Introduction and Background, Survivability and the Impact of Fault Models, Dependability Considerations, Survivability Considerations, Design for Survivability, Identification of Essential Functionalities, Tolerating Faults, Dealing with Common-Mode Faults, Applying the Notion of Optimality, Decentralized Storage, Survivability of Large Distributed Systems, Borrowing from Well-established Fields, Problem Transformation, Scheduling Problems, Case Study: Autonomous Mobile Agents

Module 6 Taxonomy and Framework for Integrating Dependability and Security
Introduction, Basic Concepts and Related Work, Dependability, Integration of Dependability and Security, Proposed Taxonomy and Framework, Key Notations of the Feedback Control System Model, Definitions of Basic Concepts of Dependability and Security within the Proposed Framework , Dependability, Security, and their Attributes, Taxonomy of Faults ,The Means to Attain Dependability and Security ,Fault Prevention, Fault Tolerance, Fault Removal

Module 7 Stochastic Modeling Techniques for Secure and Survivable Systems
Introduction, Survivability and Security, Analytical Modeling Techniques, Markov Models , Semi-Markov Process, Higher-Level Model Formalisms, Security Modeling, Intrusion-Tolerant Systems
Security Modeling of SITAR Security System, Survivability Modeling, System Description

Text Book :
Qian Y., Joshi J., Tipper D., Krishnamurty P., "*Information Assurance : Dependability and Security in Networked Systems"*, 1st Edition, Morgan Kauffman Publication, 2008

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SEMESTER-VII

CS 7117 OPTIMIZATION TECHNIQUES

Module I

Introduction to Linear Programming: Prototype Example, the Linear Programming Model, Assumptions of Linear Programming, Additional Examples, Some Classic Case Studies.

Solving Linear Programming Problems - The Simplex Method: The Essence of the Simplex Method, Setting Up the Simplex Method, the Algebra of the Simplex Method, the Simplex Method in Tabular Form, Tie Breaking in the Simplex Method, Adapting to Other Model Forms, Postoptimality Analysis.

Module II

The Theory Of The Simplex Method: Foundations of the Simplex Method, The revised Simplex Method, A Fundamental Insight.

Duality Theory And Sensitivity Analysis: The Essence of Duality Theory, Economic Interpretation of Duality, Primal-Dual relationships, Adapting to Other Primal Forms, the Role of Duality Theory in Sensitivity Analysis.

Module III

Other Algorithms for Linear Programming: The Dual Simplex Method, Parametric Linear Programming, the Upper Bound Techniques, an Interior-Point Algorithm.

Network Optimization Models: Prototype Example, the Terminology of Networks, The Shortest-Path Problem, The Minimum Spanning Tree Problem, The Maximum Flow Problem, The Minimum Cost flow Problem, The Network Simplex Method.

Module IV

Dynamic Programming: A Prototype Example for Dynamic Programming, Characteristics of Dynamic Programming Problems, Deterministic Dynamic Programming, Probabilistic Dynamic Programming.

Module V

Integer Programming: Prototype Example, Some BIP Applications, Innovative Uses of Binary Variables in Model Formulation, Some Formulation examples, Some Perspectives on Solving Integer Programming problems, The Branch-and-Bound Technique and Its Application to Binary Integer Programming, A Branch-and-Bound Algorithm for Mixed Integer.

Module VI

Nonlinear Programming: Sample Applications, Graphical Illustration of Nonlinear Programming Problems, Types of Nonlinear Programming Problems, One-Variable Unconstrained Optimization, Multivariable Unconstrained Optimization, The Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization, Quadratic Programming, Separable Programming , Convex Programming.

Module VII

Queuing Theory: Prototype Example, Basic Structure of queuing Models, Examples of Real Queuing Systems, The role of the Exponential Distribution, the Birth-and-Death Process, Queuing Models Based on the Birth-and Death Process, Queueing Models Involving Non-exponential Distributions.

Text Book:

1. S. Hiller & G.J. Lieberman – Operations Research, 8th Edn, TMH, New Delhi – 2006.

Reference Books:

1. H.A.Taha – Operations Research, 8/e , Pearson Education , New Delhi-2007.
2. J.K. Sharma – Operations Research, 3/e, Mcmillan , India Ltd, 2007.

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CS 8031 DATA MINING & DATA WAREHOUSEING

Module - I

Data Mining : Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

Module - II

Data Warehouse : Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data warehousing to Data Mining.

Module - III

Data Processing : Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept Hierarchy Generation.

Data Mining Primitives, Languages and System Architecture : Data Mining Primities, DMQL, Architectures of Data Mining Systems.

Module – IV

Concept Description : Data Generalization & Summarization – Based Characterization, Analytical Characterization, Mining class Comparisons, Mining Descriptive Statistical Measures in Large Databases.

Module - V

Mining Association Rules in Large Databases : Association Rule Mining, Single – Dimensional Boolean Association Rules, Multilevel Association Rules from Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis, Constraint – Based Association Mining.

Module - VI

Classification and Prediction : Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule, Other Classification, Prediction, Classification Accuracy.

Module - VII

Cluster Analysis : Types of Data in Cluster Analysis, Partitioning methods, Hierarchical methods, Density – Based Methods, Grid – Based Methods, Model – Based Clustering Methods, Outlier Analysis.

Mining Complex Types of Data.

Text Books :

1. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques Publisher Harcout India. Private Linited.

Reference Books :

1. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.
2. A. Berson & S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004
3. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.

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EC7205 MOBILE & CELLULAR COMMUNICATION

MODULE- I

Mobile Communication Systems & Standards: Evolution of Mobile Radio Communications, Elements of cellular communication systems, Different generations of Cellular Networks, Introduction to GSM, GPRS, UMTS, WLAN, WLL, Bluetooth, PAN.

MODULE- II

The Cellular Concept: Frequency Reuse, Hand-off strategies, Schemes to enhance cellular system capacity and range extension, Spectral efficiency.

MODULE- III

Mobile Radio Interferences & System Capacity: Co-channel interference and Adjacent channel interference, Power control, Inter-symbol interference, Interference and system capacity.

MODULE- IV

Propagation & Fading: Free-space propagation model, Propagation path loss, Outdoor propagation models (Okumura model & Hata model), Indoor propagation models (Partition Losses in the same floor and between floors), Multipath fading, time dispersive and frequency dispersive channels, delay spread and coherence bandwidth, LCR and ADF.

MODULE- V

Diversity & Combining Techniques: Diversity Schemes (Space, frequency, field and polarization diversities) and combining techniques.

MODULE- VI

Antenna Design Parameters: Antennas used for Mobile Communications, Radiation patterns, smart antenna (basic concept), Antenna location, Spacing and height.

MODULE- VII

Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, OFDM, DS-CDMA, FH-CDMA, TH-CDMA, Capacity of Cellular CDMA.

Text Book:

1. Theodore S Rappaport, "Wireless Communication: Principles and Practice" Prentice Hall of India, New Delhi, 2006, 2/e.

Reference Book:

1. William C. Y. Lee, "Mobile Communications Engineering" Tata McGraw Hills Education Pvt. Ltd., 2010 , 2/e, (Indian reprint)

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SEMESTER – VII

CS 7033 MULTIMEDIA TECHNOLOGY

MODULE I

Multimedia ¬An Overview : Introduction, Multimedia presentation and production, Characteristics of a multimedia presentation, Multiple media, Utilities of multisensory perception, Hardware and Software requirements, Uses of multimedia, Promotion of multimedia based content, Steps for creating a multimedia presentation.

Digital Representation: Introduction, Analog representation, Waves, Digital representation, Need for digital representation, Analog to Digital conversion, Digital to Analog conversion, Relation between sampling rate and Bit Depth, Quantization error, Fourier representation, Pulse modulation, Importance and drawbacks of digital representation.

MODULE II

Text: Introduction, Types of text, Unicode standard, Font, Insertion of text, Text compression, File formats.

Images: Introduction, Image types, Seeing color, Color models, Basic steps for image processing, Scanner, Digital camera, Interface standards, Specifications of digital images, Color management system(CMS), Device independent color models, Gamma and Gamma correction, Image processing software, File formats, Image output on monitor, Image output on printer.

MODULE –III

Audio: Introduction, Acoustics, Nature of sound waves, Fundamental characteristics of sound, Musical note and pitch, Psycho¬Acoustics, Elements of audio systems, Microphone, Amplifier, Loudspeaker, Audio Mixer, Digital Audio, Synthesizers, Musical instrument digital interface (MIDI), MIDI messages, MIDI connections, General MIDI (GM) specifications, Basics of staff notation, Sound Card, Audio transmission, Audio recording devices, Audio file formats and CODECs, Software audio players, Audio recording systems, Digital audio broadcasting, Audio and Multimedia.

MODULE IV

Video: Introduction, Analog Video camera, Transmission of video signals, Video signal formats, Television broadcasting standards, Digital Video, Digital Video standards, PC Video, Video recording formats and systems, Video file formats and CODECs, Video editing.

MODULE-V

Animation: Introduction, Historical background, Uses of Animation, Keyframes and Tweening, Types of Animation, Computer assisted animation, Creating movement, Principles of animation, Some techniques of animation, Animation on the web, 3D animation, Camera, Special effects, Creating animation, Rendering algorithm

MODULE VI

Compression: Introduction, CODEC, Types of compression, Types of redundancies, Lossless/Statistical compression techniques, GIF image coding standard, Lossy/Perceptual compression techniques, JPEG image coding standard, MPEG standards overview, MPEG¬1 Audio, MPEG¬1 Video, MPEG-2 Audio, MPEG¬2 Video,MPEG¬4, MPEG¬7, Fractals.

Head of Department

MODULE: VII

Multimedia Architecture: Introduction, User interfaces, Windows multimedia support, Hardware support, Distributed multimedia applications, Real¬time protocols, Playback Architectures, Streaming technologies, Temporal relationships, Synchronization, Multimedia database systems(MMDBS), Feature extraction of image, Feature extraction of audio, Feature of extraction of video, Benchmarking of MMDBS.

Text Book:

1. R. Parekh – Principles of Multimedia, 2nd Edition, TMH, New Delhi, 2006

Reference Books:

1. R.Steinmetz & K. Nahrstedt¬ Multimedia: Computing, Communications and Applications, Pearson Edn., New Delhi, 2006.
2. P.K.Andleigh & K.Thakrar Multimedia Systems Design, PHI, New Delhi, 2005.

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A Deemed University u/s 3 of UGC Act, 1956
MESRA, RANCHI – 835 215 (INDIA)

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EC4201 VLSI DESIGN

Module – 1:

Circuits and System Representation: Behavioral, structural and physical representation, example of a triangular waveform generator and its behavioural, structural and physical description

Text Book:

Principle of CMOS VLSI Design A System Perspective, Weste Neil H E & Eshraghian K, Pearson Education, 1993.

Module – 2:

Basic CMOS Technology: Basic n-well CMOS Process, p-well process, twin-tub process, silicon on insulator, CMOS process enhancements, metal interconnect, polysilicon / refractory metal interconnect, local interconnect, circuit elements like resistors, capacitors, EAROM, bipolar transistors and thin film transistor.

Text Book:

Principle of CMOS VLSI Design A System Perspective, Weste Neil H E & Eshraghian K, Pearson Education, 1993.

Module – 3:

Layout Design Rules: Layer representations, CMOS n-well rules, design rule backgrounder, layer assignment, latch-up problem, latch-up triggering, internal latch-up prevention techniques, resistance estimation, and capacitance estimation.

Text Book:

Principle of CMOS VLSI Design A System Perspective, Weste Neil H E & Eshraghian K, Pearson Education, 1993.

Module – 4:

Basic Physical Design of Simple Logic Gates: Inverter, NAND and NOR gates, complex logic gates layout, CMOS standard cell design, gate array layout, sea-of-gates layout, general CMOS logic gate layout guidelines, layout optimisation for performance, transmission gate layout consideration, 2-input multiplexers, I/O structures, V_{DD} and V_{SS} pads, output & input pads, tri-state and bi-directional pads, miscellaneous pads.

Text Book:

Principle of CMOS VLSI Design A System Perspective, Weste Neil H E & Eshraghian K, Pearson Education, 1993.

Module – 5:

CMOS Analogue Design Method: Opamp design, opamp as a comparator, sample and hold, analogue layout considerations, transistor layouts, centroid design, capacitor matching, resistor layout, noise consideration.

Text Book:

Analog Integrated Circuits Deisgn, Johns Dand Martin K, John Wiley & Sons, 1997.

Module – 6:

CMOS Digital Design Methods: Structured design strategies, hierarchy, regularity, modularity, locality, design options like PL, re-programmable gate arrays, Standard Cell design, behavioural synthesis, RTL synthesis, logic optimisation, structural to layout synthesis, placement, routing

Text Book:

Principle of CMOS VLSI Design A System Perspective, Weste Neil H E & Eshraghian K, Pearson Education, 1993.

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Module – 7:

CMOS Subsystem Design: Single bit address, bit parallel adder, transmission gate adder, asynchronous counter, synchronous counter, RAM, finite state machines, multilevel logic.

Text Book:

Principle of CMOS VLSI Design A System Perspective, Weste Neil H E & Eshraghian K, Pearson Education, 1993.

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SEMESTER-VII

CS 7123 BIO-INFORMATICS

Module I

Molecular Biology and Biological Chemistry: The Generic Material: Nucleotides, Orientation, Base Pairing, The Central Dogma of Molecular Biology, Gene Structure and Information Content: Promoter Sequences, The Genetic Code, Open Reading Frames, Introns and Exons, Protein Structure and Function: Primary Structure, Secondary, Tertiary, and Quaternary Structure, The Nature of Chemical Bonds: Anatomy of an Atom, Valence, Electronegativity, Hydrophilicity and Hydrophobicity, Molecular Biology Tools: Restriction Enzyme Digests, Gel Electrophoresis, Blotting and Hybridization, Cloning, Polymerase Chain Reaction, DNA Sequencing, Genomic Information Content: C-Value Paradox, Reassociation Kinetics.

Module II

Data Searches and Pairwise Alignments: Dot Plots, Simple Alignments, Gaps: Simple Gap Penalties, Origination and Length Penalties, Scoring Matrices, Dynamic Programming: The Needleman and Wunsch Algorithm, Global and Local Alignments: Semiglobal Alignments, The Smith-Waterman algorithm, Database Searches: BLAST and Its Relatives, FASTA and Related Algorithms, Alignment Scores and Statistical Significance of Database Searches, Multiple Sequence Alignments.

Module III

Substitution Patterns: Estimating Substitution Numbers: Jukes-Cantor Model, Transitions and Transversions, Kimura's Two-Parameter Model, Models With Even More Parameters, Substitutions Between Protein Sequences, Variations in Evolutionary Rates Between Genes.

Module IV

History of Molecular Phylogenetics: Advantages to Molecular Phylogenies, Phylogenetic Trees: Terminology of Tree Reconstruction, Rooted and Unrooted Trees, Gene vs. Species Trees, Character and Distance Data, Distance Matrix Methods: UPGMA, Estimation of Branch Lengths, Transformed Distance Method, Neighbor's Relation Method, Neighbor-Joining Methods, Maximum Likelihood Approaches, Multiple Sequence Alignments.

Module V

Character – Based Methods of Phylogenetics: Parsimony: Informative and Uninformative Sites, Unweighted Parsimony, Weighted Parsimony, Inferred Ancestral Sequences, Strategies for Faster Searches: Branch and Bound, Heuristic Searches, Consensus Trees, Tree Confidence: Bootstrapping, Parametric Tests, Comparison of Phylogenetic Methods, Molecular Phylogenies: The Tree of life, Human Origins.

Module VI

Genomics and Gene Recognition: Prokaryotic Genomes, Prokaryotic Gene Structure: Promoter Elements, Open Reading Frames, Conceptual Translation, Termination Sequences, GC Content in Prokaryotic Genomes, Prokaryotic Gene Density, Eukaryotic Genomes, Eukaryotic Gene Structure: Promoter Elements, Regulatory Protein Binding Sites, Open Reading Frames: Introns and Exons, Alternative Spicing, GC Content in

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Eukaryotic Genomes: CpG Islands, Isochores, Codon Usage Bias, Gene Expression: cDNAs and ESTs, Serial Analysis of Gene Expression, Microarrays.

Module VII

Protein and RNA Structure Prediction: Amino Acids, Polypeptide Composition, Secondary Structure: Backbone Flexibility, Accuracy of Predictions, The Chou-Fasman and GOR Methods, Tertiary and Quaternary Structure: Hydrophobicity, Disulfide Bonds, Active Structures vs. Most Stable Structures, Algorithms for Modeling Protein Folding: Lattice Models, Off-Lattice Models, Energy Functions and Optimization, Structure Prediction: Comparative Modeling, Threading : Reverse Protein Folding, Predicting RNA Secondary Structures.

Text Book:

1. D.E. Krane & M.L. Raymer - Fundamental Concepts of Bioinformatics, Pearson Education, New Delhi-2003.

Reference Books:

1. S.C. Rastogi et.al.- Bioinformatics: Methods and Applications, PHI, New Delhi-2005.
2. V.R. Srinivas - Bioinformatics: A Modern Approach, PHI, New Delhi-2005.
3. A.M. Lesk – Introduction to Bioinformatics, Oxford (Indian Edn), New Delhi-2004.

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SEMESTER-VII

CS 7125 OBJECT-ORIENTED ANALYSIS & DESIGN

Module I

What Is Object-Orientation: Introduction, Basic Concepts, The Origins of Object-Orientation, Object-Oriented languages Today.

Modelling Concepts: Introduction, Models and diagrams, Drawing Activity Diagrams.

Module II & III

Requirements Capture: Introduction, User Requirements, Fact Finding Techniques, User Involvement, Documenting Requirements, Use Cases, Requirements Capture and Modelling.

Requirements Analysis: Introduction, What Must a Requirements Model Do, Use Case Realization, The Class Diagram, Drawing a Class Diagram, CRC (Class Responsibility Collaboration) Cards, Assembling the Analysis Class Diagram.

Refining The Requirements Model: Introduction, Component-based Development, Adding Further Structure, Software Development Patterns.

Module IV

Object Interaction: Introduction, Object Interaction and Collaboration, Interaction Sequence Diagrams, Collaboration Diagrams, Model Consistency.

Specifying Operations: Introduction, The Role of Operation Specifications, Contracts, Describing Operation Logic, Object Constraint Language, Creating an Operation Specification.

Module V

Specifying Control: Introduction, States and Events, Basic Notation, Further Notation, Preparing a Statechart, Consistency Checking, Quality Guidelines, Summary.

Moving Into Design: Introduction, How is Design Different from Analysis, Logical and Physical Design, System Design and Detailed Design, Qualities and Objectives of Analysis and Design, Measurable Objectives of Analysis and Design, Measurable Objectives in Design, Planning for Design.

Module VI

System Design: Introduction, The Major Elements of System Design, Software Architecture Concurrency, Processor Allocation, Data Management Issues, Development Standards, Prioritizing Design Trade-offs, Design for Implementation.

OBJECT DESIGN: Introduction, Class Specification, Interfaces, Criteria for Good Design, Designing Associations, Integrity Constraints, Designing Operations, Normalization.

Module VII

Design Patterns: Introduction, Software Development Patterns, Documenting Patterns-Pattern Templates, Design Patterns, How to Use Design Patterns, Benefits and Dangers of Using Patterns.

Designing Boundary Classes: Introduction, The Architecture of the Presentation Layer, Prototyping the User Interface, Designing Classes, Designing Interaction with Sequence Diagrams, The Class Diagram Revisited, User Interface Design Patterns, Modelling the Interface Using Statecharts.

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Text Books:

1. S.Bennett, S.Mc Robb and R.Farmer – Object- Oriented Systems Andlysis and Design U**sing** UML 2nd **edn,** TMH, New Delhi – 2007.

Reference Book:

1. M.Blaha and J.Runbangh – Object- Oriented Modeling and Design with UML 2./e, Pearson Education, New Delhi,2007.
2. J.W. Satzinger, B.R. Jackson and S.D. Burd – Object –Oriented Analysis and Design, Thomson Learning, India Edition, 2007.
3. G. Booch – Object Oriented Analysis and Design with Applications,2/e, CA;Benjamin/Cumming,1994.

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SEMESTER-VII

CS 7127 SOFTWARE PROJECT MANAGEMENT

Module I
Managing Software Project: Process & Project Management, Project Management and the CMM, Project Management at Infosys, Introduction to CMMI, PCMM.
The Project Planning Infrastructure: The process data base, The process capability Baseline, Process Assets and the Body of Knowledge System.

Module II
Process Planning: The Infosys Develelopment Process, Requirement Change Management
Effort Estimation & Scheduling: Estimation and Scheduling Concepts, Effort – Estimation, Scheduling.

Module III
Quality Planning: Quality Concepts, Quantitative quality Management Planning, Defect Prevention Planning.
Risk Management: Concepts of Risks and Risk Management, Risk Assessment, Risk Control, Examples.

Module IV
Measurement and Tracking Planning: Concepts in measurement, Measurements, Project tracking.
Project Management Plan: Team Management, Customer Communication and Issue Resolution, Structure of the Project Management Plan.

Module V
Configuration Plan: Concepts in Configuration Management, Configuration Management Process.
Reviews: The Reviews, Review process Data Collection, Monitoring & Control, Intruduction of Reviews & the NAH Syndrome.

Module VI
Project Monitoring & Control: Project tracing, Milestone Analysis, Activity Level Analysis using SPC, Defect Analysis & Prevention Process Monitoring & audit.

Module VII
Project Closure: Project closure Analysis.

Text Book:
Pankaj Jalote – Software Project Management in Practice, Pearson Education, New Delhi, 2002

Reference Books:
B.Huges and M.Cotterell – Software Project Management, 3/e, Tata Mcgraw Hill, New Delhi, 2004.
Pankaj Jalote – CMM in Practice, Pearson Education, New Delhi, 2002
W. Humph Grey – Managing the Software Process, Addition – Wesley, 1989.

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SEMESTER-VIII

CS 8123 REAL TIME SYSTEMS

Module I
Basic Real-Time Concepts: Terminology, Real-Time System Design Issues, Example Real-Time Systems, Common Misconceptions, Brief History.

Module II
Hardware Considerations: Basic Architecture, Hardware Interfacing, Central Processing Unit, Memory, Input/Output, Enhancing Performance, Other Special Devices, Non-von-Neumann Architectures.

Module III
Real-Time Operating Systems: Real-Time Kernels, Theoretical Foundations of Real-Time Operating Systems, Intertask Communication and Synchronization, Memory Management, Case Study: POSIX.

Module IV
Software Requirements Engineering: Requirements-Engineering Process, Types of Requirements, Requirements Specification for Real-Time Systems, Formal Methods in Software Specification, Structured Analysis and Design, Object-Oriented Analysis and the Unified Modeling Language, Organizing the Requirements Document, Organizing and Writing Requirements, Requirements Validation and Review.

Module V
Software System Design: Properties of Software, Basic Software Engineering Principles, The Design Activity, Procedural-Oriented Design, Object-Oriented Design, Appendix: Case Study in Software Requirements Specification for Four-Way Traffic Intersection Traffic Light Controller System.

Module VI
Programming Languages and the Software Production Process: Introduction, Assembly Language, Procedural Languages, Object-Oriented Languages.

Module VII
Performance Analysis and Optimization: Theoretical Preliminaries, Performance Analysis, Application of Queuing Theory, I/O Performance, Performance Optimization.

Text Book:
1. Phillip A. Laplante- Real-Time Systems: Design and Analysis, John Wiley- India Edition, 2006.

Reference Books:
1. Rajib Mall- Real Time Systems; Theory and Practice, Pearson Edition, New Delhi- 2007.
2. J.W.S.Liu – Real Time Systems, Pearson Education, New Delhi – 2004.
3. C.M.Krishna & K.G. Shiv – Real Time Systems, Mc Graw Hill – 1997.

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SEMESTER-VIII

CS 8113 COMPUTATIONAL GEOMETRY

Module I

Geometric Data Structures: Points, Polygons, Edges, Geometric objects in space, finding intersection of a line and a triangle.

Module II & III

Incremental Insertion: Finding star shaped polygons, finding convex hulls, point enclosure : The ray – shooting and the signed angle method, line clipping, polygon clipping, triangulating monotone polygons.

Module IV

Incremental selection: Different methods for finding convex hulls, removing hidden surfaces, Intersection of convex polygons, Finding Delaney triangulations.

Module V

Plane – sweep algorithms: Finding the intersections of line segments, finding convex hulls, contour of the union of rectangles, Decomposing polygons into monotone pieces.

Module VI

Divide and conquer Algorithms: Computing the intersection of half planes, finding the kernel of polygon, finding voronoi regions, Merge Hull, closest points, polygon triangulation.

Module VII

Spatial subdivision Methods: The Grid method, quad trees, Two-dimensional search tree, removing hidden surfaces.

Text Book:

1. Michael J. Laszlo - Computational Geometry and computer graphics in C++, PHI, New Delhi, 1999.

Head of Department

SEMESTER-VIII

CS 8111 NATURAL LANGUAGE PROCESSING

Module I

Introduction: Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms, Language, Thought, and Understanding, The State of the Art and the Near-Term Future.

Regular Expressions and Automata: Regular Expressions, Finite-State Automata, Regular Languages and FSAs.

Module II

Word Classes and Part-of –Speech Tagging: (Mostly) English Word Classes, Tagsets for English, Part-of –Speech Tagging, Rule-Based Part-of –Speech Tagging, Stochastic Part-of –Speech Tagging, Transformation-Based Tagging, Other Issues.

Module III

Context-Free Grammars for English: Constituency, Context-Free Rules and Trees, Sentences-Level Constructions, The Noun Phrase, Coordination, Agreement, The Verb Phrase and Subcategorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence and Normal Form, Finite-State and Context-Free Grammars, Grammars and Human Processing.

Module IV

Parsing with Context-Free Grammars: Parsing as Search, A Basic Top-Down Parser, Problems with the Basic Top-Down Parser, The Early Algorithm, Finite – State Parsing Methods.

Module V

Features and Unification: Feature Structures, Unification of Features Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints, Types and Inheritance.

Module VI

Representing Meaning: Computational Desiderata for Representations, Meaning Structure of Language, First Order Predicate Calculus, Some Linguistically Relevant Concepts.

Semantic Analysis: Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Early Parser, Idioms and Composionality, Robust Semantic Analysis.

Module VII

Discourse: Reference Resolution, Text Coherence, Discourse Structure, Psycholinguistic Studies of Reference and Coherence.

Natural Language Generation: Introduction to Language Generation, An Architecture for Generation, Surface Realization, Discourse Planning, Other Issues.

Text Book:

D.Jurafsky & J.H.Martin- Speech and Language Processing, 4th Edn, Pearson Education, 2005.

Reference Book:

1. J. Allen – Natural Language Understanding, Pearson Education, New Delhi, 2006.

Head of Department

SEMESTER-VIII

CS 8029 PARALLEL AND DISTRIBUTED SYSTEMS

Module-I
Introduction: Computational Demand of Modern Science, Advent of Practical rocessing, Parallel Processing Terminology- Contrasting Pipelining and Data arallelism, Control Parallelism, Scalability, Control-Parallel Approach, Data-Parallel
Approach with I/O.

Module-II
PRAM Algorithm: A Model of Serial Computation, The PARAM Model of Parallel Computation, PARAM Algorithm- Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Colouring, Problem defining Fast Solutions on PRAMS.

Module-III
Elementary Parallel Algorithm: Classifying MIMD Algorithm, Reduction. Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors.

Module-IV
Solving Linear Systems: Terminology, Back Substitution, ODD-EVEN Reduction, Gaussian Elimination, The JACOBI Algorithm, The Gauss-Seidel Algorithm, Jacobi Overrelaxation and Successive Overrelaxation, Mulyigrid Methods, Conjugate Gradient.

Module-V
Basic Algorithms in Message-Passing Systems: Formal Models for Message Passing Systems, Broadcast and Convergecast on a Spanning Tree, Flooding and Building a Spanning Tree, Constructing a Depth-First Search Spanning Tree for a
Specified Root, Constructing a Depth-First Search Spanning Tree without a Specified Root.Leader Election in Rings: The Leader Election Problem, Anonymous Rings, Asynchronous Rings, Synchronous Rings.

Module-VI
Mutual Exclusion in Shared Memory: Formal Model for Shared Memory Systems, The Mutual Exclusion Problem, Mutual Exclusion using Powerful Primitives, Mutual Exclusion using Read/Write Registers. A formal Model for Simulations: Problem Specifications, Communication Systems, Processes, Admissibility, Simulations, Pseudocode Conventions.

Module- VII
Broadcast and Multicast: Specification of Broadcast Services, Implementing a Broadcast Service, Multicast in Groups, An Application: Replication Distributed Shared Memory: Linearizability Shared Memory, Sequentially Consistent Shared Memory, Algorithms, Lower Bounds.

Text Books:
1. H.Attiya & J. Welch- Distributed Computing- Fundamentals, Simulations and Advanced
Topics,2nd Edn., Wiley India Publication, New Delhi, 2006.
2. M.J. Quinn-Parallel Computing-Theory and Practice, 2nd Edn., McGraw Hill Inc., New York.

Head of Department

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SEMESTER-VIII

CS 8121 PATTERN RECOGNITION

Module I
Pattern Recognition Overview: Overview, Pattern Recognition, Classification and Description, Patterns and Feature Extraction, Training and Learning in PR Systems, Pattern Recognition Approaches.

Module II
Statistical Pattern Recognition: Introduction, The Gaussian case and Class Dependence Discriminate Functions, Extensions, Classifier Performance, RISK and Errors.

Module III
Supervised Learning: Parametric Estimation and Supervised Learning, Maximum Likelihood Estimation Approach, Bayesian Parameter Estimation Approach, Non – Parametric Approaches, Parzen Windows, K-nn Non-Parametric Estimation. Nearest Neighbour Rule.

Module IV
Linear Discriminate Functions and The Discrete and Binary Feature Cases: Introduction, Discrete and Binary Classification Problems, Techniques to Directly Obtain Linear Classifiers.

Module V & VI
Syntactic Pattern Recognition: Overview Quantifying Structure in Pattern Description and Recognitions, Grammar Based Approach and Application, String Generation as Pattern Description. Recognition by String Matching and Parsing. The Cocke-Younger Kasami ((ck) parsing algorithm.

Module VII
Neural Pattern Recognition: Introduction to Neural Networks, Neural Network Structure from Pattern Recognition Applications. Physical Neural Network. The Artificial Neural Network Model, Neural Network Based Pattern Associators.

Text Book:

1. Robort Schalkoff - Pattern Recognition, Statistical, Structural and Neural Approach, John Wiley, Indian Edition, 200.

Reference Books:

1. R. U. Duda – Pattern Classification, John Wiley, Indian Edition, 2006.

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SEMESTER-VIII

CS 8125 COMPUTER VISION

Module I

Cameras: Pinhole Cameras, Cameras with Lenses, The Human Eye, Sensing.
Radiometry- Measuring Light: Light in Space, Light at Surfaces, Important Special Cases, Notes.

Module II

Sources, Shadows, and Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models.

Module III

Color: The Physics of color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

Module IV

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates.
Edge Detection: Noise, Estimating Derivatives, Detecting Edges.

Module V

Segmentation By Clustering: What Is Segmentation, Human Vision: Grouping and Gestalt , Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering.

Module VI

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem.

Module VII

Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association.

Text Book:

1. D.A. Forsyth & J. Ponce – Computer Vision: A Modern Approach, Pearson Education, New Delhi-2003.

Head of Department

SEMESTER-VIII

CS 8127 COMPUTING AND COMPLEXITY THEORY

Module I

The Church- Turing Thesis: Turing Machines- Formal definition of a Turing machine, Examples of Turing machines; Variants of Turing Machines- Multitape Turing machines, Nondeterministic Turing machines, Enumerators, Equivalence with other models; The Definition of Algorithm- Hilbert's problems, Terminology for describing Turing machines.

Module II

Decidability: Decidable Languages- Decidable problems concerning regular languages, Decidable problems concerning context-free languages; The Halting Problem- The diagonalization method, The halting problem is undecidable.

Module III

Reducibility: Undecidable Problems from Language Theory- Reductions via computation histories; A Simple Undecidable Problem; Mapping Reducibility-Computable functions, formal definition of mapping reducibility.

Module IV

Advanced Topics In Computability Theory:- The Recursion Theorem, Self-reference, Terminology for the recursion theorem, applications; Decidability of logical theories- A decidable theory, An undecidable theory; Turing Reducibility; A Definition of Information- Minimal length descriptions, Incompressible strings and randomness.

Module V & VI

Time Complexity: Measuring Complexity- Big-O and small-o notation, Analyzing algorithms, Complexity relationships among models; The Class P- Polynomial time, Examples of problems in P; The Class NP- Examples of problems in NP, The P versus NP question; NP-completeness- Polynomial time reducibility, Definition of NP-completeness, The Cook-Levin Theorem; Additional NP-complete Problems- The vertex cover problem, The Hamiltonian path problem, The subset sum problem.

Module VII

Space Complexity: Savitch's Theorem, The Class PSPACE, PSPACH-completeness – The TQBF problem, Winning strategies for games, Generalized geography; The Classes L and NL, NL-completeness- Searching in graphs; NL equals coNL.

Intractability: Hierarchy Theorems- Exponential space completeness; Relativization- Limits of the diagonalization method; Circuit Complexity.

Text Book:

2. Michael Sipser – Introduction to the Theory of Computation, 2/e, Thomson Learning – India Edition 2006.

Reference Books:

1. R.G.Taylor – Models of Computation and Formal Languages, Oxford University New York, 1998.
2. B.M. Moret – The Theory of Computation, Pearson Education, New Delhi – 2002.

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Syllabus BE IT Non-CBCS

SEMESTER – III

IT 3021 DISCRETE MATHEMATICS & GRAPH THEORY 3 (3-0-0)

MODULE - I

Introduction to Logic: Compound Statements, Proofs in Mathematics, Truth Tables, The Algebra of Propositions, Logical Arguments.

MODULE - II

Induction and Recursion: Mathematical Induction, Recursively Defined Sequences, Solving Recurrence Relations; The Characteristic Polynomial, Solving Recurrence Relations; Generating Functions.

MODULE - III

Principles of Counting and Algorithms: The Principle of Inclusion- Exclusion, The Addition and Multiplication Rules, The Pigeon-Hole Principle, What is an Algorithm?, Complexity, Searching and Sorting, Enumeration of Permutations and Combinations

MODULE - IV & V

Graphs, Paths and Circuits and Applications: A Gentle Introduction, Definitions and Basic Properties, Isomorphism, Eulerian Circuits, Hamiltonian Cycles, The Adjacency Matrix, Shortest Path Algorithms, The Chinese Postman Problem, Digraphs, Tournaments, Scheduling Problems.

MODULE - VI

Trees and Searching: What is a Tree?, Properties of Trees, Spanning Trees, Minimum Spanning Tree Algorithms, Acyclic Digraphs and Bellman's Algorithm, Depth – First Search.

MODULE - VII

Planar Graphs, Colorings and Maximal Flows: Planar Graphs, Coloring Graphs, Flows and Cuts, Constructing Maximal Flows, Applications.

Text Books:

1. E.G. Goodaire & M.M Parmenter- Discrete Mathematics with Graph Theory, 2nd Edn

Pearson Education, New Delhi - 2002.

Reference Books:

1. B.Kolman et.al- Discrete mathematical Structures, 5th Edn, Pearson Education, New Delhi - 2004.

2. K.H. Rosen – Discrete Mathematics and Its Applications – 4th Edn, Tata McGraw Hill, New Delhi - 2001

3. D.B. West – Introduction to Graph Theory, 2nd Edn, Pearson Education, New Delhi 2002.

4. N.Deo – Graph Theory with Application to Engineering and Computer Science, PHI, New Delhi- 2004.

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IT 3023 JAVA PROGRAMMING 4 (3-1-0)

MODULE – I

Introduction to Java Applications, Memory Concepts, Arithmetic, Decision making, Equality and Relational Operators. Introduction to Java Applets, Drawing strings and lines.

Control Statements : if, if ... else, selection statements, while statement, compound assignment operators, increment decrement operators, for ... statement, do .... while, switch, break and continue, labeled break and continue, logical operators.

Methods in java : declarations, argument promotions, scope of declarations, method overloading, Recursion.

Arrays : declaring and creating references and reference parameters, passing arrays to methods, multi dimensional arrays.

MODULE – II

Object based programming, classes, class scope, controlling access to members, this keyword and its use, constructors, overloading constructors, composition, garbage collection, static class members, final instance variables, crating packages, package access, Data abstraction and encapsulation.

MODULE – III

Inheritance and polymorphism : super class and subclass, protected members, Relation ship between super and sub class. Inheritance hierarchy , abstract classes and methods, final methods and classes, nested classes, Type wrappers.

MODULE – IV

Exception handling, Java exception hierarchy, rethrowing an exception, finally clause, stack unwinding, chained exception, Declaring new exception types.

MODULE-V

Multithreading : Life cycle of a thread, priorities and scheduling, creating and executing threads synchronization.

MODULE – VI

Files and streams, hierarchy, files and streams, File class, Sequential access file manipulation, random access file handling, Introduction to String class and its members.

MODULE – VII

Fundamental of GUI , Applet and swing programming.

Head of Department

Text Book :

1. Dietel,Dietel - Java How to program , 5th edition; Pearson Education , New Delhi.
2. S. Raj Kamal – Intrernet and Web Technology, Tata McGraw Hill, New Delhi, 2002.

Reference:

1. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi.
2. Balagurusamy -Programming in Java , 2nd Edition; Tata McGraw Hill Publication; New Delhi.
3. Patrick Naghton & H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.

Head of Department

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IT 3025 COMPUTER ORGANIZATION & ARCHITECTURE 4 (3-1-0)

MODULE - I

Introduction: Organization and Architecture, Structure and Function, Why Study Computer Organization and Architecture?

Computer Evolution and Performance: A Brief History of Computers, Designing for Performance, Pentium and PowerPC Evolution.

MODULE - II

A Top-Level view of Computer Function and Interconnection: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, PCI.

MODULE - III

Cache Memory: Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Pentium 4 and PowerPC Cache Organizations.

Internal Memory: Semiconductor Main Memory, Error Correction, Advanced DRAM Organization.

MODULE - IV

External Memory: Magnetic Disk, RAID, Optical Memory, Magnetic Tape.

Input/Output: External Devices, I/Os, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors.

MODULE - V

Computer Arithmetic: The Arithmetic and Logic Unit, Integer Representation, Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic.

MODULE - VI

Instruction Sets- Characteristics and Functions: Machine Instruction Characteristics, Type of Operands, Pentium and PowerPC Data Types, Types of Operations, Pentium and PowerPC Operation Types.

Instruction Sets- Addressing Modes and Formats: Addressing, Pentium and PowerPC Addressing Modes, Instruction Formats, Pentium and PowerPC Instruction Formats.

MODULE - VII

Processor Structure and Function: Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining, The Pentium Processor, The PowerPC Processor.

Reduced Instruction Set Computers: Instruction Execution Characteristics, The Use of a Large Register File, Compiler-Based Register Optimization, Reduced Instruction Set Architecture, RISC Pipelining, MIPS R4000, SPARC, RISC versus CISC Controversy.

Head of Department

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Text Book:

1. William Stallings- Computer Organization & Architecture: Designing for Performance, 7th Edn, Pearson Education, New Delhi-2006.

Reference Books:

1. C. Hamacher- Computer Organization, 5th Edn, McGraw Hill, Internaional Education, New Delhi-2002.
2. M.M.Mano- Computer System Architecture, 3rd Edn, PHI/Pearson Education, New Delhi-2006.

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SEMESTER – IV

IT 4021 DATABASE SYSTEM CONCEPTS 4 (3-1-0)

MODULE-I

Introduction: Purpose of Database System; View of Data, Database Languages, Transaction Management, Database architecture, Database Users and Administrator, Types of database System.

MODULE-II

Database Design and Entity - Relational Model: Overview of design process, E-R model, Constraints, E – R Diagram, E-R Diagram issues, Weak Entity Sets, Extended E – R Features, Reduction to E – R Schemas.

MODULE-III

Relational Model: Structure of Relational Database, Codd's Rules, Fundamental Relational Algebra Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations.

MODULE-IV

SQL & Advanced SQL: Data definition, Basic structure of SQL queries, Set Operations, Aggregate Functions, Null Values, Nested Sub Queries, complex queries, views, modification of database, Joined relations, SQL data types & schemas, Integrity constraints, authorization, Embedded SQL.

MODULE-V

Relational Database Design: Functional dependency, Decomposition, Normalization, First normal form, Second normal form, Third normal form, BCNF, Multivalued dependencies and Fourth normal form, Join dependencies and Fifth normal form.

MODULE-VI

Indexing & Hashing: Ordered Indices, B+ Tree index files, B-Tree index files, Multiple key access Static hashing, Dynamic Hashing, Comparison of ordered indexing and hashing, Index definition in SQL.

Query Processing: Measure of Query Cost, Selection Operation, Evaluation of Expressions.

MODULE-VII

Transaction & Concurrency Control: Transaction Concepts & ACID Properties, Transaction States, Implementation of Atomicity & Durability, Concurrent Executions, Serializability & Its Testing, Recoverability, Lock-Based protocols, Validation based protocol, Multiple Granularity, Multiversion Schemes, Deadlock Handling.

Text Book:

1. A.Silberschatz et.al - Database System Concepts, 5/e, Tata Mc-Graw Hill, New Delhi – 2000.

Reference Books:

1. Date C.J. - An Introduction to Database System, Pearson Education, New Delhi- 2005
2. R.Elmasri, Fundamentals of Database Systems, Pearson Education, New Delhi, 2005.
3. S.K.Singh.-Database Systems, Pearson Education, New Delhi- 2006

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IT 4023 OPERATING SYSTEM CONCEPTS 3 (3-0-0)

MODULE - I

Operating-System Structures: Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Debugging, Operating-System Generation

MODULE - II

Processes: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication

Threads: Overview, Multithreading Models, Thread Libraries, Threading Issues

MODULE - III

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Operating System Examples, Algorithm Evaluation

MODULE - IV

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples, Atomic Transactions

MODULE - V

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

MODULE - VI

Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation

Virtual Memory: Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames,Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Other Considerations

MODULE - VII

File-System Interface: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection

File-System Implementation: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, NFS

MODULE - VIII

Mass-Storage Structure: Overview of Mass-Storage, Structure, Disk Structure, Disk attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure

Head of Department

Text Book:

1. Avi Silberschatz, Peter Baer Galvin,Greg Gagne, "Operating System Concepts", Eight Edition. John Wiley & Sons,

Reference Books:

1. D.M. Dhamdhere- Operating Systems: A Concept-Based Approach, 2nd Edn, TMH, New Delhi-2006.
2. C.Cronsley-Operating Systems: A Design-Oriented Approach, TMH, New Delhi, 2002.
3. H.M.Deitel-Operating Systems, 2nd Edn, Pearson Education, 2003.
4. A.S.Tanenbaum-Operating System:Design and Implementation, PHI, New Delhi, 2002.

Head of Department

IT 4025 THEORY OF COMPUTATIONS 3 (3-0-0)

MODULE I & II

Sets, Relations, and Languages : Sets, Relations and functions, Special types of binary relations, Finite and infinite sets, Three fundamental proof techniques, Closures and algorithms, Alphabets and languages, Finite representations of languages.

Finite Automata: Deterministic finite automata, Nondeterministic finite automata, Finite automata and regular expressions, Languages that are and are not regular, State minimization, Algorithmic aspects of finite automata.

MODULE III & IV

Context-free Languages: Context-free grammars, Parse trees, Pushdown automata, Pushdown automata and context-free grammars, Languages that are and are not context-free, Algorithms for context-free grammars, Determinism and parsing.

MODULE - V & VI

Turing Machines: Definition and Computing with Turning machines, Extensions of Turning machines, Random access Turing machines, Nondeterministic Turing machines, Grammars, Numerical functions.

MODULE -VII

Undecidability : The Church-Tuning thesis, Universal Turing machines, The halting problem, Unsolvable problems about Turing machines, Unsolvable problems about grammars, Properties of recursive languages.

Text Book:

H.R. Lewis & C.H. Papadimitriou, Elements of the theory of computation – 2nd Edn. Pearson Education.

Reference Books:

1. Fundamentals of the Theory of Computation : Principles and Practices : Horcourt India Pvt Ltd. 2000 Morgan Kaufmann Publishers.
2. J.C. Martin – Introduction to Languages and the theory of computation, 2nd Edn., TMH, New Delhi 2000
3. K.L.P. Misra – et.al., "Theory of Computer Science", 2nd Edn. PHI, New Delhi, 2000

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IT 4027 SCIENTIFIC COMPUTING 3 (3-0-0)

A – NUMERICAL COMPUTING

MODULE - I

High Speed Computation: Introduction, Computer Arithmetic, Errors, Machine Computation.

Transcendental and Polynomial Equations: Introduction, Bisection Method, Iterative Methods, Rate of Convergence, Methods for Complex Roots, Polynomial Equations.

MODULE - II

System of Linear Algebraic Equations and Eigenvalue Problems: Introduction, Direct Methods, Error analysis, Iteration Methods, Eigenvalues and Eigen Vectors.

Interpolation and Approximation: Introduction to Lagrange and Newton Interpolations, Finite difference operators, Interpolating polynomial using finite differences, Hermite interpolations, Piecewise and spline interpolation.

MODULE - III

Differentiation and Integration: Introduction, Numerical differentiation, Numerical integration, Methods based on interpolation.

Ordinary Differential Equations: Introduction, Euler methods, Single and Multistep methods, Predictor-corrector methods.

B – STATISTICAL COMPUTING

MODULE - IV

Empirical and Probability Distributions : Basic Concepts, The Mean Variance, and Standard Deviation, Continuous-Type Data, Exploratory Data Analysis, Graphical Comparisons of Data Sets, Probability Density and Mass Functions.

Probability : Properties of Probability, Methods of Enumeration, Conditional Probability, Independent

Events, Bayes Theorem.

Head of Department

MODULE – V & VI

Discrete, Continuos & Multivariable Distributions : Random Variables of the Discrete Type, Mathematical Expectation, Bernoulli Trials and the Binomial Distribution, The Moment-Generating Function, The Poisson Distribution, Random Variables of the Continuous Type, The Uniform and Exponential Distributions, The Gamma and Chi-Square Distributions, The Normal Distribution, Distributions of Functions of a Random Variable, Distributions of Two Random Variables.

Sampling Distribution Theory : Independent Random Variables, Distributions of Sums of Independent Random Variables, Random Functions Associated with Normal Distributions, The Central Limit Theorem, Approximations for Discrete Distributions, The t and F Distributions.

MODULE - VII

Estimation & Tests of Statistical Hypotheses : Point Estimation, Confidence Intervals for Means, Confidence Intervals for Difference of Two Means, Sample Size,

Tests About Proportions, Tests of the Equality of Two Normal Distributions, Chi-Square Goodness of Fit Tests, Contingency Tables, Tests of the Equality of Several Means.

Text Books:

1. Jain,M.K., etal : Numerical Methods for Scientific and Engineering Computation, 3rd Edn. New Age Publication, New Delhi, 1999
2. Hogg, R.V. & Tanis E. A. : Probability and Statistical Inference, 6th Edn., Pearson Education, New Delhi , 2004.

Reference Books :

1. Sastrty, S.S. – Introductory Methods of Numerical Analysis, 4th Edn., PHI, New Delhi, 2005
2. Hines, W.W. et_al – Probability and Statististics in Engineering, 4th edn., John Witey, Singapore (Indian Reprint), 2003.
3. Veerarajan, T. – Probability, Statististics and Random Processes, 2nd Edn., TMH, New Delhi, 2003.

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SEMESTER –V

IT 5021 DATA COMMUNICATIONS 3 (3-0-0)

Module - I

Data Communications and Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture

Module - II

Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity.

Guided and Wireless Transmission: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.

Module - III

Signal Encoding Techniques: Digital Data Digital Signals, Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals.

Module - IV

Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing.

Module - V

Data Link Control: Flow Control, Error Control, High-Level Data Link Control (HDLC).

Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.

Module - VI

Circuit Switching and Packet Switching: Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signaling, Soft switch Architecture, Packet-Switching Principles, X.25, and Frame Relay.

Module -VII

Asynchronous Transfer Model: Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.

Routing in Switched Networks: Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms

Text Book:

1. W. Stallings - Data and Computer Communications, 7th Edn., Pearson Edn./ PHI, New Delhi, 2006

Reference Books:

1. B. A. Forouzan - Data Communications and Networking, 4th Edn. TMH, New Delhi 2006

2. P.C. Gupta – Data Communications and Computer Networks, PHI, New Delhi 2006

Head of Department

IT 5023 SOFTWARE ENGINEERING PRINCIPLES 4 (3-1-0)

MODULE – I

Introduction: Some Definitions, FAQs about software engineering, The evolving role of software, Software characteristics, SW applications

Software Processes: Software process models, Waterfall model, the Prototyping model, Spiral model, RAD and Incremental model.

MODULE – II

Project Management : Management activities, Project planning, Project scheduling, Risk Management.

MODULE – III

Software Requirements : Functional and non functional requirements, User requirements, System requirements, The software requirements document. IEEE standard of SRS, Quality of good SRS.

Requirement Engineering Process : Feasibility study, Requirements elicitation and analysis, Requirements validation, Requirement management.

MODULE – IV

Software Design : Design Concepts and Principles, Architectural Design, Object oriented Design, User interface design

UML : Class diagram, Sequence diagram, Collaboration diagram

MODULE – V

Verification and Validation : Verification and Validation Planning, S/W inspection, static analysis.

Software Testing : Testing functions, Test care design, White Box testing, Black box testing, Unit testing, Integration Testing, System testing, Reliability.

MODULE – VI

Management : SW cost estimation : Estimation techniques, Algorithmic cost modelling, Project duration and staffing.

Quality Management : Quality assurance and standards, Quality planning, Quality control.

MODULE – VII

Software Change : Program Evolution Dynamic, S/W Maintance in detail.

Text Book :

I. Sommerville : Software Engineering, Pearson Education Publication, 7th ed.

Reference Books:

1. R. S. Pressman : Software Engineering : A Practiioners Approach, 5th Edn., TMA, New Delhi.
2. J. F. Peters & W. Pedrycz– Software Engineering, John Wiley & Sons,Inc. 2000
3. A.Behforooz & F.J. Hudson – Software Engineering Fundamentals, Oxford Univ. Press, New York, 2000.

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IT 5025 PRINCIPLE OF SOFT COMPUTING 3 (3-0-0)

I FUZZY LOGIC

MODULE -I

Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimension, Fuzzy Union, Intersection and Complement.

MODULE -II

Fuzzy Rules and Fuzzy Reasoning : Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning.

MODULE –III

Fuzzy Inference System Introduction, Mamdani Fuzzy Models, Other Variants, Sugeno Fuzzy Models, Tekamoto Fuzzy Models.

II GENETIC ALGORITHMS

MODULE –IV

Fundamentals of Genetic Algorithms: Basic Concepts Creation, Offsprings Encoding, Fitness functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.

ARTIFICIAL NEURAL NETWORKS :

MODULE -V

Introduction, Architecture, Back Propagation and feed Forward Networks, Offline Learning, Online Learning.

MODULE -VI

Supervised Learning of Neural Networks : Introduction, Perceptrons, Adaline, Back Propagation Multilayer Perceptrons, Back Propagation Learning Rules, Methods of Speeding. Radical Basis Function Networks, Functional Expansion Networks.

Head of Department

MODULE -VII

Unsupervised Learning : Competitive Learning Networks, Kohonen self-organising networks, Hebbian Learning, The Hopfield Network

Text Book :

1. J.S.R. Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi 2004.
1. S. Rajasekaran & G.A. Vijayalakshmi Pai, PHI, New Delhi 2003

Reference Book:

1. T. J. Ross, " Fuzzy Logic with Engineering Applications." TMH, New York,

1997.

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IT 5027 DESIGN OF COMPUTER ALGORITHMS 4 (3-1-0)

MODULE-I

Introduction: Some linear and non-linear Data structures, Asymptotic notation to measure complexity, of algorithms, Analysis of algorithms efficiency, Analysis of non recursive & recursive algorithms, Space and Time trade-offs

MODULE-II&III

Divide & Conqure: Merge Sort, Quick sort, Binary search, Large integer- multiplication, Strassens matrices multiplication, Closest pair & convex hull problems

Decrease & Conquer: DFS& BFS, decrease-by –a-constant-factor algorithms, Variable-Size-decrease algorithms

Transform & Conquer: Horner's Rule & Binary exponentiation, Problem reduction : Input enhancement in string matching

MODULE- IV

Greedy Techniques: Knapsack problem, Job-scheduling, Prim's & Krushkal algorithms, Dijkstra's algorithm, Huffman coding alg.,

MODULE- V

Dynamic Programming: Warshall's & Floyd's algorithm, Optional binary search trees, Knapsack problem ,

MODULE- VI

Backtracking, Branch and Bound Methods.

MODULE-VII

Limitations of Algorithm Power: Lower bound arguments-decision trees, P,NP & NP Complete problem, Approximation algorithms for NP-hard problems

Text Book:

1. Thomas H. Cormen, An Introduction to Algorithms, PHI publication,2009

Reference Books:

1. Fundamentals of Computer algorithms,Horowitz & sahni,Galgothia publications.

2. Introduction to Design & Analysis of Algorithms, Anany Levitin,Pearson Education 2003.

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IT 6021 COMMUNICATION THEORY 4 (3-1-0)

MODULE –I

Signal Analysis: Introduction of Signal, Representation of Signals in the Frequency and Time Domain**,** Fourier Transform and its Application to signal Analysis. The Discrete Spectrum, The Continuous Spectrum, Dirac Delta Functions, Energy Density Spectra.

MODULE -II

Amplitude Modulation System: Basics Communication system, Modulation, Need of Modulation, Introduction of Amplitude Modulation, Frequency spectrum of Amplitude Modulation, Modulator: Square law Modulator, Switching Modulator, Demodulator: Envelop Detector, Square law detector, AM-DSB-SC, Balanced Modulator and Ring Modulator, AM-SSB-SC, Generation of SSB-SC signal and demodulation of SSB-SC and DSB-SC signal. Comparisons of Various AM systems

MODULE -III

Angle Modulation System: Introduction, Concept of Angle Modulation, Frequency and phase Modulations, Types of Frequency Modulation, Generation of FM wave: Direct and Indirect Method Detection of FM wave using slope detector, Balanced Slope Detector and Phase Discriminator, Comparison of Frequency Modulation and Amplitude Modulation.

MODULE –IV

Multiplexing: Introduction and its classification, Frequency division Multiplexing. Time Division Multiplexing.

MODULE –V

AM and FM receivers: Introduction, Classification of Radio receiver, Superheterodyne receiver, Sensitivity, Selectivity, Fidelity and Image rejection ratio.

MODULE -VI

Random Signal Theory: Random Variables, Continuous and Statistically Independent random variables, Examples of probability Density functions of Uniform, Gaussian, Rayleigh functions. Stationary & Ergodic Processes, Auto Correlation Functions, Energy Spectral Density.

MODULE -VII

Noise: White Noise, Atmospheric Noise, Thermal Noise, Equivalent Noise Band width

Shot noise, Partition Noise, Flicker Noise, Noise Figure, Signal to Noise Ratio, Noise Factor, Noise Temperature. Equivalent Noise figure of Amplifiers.

Text Book:

Communication Systems by S. Haykin; 4th Edition-2001

Reference Books:

D. Roddy & J. Coolen: Electronics Communication 4th Edition, PHI-2005

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IT 6023 COMPUTER NETWORK AND SECURITY 3 (3-0-0)

MODULE-I

OSI Security Architecture: Classical Encryption techniques – Cipher Principles – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation .

MODULE-II

Evaluation criteria for AES: AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality.

MODULE-III

PUBLIC KEY CRYPTOGRAPHY

Key Management: Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography .

Introduction to Number Theory: Confidentiality using Symmetric Encryption – Public Key Cryptography and RSA.

MODULE-IV

AUTHENTICATION AND HASH FUNCTION

Authentication requirements: Authentication functions – Message Authentication Codes Hash Functions – Security of Hash Functions and MACs.

MODULE-V

MD5 message Digest algorithm: - Secure Hash Algorithm – RIPEMD – HMAC Digital Signatures – Authentication Protocols – Digital Signature Standard

MODULE-VI

NETWORK SECURITY

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security.

MODULE-VII

SYSTEM LEVEL SECURITY

Intrusion detection: password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

Text Book

William Stallings, “Cryptography And Network Security – Principles and Practices”, Prentice Hall of India, fifth Edition, 2009.

Reference Book

1. Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.
2. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001.

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IT 6025 INFORMATION AND CODING THEORY 3(3-0-0)

MODULE – I & II

The concept of Amount of Information, Average Information, Entropy, Information rate, Shannon's Theorem, Channel Capacity & Coding: Introduction to Channel Capacity & Coding, Channel Models, Channel Capacity Theorem, Shannon Limit.

MODULE-III

Data Compression Techniques: RLE, Lempel-Ziv Algorithm, Introduction to Image Compression, The JPEG standard for loss less and Lossy Image Compression & Decompression.

MODULE – IV & V

Error Control Coding: Introduction, Forward & Backward error Correction, Hamming Weight and Hamming Distance, Linear Block Codes, Encoding and decoding of Linear Block-codes, Parity Check Matrix, Syndrome Decoding, Hamming Codes.

MODULE – VI

Cyclic Codes: Introduction, Method for generating Cyclic Codes, Matrix description of Cyclic codes, Burst error correction, Cyclic redundancy check (CRC) codes, Circuit implementation of cyclic codes.

MODULE – VII

Convolutional Codes: Introduction, Polynomial description of Convolutional Codes, Generating function, Matrix description of Convolutional Codes, Viterbi Decoding of Convolutional codes.

Text Book:

Ranjan Bose, Information Theory, Coding & Cryptography", TMH, 2001, New Delhi.

Reference Books:

1. Salvatore Gravano, Introduction to Error-Control Codes, Oxford Unv. Press, New Delhi, 2010

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IT 6027 OPTIMIZATION TECHNIQUES 3 (3-0-0)

MODULE -I

Introduction To Linear Programming : Prototype Example, The Linear Programming Model, Assumptions of Linear Programming, Additional Examples, Some Classic Case Studies.

Solving Linear Programming Problems- The Simplex Method : The Essence of the Simplex Method, Setting Up the Simplex Method, The Algebra of the Simplex Method, The Simplex Method in Tabular Form, Tie Breaking in the Simplex Method, Adapting to Other Model Forms, Postoptimality Analysis.

MODULE -II

The Theory Of The Simplex Method : Foundations of the Simplex Method ,The revised Simplex Method, A Fundamental Insight.

Duality Theory And Sensitivity Analysis : The Essence of Duality Theory, Economic Interpretation of Duality, Primal-Dual relationships, Adapting to Other Primal Forms, The Role of Duality Theory in Sensitivity Analysis.

MODULE -III

Other Algorithms For Linear Programming : The Dual Simplex Method, Parametric Linear Programming, The Upper Bound Techniques, An Interior-Point Algorithm.

Network Optimization Models: Prototype Example, The Terminology of Networks, The Shortest-Path Problem, The Minimum Spanning Tree Problem, The Maximum Flow Problem, The Minimum Cost flow Problem, The Network Simplex Method.

MODULE -IV

Dynamic Programming : A Prototype Example for Dynamic Programming, Characteristics of Dynamic Programming Problems, Deterministic Dynamic Programming, Probabilistic Dynamic Programming.

MODULE -V

Integer Programming : Prototype Example, Some BIP Applications, Innovative Uses of Binary Variables in Model Formulation, Some Formulation examples, Some Perspectives on Solving Integer Programming Problems, The Branch-and-Bound Technique and Its Application to Binary Integer Programming, A Branch-and-Bound Algorithm for Mixed Integer.

MODULE -VI

Nonlinear Programming : Sample Applications, Graphical Illustration of Nonlinear Programming Problems, Types of Nonlinear Programming Problems, One-Variable Unconstrained Optimization, Multivariable Unconstrained Optimization, The Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization, Quadratic Programming, Separable Programming , Convex Programming.

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MODULE -VII

Queueing Theory : Prototype Example, Basic Structure of queueing Models, Examples of Real Queueing Systems, The role of the Exponential Distribution, The Birth-and-Death Process, Queueing Models Based on the Birth-and Death Process ,Queueing Models Involving Nonexponential Distributions.

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Text Book:

S. Hiller & G.J. Lieberman – Operations Research, 8th Edn, TMH, New Delhi – 2006.

Reference Books:

1. H.A.Taha – Operations Research, 8/e , Pearson Education , New Delhi-2007.

2. J.K. Sharma – Operations Research, 3/e, Mcmillan , India Ltd, 2007.

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IT 7021 DATA MINING CONCEPTS AND TECHNIQUES 3 (3-0-0)

MODULE - I

Data Mining: Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

MODULE – II

Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Data Warehouse: Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining.

MODULE - III

Data Mining Primitives, Languages and System Architecture: Data Mining Primitives, DMQL, Architectures of Data Mining Systems.

MODULE – IV

Concept Description: Data Generalization & Summarization – Based Characterization, Analytical Characterization, Mining class Comparisons, Mining Descriptive Statistical Measures in Large Databases.

MODULE - V

Mining Association Rules in Large Databases: Association Rule Mining, Single – Dimensional Boolean Association Rules, Multilevel Association Rules from Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis, Constraint – Based Association Mining.

MODULE - VI

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Backpropagation, Classification based on concepts & Association Rule Analysis, Other Classification Methods, Prediction, Classification Accuracy.

MODULE - VII

Cluster Analysis: Introduction , Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Method - k- Medoids Algorithm, CLARANS, Hierarchical Methods - BIRCH, ROCK Density-Based Methods - DBSCAN, Grid-Based Methods – STING, WaveCluster

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Text Book :

Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques

Publisher Harcout India. Private Limited, Second Edition

Reference Books :

G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.

A. Berson & S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004

H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.

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LIST OF ELECTIVES - I

IT 7023 SIMULATION & MODELLING

MODULE-I

The concepts of a system, System Environment , Stochastic Activities,continueous and discrete systems,System Modeling,Types of models. The full corporate Model.

MODULE-II

The technique of simulation, the monte carlo method, comparison of simulation and analytical methods, experimental nature of simulation, types of system simulation, numerical computation technique for continueous & discrete models,distributed lag models,cobweb models. Continoueou system models,differential equations,analog computers & methods, hybrid computers.CSSLs,CSMP-III, Feedback Systems, Simulation of an Autopilot.

MODULE-III

Exponential Growth & decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamics diagrams,Simple system dynamics diagrams,multi –segment models,representation of time delays.

MODULE-IV

Stocastic variables, discrete & continueuos probability functions,measures of probability functions,numerical evaluation of continoues probability functions, continous uniformly distributed random numbers, a uniform random number numbers,generating discrete distributions, non-uniform continousely distributed random no,s. the rejection method.

Random no's Generation : Techniques for generating random numbers. Tests for random numbers.

Random variate Generation: Inverse transform technique, exponential distribution,uniform distribution.

MODULE-V

Congestion in systems, arrival patterns , poisson arrival patterns, the exponential distribution, the erlang distribution, service times, normal distributions, queuing disciplines, measures of queues.

MODULE-VI

Discrete events, representation of time, generation of arrival patterns, simulation of a telephone system, delyed calls, simulation programming tasks, measuring utilization and occupancy.

MODULE-VII

GPSS programs, general description, action times, succession of events, choice of paths, simulation of a Manufacturing shop, facilities and storage, gathering statics, conditional transfers. Program control statements. simcript:

Text Book:

1. Gordon Geoffrey, System Simulation, 4nd edition, PHI, 2008.

Reference Book:

Simulation Modeling and Analysis Third Edition by Law kelton Mc Graw Hill Publication.

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IT 7025 ARTIFICIAL INTELLIGENCE

MODULE – I

Overview of Artificial Intelligence : Definition & Importance of AI.

Knowledge : General Concepts : Introduction, Definition and Importance of Knowledge, Knowledge-Based Systems, Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, Acquisition of Knowledge.

MODULE – II

LISP and Other AI Programming Languages : Introduction to LISP : Syntax and Numeric Function, Basic List Manipulation Functions in LISP, Functions, Predicates and Conditionals, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays, Miscellaneous Topics, PROLOG and Other AI Programming Languages.

MODULE – III

Knowledge Representation : Introduction, Syntax and Semantics for Propositional logic, Syntax and Semantics for FOPL, Properties of Wffs, Conversion to Clausal Form, Inference Rules, The Resolution Principle, No deductive Inference Methods, Representations Using Rules.

MODULE – IV

Dealing With Inconsistencies and Uncertainties : Introduction, Truth Maintenance Systems, Default Reasoning and the Closed World Assumption, Predicate Completion and Circumscription, Modal and Temporal Logics.

Probabilistic Reasoning : Introduction, Bayesian Probabilistic Inference, Possible World Representations, Dumpster-Shafer Theory, Ad-Hoc Methods.

MODULE – V

Structured Knowledge : Graphs, Frames and Related Structures : Introduction, Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.

Object-Oriented Representations : Introduction, Overview of Objects, Classes, Messages and Methods, Simulation Example using an OOS Program.

MODULE – VI

Search and Control Strategies : Introduction, Preliminary Concepts, Examples of Search Problems, Uninformed or Blind Search, Informed Search, Searching And-Or Graphs.

Matching Techniques : Introduction, Structures Used in Matching, Measures for Matching, Matching Like Patterns, Partial Matching.

MODULE – VII

Knowledge Organization and Management : Introduction, Indexing and Retrieval Techniques, Integrating Knowledge in Memory, Memory Organization Systems.

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Text Book :

1. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

Reference Books:

1. E. Rich & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2005.
2. P.H. Winston - Artificial Intelligence, 3/e, Pearson Edition, New Delhi, 2006.
3. D.W. Rolston,- Principles of AI & Expert System Development, TMH, New Delhi.

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IT 7027 DIGITAL IMAGE PROCESSING

MODULE - I

Introduction : Background, Digital Image Representation, Fundamental Steps in Image Processing, Elements of a Digital Image Processing System.

Digital Image Fundamentals : Elements of Visual Perception, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels, Imagining Geometry.

MODULE - II

Image Transforms : Introduction to the Fourier Transform, The Discrete Fourier Transform, Some Properties of the Two-Dimensional Fourier Transform, Other Separable Image Transforms.

MODULE - III

Image Enhancement : Spatial Domain Methods, Frequency Domain Methods, Some Simple Intensity Transformations, Histogram Processing, Image Subtraction, Image Averaging, Background, Smoothing Filters, Sharpening Filters, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications.

MODULE – IV & V

Image Restoring : Degradations Model - Definitions, Degradation Model for Continuous Functions, Diagonalization of Circulant and Block-Circulant Matrices, Circulant Matrices, Block Circulant Matrices, Effects of Diagonalization on the Degradation Model, Algebraic Approach to Restoration, Unconstrained Restoration, Constrained Restoration, Inverse Filtering – Formulation, Removal of Blur Caused by Uniform Linear Motion, Restoration in the Spatial Domain, Geometric Transformation.

MODULE – VI & VII

Image Compression : Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. Image Compression Models – The Source Encoder and Decoder, The Channel Encoder and Decoder. Elements of Information Theory – Measuring Information, The Information Channel, Fundamental Coding Theorems, Using Information Theory. Error-Free Compression – Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.

Head of Department

Text Book :

1. Rafael. C. Gonzalez & Richard E.Woods.- Digital Image Processing, 2/e Pearson Education, New Delhi - 2006

Reference Books :

1. W.K.Pratt.-Digital Image Processing ,3/e Edn., John Wiley & sons, Inc. 2006

2. A.K.Jain.- Fundamentals of Digital Image Processing, PHI, New Delhi, 2006

3. M. Sonka et.al Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007.

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IT 7029 OBJECT-ORIENTED DESIGN

MODULE-I

What Is Object-Orientation: Introduction, Basic Concepts, The Origins of Object-Orientation, Object-Oriented languages Today.

Modelling Concepts: Introduction, Models and diagrams, Drawing Activity Diagrams.

MODULE-II & III

Requirements Capture: Introduction, User Requirements, Fact Finding Techniques, User Involvement, Documenting Requirements, Use Cases, Requirements Capture and Modelling.

Requirements Analysis: Introduction, What Must a Requirements Model Do, Use Case Realization, The Class Diagram, Drawing a Class Diagram, CRC (Class Responsibility Collaboration) Cards, Assembling the Analysis Class Diagram.

Refining The Requirements Model: Introduction, Component-based Development, Adding Further Structure, Software Development Patterns.

MODULE-IV

Object Interaction: Introduction, Object Interaction and Collaboration, Interaction Sequence Diagrams, Collaboration Diagrams, Model Consistency.

Specifying Operations: Introduction, The Role of Operation Specifications, Contracts, Describing Operation Logic, Object Constraint Language, Creating an Operation Specification.

MODULE-V

Specifying Control: Introduction, States and Events, Basic Notation, Further Notation, Preparing a Statechart, Consistency Checking, Quality Guidelines, Summary.

Moving Into Design: Introduction, How is Design Different from Analysis, Logical and Physical Design, System Design and Detailed Design, Qualities and Objectives of Analysis and Design, Measurable Objectives of Analysis and Design, Measurable Objectives in Design, Planning for Design.

MODULE-VI

System Design: Introduction, The Major Elements of System Design, Software Architecture Concurrency, Processor Allocation, Data Management Issues, Development Standards, Prioritizing Design Trade-offs, Design for Implementation.

OBJECT DESIGN: Introduction, Class Specification, Interfaces, Criteria for Good Design, Designing Associations, Integrity Constraints, Designing Operations, Normalization.

MODULE-VII

Design Patterns: Introduction, Software Development Patterns, Documenting Patterns-Pattern Templates, Design Patterns, How to Use Design Patterns, Benefits and Dangers of Using Patterns.

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Designing Boundary Classes: Introduction, The Architecture of the Presentation Layer, Prototyping the User Interface, Designing Classes, Designing Interaction with Sequence Diagrams, The Class Diagram Revisited, User Interface Design Patterns, Modelling the Interface Using Statecharts.

Text Book:

1. S.Bennett, S.Mc Robb and R.Farmer – Object- Oriented Systems Analysis and Design Using UML 2nd edn, TMH, New Delhi – 2007.

Reference Books:

4. M.Blaha and J.Runbangh – Object- Oriented Modeling and Design with UML 2./e, Pearson Education, New Delhi,2007.
5. J.W. Satzinger, B.R. Jackson and S.D. Burd – Object –Oriented Analysis and Design, Thomson Learning, India Edition, 2007.
6. G. Booch – Object Oriented Analysis and Design with Applications,2/e, CA;Benjamin/Cumming,1994.

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IT 7031 SYSTEM PROGRAMMING

MODULE – I

Background : Introduction, System Software and Machine Architecture, The Simplified Instructional Computer (SIC), Traditional (CISC) machines, RISC Machines.

MODULE – II & III

Assemblers : Basic Assembler Functions, Machine – Dependent Assembler Features, Machine – Independent Assembler Features, Assembler Design Options, Implementation Examples.

MODULE – IV & V

Loaders and Linkers : Basic Loader Functions, Machine - Dependent Loader Features, Machine – Independent Loader Features, Loader Design Options, Implementation Examples.

MODULE – VI

Macro Processors : Basic Macro Processor Functions, Machine – Independent Macro Processor Features, Macro Processor Design Options, Implementation Examples.

MODULE – VII

Software Engineering Issues : Introduction to Software Engineering Concepts, System Specifications, Procedural System Design, Object – Oriented Design, System Testing Strategies.

Text Book :

1. L. L. Beck – System Software – An Introduction to Systems Programming, 3/e, Pearson Education, New Delhi, 2004

Reference Books:

1. J.J. Donovan – System Programming, McGraw Hill , New Delhi, 1993.
2. D.M. Dhamdhere – System Programming and Operating Systems, 2/e., Tata McGraw Hill , New Delhi, 2000

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IT 7033 WEB TECHNOLOGY

MODULE-I

Web Essentials : Clients , Server and Communication, The Internet, Basic Internet Protocols , The World Wide Web , Http Request Message, HTTP Response Message , Web Clients , Web Servers .

Markup Languages : XHTML 1.0 , Introduction to HTML ,History and Versions, Basic XHTML Syntax and Semantics, Some Fundamental HTML Elements , Relative URIs , List , Tables , Frames , Forms, Defining XHLML Abstract syntax : XML, Creating HTML Documents .

MODULE- II

Style Sheets : CSS , Introduction to Cascading Style Sheets and features , CSS Code Syntax , Style Sheets and HTML , Style Rule Cascading and Inheritance , Text Properties, CSS Box Model, Normal Flow Box Layout, Beyond the Normal Flow , Other useful style properties .

MODULE-III

Client – Side Programming : The Java Script Language , History and Introduction ,Java Script Perspective ,Basic Syntax , Variables and Data Types , Statements , Operators , Literals , Functions , Objects , Arrays , Build in Objects, Java Scripts Debuggers .

MODULE- IV

Host Objects : Browsers and the DOM, Introduction to Document Object Model , DOM History and Model, Intrinsic Event Handling , Modifying Elements Style, The Document Tree , DOM Event Handling .

MODULE- V

Server Side Programming : Java Servlet Architecture over view , Servelet generating Dynamic Content , Servlet life Cycle , Parameter Data , Session , Cookies , URL Rewriting , Other Servelet Capabilities , Data Storage , Servelets and Concurrency.

MODULE- VI

Representing Web Data : XML Documents , vocabularies, versions , declarations, Namespaces , Java Script and XML: AJAX, DOM based XML Processing , Event oriented Parsing :SAX, Transforming XML Documents

MODULE- VII

JSP Technology : Introduction JSP and Servlets , Running JSP Applications , JSP Basic , Java Beans classes and JSP, Tag Libraries and Files ,Support for Model View Controller Paradigm . Web Services : Concepts , Writing Java Web Services , Writing Java Web Service Client, Describing Web services : WSDL , Representing Data Types : XML Schema , Communication Object Data :SOAP

Text Book : Web Technologies: A Computer Science Perspective , Jeffrey C Jackson , Pearson Education , India.

Reference Book : Web Technology by Uttam K. Roy , Oxford University Press 2010

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IT 7041 PARALLEL AND DISTRIBUTED COMPUTING 3 (3-0-0)

Module-I
Introduction: Computational Demand of Modern Science, Advent of Practical rocessing, Parallel Processing Terminology- Contrasting Pipelining and Data arallelism, Control Parallelism, Scalability, Control-Parallel Approach, Data-Parallel Approach with I/O.

Module-II
PRAM Algorithm: A Model of Serial Computation, The PARAM Model of Parallel Computation, PARAM Algorithm- Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Colouring,

Module III
Mapping and Scheduling: Mapping Data to Processors on Processor Arrays Multicomputers., Dynamic Load Balancing on Multicomputers, Static Scheduling on UMA Multiprocessors, Deadlock,

Module-IV
Elementary Parallel Algorithm: Classifying MIMD Algorithm, Reduction. Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors.

Module-V
Introduction to Distributed System: Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems.

Communication: Layered protocols, Remote procedures call, Remote object invocation, Message-oriented communication, Stream-oriented communication

Module-VI
Synchronization: Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions,

Module-VII
Consistency and Replication: Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols.

Text Books

1. M.J. Quinn-Parallel Computing-Theory and Practice, 2nd Edn., McGraw Hill Inc., New York.
2. M. Singhal, N. Shivaratri, Advanced Concepts in Operating Systems, TMH,2010

Referece Book:

3. Sunit Mahajan and Seema Shah, Distributed Computing, Oxford Unv. Press, New Delhi, 2010

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IT 7043 COMPILER DESIGN 3 (3-0-0)

MODULE-I

Introduction to Compiling, Analysis of the source program, The phases of the compiler, Lexical Analysis, The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator.

MODULE-II & III

Syntax Analysis, The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC).

MODULE-IV

Syntax directed translation, Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

MODULE-V

Type checking, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Run time environments, Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

MODULE-VI

Intermediate code generation, Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

MODULE-VII

Code optimization, Basic blocks & flow graphs, Transformation of basic blocks, DAG, representation of basic blocks, The principle sources of optimization, Loops in flow graph, Code generations, Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text Book:

1. Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education, New Delhi, 2007.

Reference Book:

1. Holub - “Compiler Design in C” – PHI, New Delhi, 2004

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LIST OF ELECTIVES - II

IT 8025 ENTERPRISE RESOURCE PLANNING

MODULE - I

Introduction to ERP : Evolution of ERP, What is ERP, Reasons for the growth of the ERP market, Advantages of ERP, Reasons of Failure.

MODULE - II

Enterprise- An overview : Integrated Management information, Business Modeling, Integrated Data Model.

MODULE- III

ERP and Related Technologies : BRP (Business Process Reengineering), MIS (Management Information System), DSS (Decision Support System), EIS (Executive Information system), Data Warehousing, Data Mining, OLAP, Supply Chain Management.

MODULE - IV

A Manufacturing Perspective : ERP, CAD/CAM, Material Requirement Planning, Bill of Material, Closed loop MRP, MRP-II, Distributed Requirement Planning, JIT and Kanban, Product Data Management, Benefit of PDM, Data Management, Market to Order, Market to Stock, Assemble to order, Engineer to order, Configure to order.

MODULE -V

ERP Modules: Finance, Sales and distribution, Manufacturing, Human Resources, Plant Maintenance, Quality Management, Material Management.

MODULE - VI

Benefits of ERP :

ERP Market : SAP, BAAN, Oracle Corporation, People Soft.

ERP Implementation Life Cycle : Different phases of ERP implementation

MODULE - VII

Vendors, Consultants & Users's : In – house Implementation – pros & cons, Vendors, Consultants, End-users.

Future Directions in ERP: New Markets, New channels, Faster Implementation methodologies, Business Models and BAPIs, New business segments, Web enabaling

ERP Case Studies.

Text Book :

1. Alexis Leon - Enterprise Resource Planning, TMH, New Delhi 2001.

Reference Book:

1. E. Monk & B. Wagner – Concepts in Enterprise source planning, 2/e, Thomson Learning, India Edition 2007.

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IT 8027 DECISION SUPPORT SYSTEMS

MODULE-I
DSS Defined, history of DSS , Ingredients of a DSS, Data and Model Management, DSS Knowledge Base, User Interfaces, The DSS User, Categories and classes of DSSs.

MODULE-II
Decision Makers :who are they?, decision Styles, decision Effectiveness, how can a DSS help?, why are decision So hard?, A typology of decisions, decision theory and simon's model of problem solving, rational decision making, bounded rationality ,the process of choice, Cognitive Processes, biases and heuristics in decision making, effectiveness and efficiency.

MODULE-III
Understanding the organization, Organizational Culture, power and politics, supporting organizational Decision making, defining the problem and its structure, decision models, types of probability, techniques for forecasting probabilities calibration and sensitivity.

MODULE-IV
Group decision making, the problem with groups ,MDM support technologies, managing MDM activities, the virtual workplace, What Exactly is an EIS?, EIS history, EIS components, making the EIS work, the future of executive decision making and the EIS.

MODULE-V
The concepts of expertise, the intelligence of AI, the concepts and structure of expert systems, designing and building Expert Systems, evaluating the benefits of expert systems.

MODULE-VI
The concept of knowledge, knowledge Acquisition for expert systems, validating and verifying the knowledge base, Fuzzy logic and artificial neural networks, genetic algorithms , Application of machines that learn.

MODULE-VII
Stores, warehouses, and Marts, the data Warehouse Architecture, data have data-the metadata, interviewing the data-metadata extraction, implementing the data warehouse, data ware house technologies, the future of data warehousing.

Text Book:

1. George M. Markas, Decision support Systems in the 21st Century, 2nd edition, Pearson Education 2005.

Reference Book:

1. E. Turban, J.E. Aronson & T.P.Liang- Decision Support Systems and Intelligent Systems, 7/e, Pearson Education, New Delhi- 2006.

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IT 8029 EMBEDED SYSTEMS

MODULE - I

Introduction :Embedded systems overview, Design challenge, Processor technology, IC technology, Design Technology, Trade offs

MODULE - II

Custom Single-purpose processors: Hardware :Introduction, Combinational Logic, Sequential logic

MODULE -III

General-purpose processors: Software :Introduction, Basic architecture, Operation, Development environment, Application-specific instruction-set processors (ASIP's), Selecting a microprocessor, General-purpose processor design

MODULE - IV

Standard single-purpose processors: Peripherals : Introduction, Timers, counters, and watchdog timers, UART, Pulse width modulator, LCD controller, Keypad controller, Stepper motor controller, Analog-digital converters, Real-time clocks

MODULE - V

Memory : Introduction, Memory write ability and storage permanence, Write ability, Storage permanence, Common memory types, Composing memories, Memory hierarchy and cache, Advanced RAM

MODULE - VI

Interfacing: Introduction, Communication basics, Microprocessor interfacing: I/O addressing, Microprocessor interfacing: interrupts, Microprocessor interfacing: Direct memory access, Arbitration, Multi-level bus architectures, Advanced communication principles, Serial Protocols, Parallel protocols, Wireless protocols

MODULE - VII

State machine and concurrent process models : Introduction, Models vs. languages, text vs. graphics, A basic state machine model: finite-state machines (FSM), Finite-state machines with data path model: FSMD, Using state machines, Hierarchal/Concurrent state machine model (HCFSM) and the State charts language, Program-state machine model (PSM), The role of an appropriate model and language, Concurrent process model, Concurrent processes, Communication among processes, Synchronization among processes, Implementation, Data flow model, Real-time systems,

Text Book:

Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid and Tony Givargis, John Wiley & Sons 2002

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IT 8031 PATTERN RECOGNITION

MODULE – I

Pattern Recognition Overview : Overview, Pattern Recognition, Classification and Description, Patterns and Feature Extraction, Training and Learning in PR Systems, Pattern Recognition Approaches.

MODULE – II

Statistical Pattern Recognition : Introduction, The Gaussian case and Class Dependence Discriminate Functions, Extensions, Classifier Performance, RISK and Errors.

MODULE – III

Supervised Learning : Parametric Estimation and Supervised Learning, Maximum Likelihood Estimation Approach, Bayesian Parameter Estimation Approach, Non – Parametric Approaches, Parzen Windows, K-nn Non-Parametric Estimation. Nearest Neighbour Rule.

MODULE – IV

Linear Discriminate Functions and The Discrete and Binary Feature Cases : Introduction, Discrete and Binary Classification Problems, Techniques to Directly Obtain Linear Classifiers.

MODULE – V&VI

Syntactic Pattern Recognition : Overview Quantifying Structure in Pattern Description and Recognitions, Grammar Based Approach and Application, String Generation as Pattern Description.

Recognition by String Matching and Parsing. The Cocke-Younger Kasami ((ck) parsing algorithm.

MODULE – VII

Neural Pattern Recognition: Introduction to Neural Networks, Neural Network Structure from Pattern Recognition Applications. Physical Neural Network. The Artificial Neural Network Model, Neural Network Based Pattern Associators.

Text Book :

1. Robort Schalkoff - Pattern Recognition, Statistical, Structural and Neural Approach, John Wiley, Indian Edition, 200.

Reference Book :

1. R. U. Duda – Pattern Classification, John Wiley, Indian Edition, 2006.

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IT 8033 COMPUTING AND COMPLEXITY THEORY

MODULE - I

The Church- Turing Thesis : Turing Machines- Formal definition of a Turing machine, Examples of Turing machines; Variants of Turing Machines- Multitape Turing machines, Nondeterministic Turing machines, Enumerators, Equivalence with other models; The Definition of Algorithm- Hilbert's problems, Terminology for describing Turing machines.

MODULE - II

Decidability : Decidable Languages- Decidable problems concerning regular languages, Decidable problems concerning context-free languages; The Halting Problem- The diagonalization method, The halting problem is undecidable.

MODULE - III

Reducibility: Undecidable Problems from Language Theory- Reductions via computation histories; A Simple Undecidable Problem; Mapping Reducibility-Computable functions, formal definition of mapping reducibility.

MODULE - IV

Advanced Topics In Computability Theory:- The Recursion Theorem, Self-reference, Terminology for the recursion theorem, applications; Decidability of logical theories- A decidable theory, An undecidable theory; Turing Reducibility; A Definition of Information- Minimal length descriptions, Incompressible strings and randomness.

MODULE – V&VI

Time Complexity: Measuring Complexity- Big-O and small-o notation, Analyzing algorithms, Complexity relationships among models; The Class P- Polynomial time, Examples of problems in P; The Class NP- Examples of problems in NP, The P versus NP question; NP-completeness- Polynomial time reducibility, Definition of NP-completeness, The Cook-Levin Theorem; Additional NP-complete Problems- The vertex cover problem, The Hamiltonian path problem, The subset sum problem.

MODULE - VII

Space Complexity: Savitch's Theorem, The Class PSPACE, PSPACH-completeness – The TQBF problem, Winning strategies for games, Generalized geography; The Classes L and NL, NL-completeness- Searching in graphs; NL equals coNL.

Intractability: Hierarchy Theorems- Exponential space completeness; Relativization- Limits of the diagonalization method; Circuit Complexity.

Text Book:

Michael Sipser – Introduction to the Theory of Computation, 2/e, Thomson Learning – India Edition 2006.

Reference Books:

1. R.G.Taylor – Models of Computation and Formal Languages, Oxford University New York, 1998.

2. B.M. Moret – The Theory of Computation , Pearson Education, New Delhi 2002.

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IT 8035 SOFTWARE RELIABILITY AND TESTING

MODULE – I
Introduction : Software Reliability & Hardware Reliability, Basic Concepts, Availability, Modeling.

MODULE – II
Selected Models : Execution Time Component, Calendar Time Component, Model Choice.

MODULE - III
Applications : System Engineering, Project Management, Management of Operational Phase, Evaluation of S/W Engg. Technologies.

MODULE – IV
System Definition : Failure definition, System Configuration, Text Run Selection.

MODULE – V
Parameter Determination : Execution Time Component, Calendar Time Component.

MODULE – VI&VII
Project Specific Techniques : Unobserved Failures, Failure Time Measurement, Evolving Programs, Changes in Environment, Other Consideration.

Text Book :

1. J. D. Musa, et.al - Software Reliability: Measurement, Prediction & Application, Mc-Graw Hill, New York.

Reference Books:

1. Hoang. Pham, et.al - Software Reliability and testing, IEEE Computer Society press.
2. Glenford J. Myers, Tom Badgett, Todd M. Thomas, Corey Sandler - The art of software testing, John Wiely & Sons, Inc.

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IT 8037 DISTRIBUTED DATABASE SYSTEM

MODULE – I

Introduction: Distributed Data Processing **,**Promises of DDBs ,Complicating Factors, Problem areas.

Distributed DBMS Architecture : DBMS Standardization , Architectural Models for Distributed DBMS s, Distributed DBMS Architecture.

MODULE – II

Distributed Database Design: Alternative Design Strategies, Distribution design issues,

Fragmentation, Allocation. Semantic Data Control **:** View management, Data security, Semantic Integrity control.

MODULE-III

Overview of Query Processing: Query Processing Problem ,Objective of Query Processing , Complexity of Relational Algebra operations , Characterization of Query Processing , Layers of Query Processing.

MODULE- IV

Query Decomposition and Data Localization : Query Decomposition , Localization of Distributed Data, Optimization of Distributed Queries : Query optimization , Centralized Query optimization , Join ordering in fragment Queries , Distributed Query Optimization Algorithms.

MODULE – V

Introduction to Transaction Management: Definition of Transaction , Properties of Transactions, Types of Transactions .

Distributed Concurrency Control : Serializability Theory , Taxonomy of Concurrency Control Mechanisms, , Locking Based Concurrency control Algorithm , Time Stamp based concurrency control Algorithms, Optimistic Concurrency Control Algorithms ,Dead Lock management, RELAXED Concurrency Control.

MODULE – VI

Distributed DBMS Reliability: Reliability Concepts and Measures , Failures and Fault Tolerance in Distributed systems, Failures in Distributed DBMS, Local Reliability Protocols , Distributed Reliability Protocols, Dealing with Site Failures, Network Partitioning.

MODULE – VII

Parallel Database Systems : Data Base Servers , Parallel Architectures , Parallel DBMS Techniques , Parallel Execution Problems , Parallel Execution for Hierarchical Architecture.

Text Book:

M. Tamer Ozsu, Patrick Valduriez , S.Sridhar - Principles of Distributed Database Systems 2nd Edn., Pearson Education Asia,2001.

Reference Book :

Stefano Ceri , Guiseppe Pelagatti ,- Distributed Databases Principles and Systems Tata McGraw-Hill Edition 2008

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IT 8039 COMPUTER GRAPHICS AND MULTIMEDIA

MODULE- I

Introduction to computer graphics & graphics systems, Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display,3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

MODULE- II

Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

MODULE- III & IV

2D transformation & viewing, Basic transformations: translation , rotation, scaling ; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations , point clipping , line clipping, clipping circles , polygons & ellipse.

3D transformation & viewing

3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.

MODULE- V & VI

Curves, Curve representation, surfaces , designs , Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational Bspline curves.

Hidden surfaces, Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry.

Color & shading models, Light & color model; interpolative shading model; Texture;

MODULE- VII

Multimedia: Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia.; Image, video and audio standards. Audio: digital audio, MIDI, processing sound, sampling, compression. Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression . Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.

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Text Books

1. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education, New Delhi, 2001

2. Buford J. K. – "Multimedia Systems" – Pearson Education, New Delhi, 2001

3. Andleigh & Thakrar, Multimedia, PHI, New Delhi, 2004

Reference Books:

1. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH, New Delhi

2. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI, New Delhi, 2001

3. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Ed.) – Pearson Education, New Delhi, 2006

4.Elsom Cook – "Principles of Interactive Multimedia" – McGraw Hill, New Delhi, 2001

Head of Department

IT 8041 INFORMATION SYSTEM PROJECT MANAGEMENT

MODULE – I

Information Systems: Information as a resource, Concept of Information System, Components of Information Systems and their roles. Types of Information System. Information Economy.

MODULE - II

Introduction to Project Management: Project –Definition and Characteristics. Projects as Systems, Project Entities, The Information Systems Project Environment, Primary Reasons for Information Systems Project Failure, Perceptions of Project Success

MODULE - III

Project Adoption: Project Selection and Approval - Measurement of Project Effect, Selection Practice , Project Evaluation Techniques , Information Systems Project Approval , Cost/Benefit Analysis, Value Analysis, Multiple Objectives, Budget Optimization

Requirements Analysis: Analysis of User Needs, Methods of Elicit User Requirements

Risk Identification and Analysis.

MODULE - IV

Planning:

System Development: Overview of Analysis and Design Methods, Software Development Standards , Information Systems Project Types , System Development Approach

Estimation: Planning Process, Software Estimation , Planning for Change.

MODULE - V

Scheduling:

Quantitative Project Scheduling Methods : The Critical Path Method , Project Crashing , Resource Leveling , Resource Smoothing , Critical Path Criticisms

Probabilistic Scheduling Models: PERT , Simulation for Project Scheduling

MODULE - VI

Implementation:

Project Organization: Alternate Organization Structures, Comparison of Organizational Structures in Projects , Levels of Project Organization

Project Implementation : Information Systems Project Success , Company- Wide Information System , Information Systems Project failure , Information Technology Failure , Critical Success Factors , Quality Control in Project Implementation , User Involvement in Project Implementation , Integrated Requisitioning System

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MODULE - VII

Project Control and Assessment: Project Control Failures, Risk Management, The Control Process and Project Evaluation

Text Book:

David L . Olson : "Introduction to Project Management" Irwin McGraw – Hill, 2001

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IT 8043 DISTRIBUTED SYSTEMS

MODULE-I

Characterization of Distributed Systems : Introduction, Examples of distributed systems, Resource sharing and the Web, Challenges.

System Models : Introduction, Architectural models, Fundamental models, Summary.

MODULE-II

Networking and Internetworking : Introduction, Types of network, Network Principles, Internet protocols, Case studies: Ethernet, WiFi, Bluetooth and ATM.

MODULE-III

Interprocess Communicaion : Introduction, The API for the Internet protocols, External data representation and marshalling, Client-server communication, Group communication, Case study : interprocess communication in UNIX.

MODULE-IV

Time and Global States : Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, Distributed debugging.

Coordination and Agreement : Introduction, Distributed mutual exclusion, Elections, Multicast communication.

MODULE-V

Transactions and Concurrency Control : Introduction, Transactions, Nested transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

MODULE-VI

Distributed Transactions : Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactiuons. Distributed deadlocks, Transactions recovery.

MODULE-VII

Replication : Introduction, System model and group communication, Fault-tolerant services, Case studies of highly available services : the gossip architecture, Bayou and Coda, Transaction with replicated data.

Text Book:

1. G. Coulouris et. al. - Distributed Systems : concepts and Design, 4/e, Pearson Education, New Delhi.

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IT 8045 ADVANCED COMPUTER GRAPHICS

MODULE-I

Representing Curves and Surfaces : Polygon Meshes, Parametric Cubic Curves, Parametric Bicubic Surfaces, Quadratic Surfaces.

MODULE-II

Achromatic and Colored Light Achromatic Light, Chromatic Color, Color Models for Raster Graphics, Reproducing color, Using Color in Computer Graphics.

MODULE-III

The Quest for Visual Realism Why Realism, Fundamental Difficulties, Rendering Techniques for Line Drawings, Rendering Techniques for Shaded Images, Improved Object Model, Dynamics, Stereopsis, Improved Displays, Interacting with Our Other Senses, Aliasing and Antialiasing.

MODULE-VI

Visible-Surface Determination : Functions of Two Variables, Techniques for Efficient Visible-Surface Algorithms, Algorithms for Visible-Line Determination, The z-Buffer Algorithm, List Priority Algorithms, Scan-Line Algorithms, Area-Subdivision Algorithms, Algorithms for Octrees, Algorithms for Curved Surfaces, Visible-Surface Ray Tracing.

MODULE-V

Illumination and Shading : Illumination Models, Shading Models for Polygons, Surface Detail, Shadows, Transparency, Interobject Reflections, Physically Based Illumination Models, Extended Light Sources, Spectral Sampling.

MODULE-VI

Advanced Raster Graphics Architecture : Simply Raster-Display System, Display-Processor Systems, Standard Graphics Pipeline, Introduction to Multiprocessing, Pipeline Front-End Architectures, Parallel Front-End Architectures, Multiprocessor Rasterization Architectures.

MODULE-VII

Advanced Geometric and Raster Algorithms : Clipping, Scan-Converting Primitives, Antialiasing, The Special Problems of Text, Filling Algorithms, Making copyPixel Fast, The Shape Data Structure and Shape Algebra.

Text Book:

J.D. Foley et. al. – Computer Graphics Principles & Practical 2/e , Pearson Education, New Delhi, 2004.

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IT 8047 REAL TIME SYSTEMS

MODULE-I

Basic Real-Time Concepts: Terminology, Real-Time System Design Issues, Example Real-Time Systems, Common Misconceptions, Brief History.

MODULE-II

Hardware Considerations: Basic Architecture, Hardware Interfacing, Central Processing Unit, Memory, Input/Output, Enhancing Performance, Other Special Devices, Non-von-Neumann Architectures.

MODULE-III

Real-Time Operating Systems: Real-Time Kernels, Theoretical Foundations of Real-Time Operating Systems, Intertask Communication and Synchronization, Memory Management, Case Study: POSIX.

MODULE-IV

Software Requirements Engineering: Requirements-Engineering Process, Types of Requirements, Requirements Specification for Real-Time Systems, Formal Methods in Software Specification, Structured Analysis and Design, Object-Oriented Analysis and the Unified Modeling Language, Organizing the Requirements Document, Organizing and Writing Requirements, Requirements Validation and Review.

MODULE-V

Software System Design: Properties of Software, Basic Software Engineering Principles, The Design Activity, Procedural-Oriented Design, Object-Oriented Design, Appendix: Case Study in Software Requirements Specification for Four-Way Traffic Intersection Traffic Light Controller System.

MODULE-VI

Programming Languages And The Software Production Process: Introduction, Assembly Language, Procedural Languages, Object-Oriented Languages.

MODULE-VII

Performance Analysis And Optimization: Theoretical Preliminaries, Performance Analysis, Application of Queuing Theory, I/O Performance, Performance Optimization.

Text Book:

1. Phillip A. Laplante- Real-Time Systems: Design and Analysis, John Wiley- India Edition, 2006.

Reference Books:

1. Rajib Mall- Real Time Systems; Theory and Practice, Pearson Edition, New Delhi- 2007.
2. J.W.S.Liu – Real Time Systems, Pearson Education, New Delhi – 2004.
3. C.M.Krishna & K.G. Shiv – Real Time Systems, Mc Graw Hill – 1997.

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IT 8049 MODERN TELECOMMUNICATION SYSTEMS

MODULE – I & II

Introduction to Switching System : General principles of switching , signaling and control, stored program control concepts, Space Division and Time Division switching, 2 -, 3- , and n – stage networks, Blocking and Non – Blocking switching, Digital Exchange (basic concept only).

MODULE – III

ISDN & ATM : ISDN user interface, architecture and user access, ISDN channels. B – ISDN, concepts of ATM and user – network Interface. Brief descriptions and functions of different layers of ATM protocol.

MODULE – IV & V

Mobile Cellular telecommunications : Basic Cellular systems, components and operation of Cellular systems , mobile propagation and fading, co channel and adjacent channel interferences , frequency reuse channels, near - end - interferences , Handoff . Channel assignment and frequency assignment . spread Spectrum technique , Multiple Access Techniques : Introduction to FDMA, TDMA & CDMA.

MODULE – VI & VII

Mobile Antennas : Antenna parameters (Gain , Directivity , Efficiency , Effective Aperture etc.) and radiation characteristics . Qualitative description of Dipole antenna, LP antenna , Discone antenna , Helical antenna , Horn antenna , Patch and slot antenna . PIFA. Characteristics of cell site and mobile antennas .

Text Books :

1. T. Vishwanathan - Telecommunication Switching Systems and Networks - PHI, 2/e, New Delhi, 2002

2. Roy Blake - Wireless Communication Technology ,Thomson Asia Pvt. Ltd , Singapore 2002.

3. W.C.Y. Lee - Mobile Cellular telecommunications - Mc Graw – Hill Int. Edition,Singapore, 1995.

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IT 8051 NEURAL NETWORKS & APPLICATIONS

MODULE - I

Recurrent Networks And Temporal Feedforward Networks: Introduction , Overview of Recurrent Neural Networks, Hopfield Associative Memory , Simulated Annealing, Boltzmann Machine , Overview of Temporal Feedforward Networks, Simple Recurrent Network, Time-Delay Neural Networks, Distributed Time-Lagged Feedforward Neural.

MODULE - II

Neural Networks For Optimization Problems : Introduction, Neural Networks for Linear Programming Problems, Neural Networks for Quadratic Programming Problems, Neural Networks for Nonlinear Continuous Constrained Optimization Problems.

MODULE - III

Solving Matrix Algebra Problems With Neural Networks: Introduction, Inverse and Pseudoinverse of a Matrix , LU Decomposition, QR Factorization, Schur Decomposition, Spectral Factorization- Eigenvalue Decomposition (EVD)(Symmetric Eigenvalue Problem), Neural Network Approach for the Symmetric Eigenvalue Problem.

MODULE – IV&V

Solution Of Linear Algebraic Equations Using Neural Networks: Introduction, Systems of Simultaneous Linear Algebraic Equations, Least-Squares Neurocomputing Approach for Solving Systems of Linear Equations, Conjugate Gradient Learning Rule for Solving Systems of Linear Equations, A Generalized Robust Approach for Solving Systems of Linear Equations Corrupted with Noise, Regularization Methods for Ill-Posed Problems with Ill-Determined Numerical Rank, Matrix Splittings for Iterative Discrete-Time Methods for Solving Linear Equations.

MODULE - VI

Statistical Methods Using Neural Networks: Introduction, Principal-Component Analysis, Learning Algorithms for Neural Network Adaptive Estimation of Principal Components, Principal- Component Regression, Partial Least-Squares Regression, A Neural Network Approach for Partial Least-Squares Regression.

MODULE- VII

Identification, Control, And Estimation Using Neural Networks: Introduction, Linear System Representation, Autoregressive Moving Average Models , Identification of Linear Systems with ARMA Models, Parametric System Identification of Linear Systems Using PLSNET, Nonlinear System Representation, Identification and Control of Nonlinear Dynamical.

Text Book:

1. M. Ham & I. Kostanic – Principles of Neurocomputing for Science & Engineering, TMH, New Delhi , 2002.

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IT 8053 E-COMMERCE

MODULE - I

Introduction to Electronic Commerce: Electronic Commerce, Scope of Electronic Commerce, Definition of Electronic commerce, Electronic Commerce and Trade cycle, Electronic Market, Electronic Data Interchange, Internet Commerce, e-Commerce in perspective.

MODULE - II

Business Strategy in an Electronic Age: Value Chain, Supply Chains, Porter's Value Chain Model, Inter organizational Value chains, Competitive advantage, Competitive strategy, Porter's Model, First Mover advantage, Competitive advantage using e-commerce.

MODULE - III

Business strategy: Introduction to Business Strategy, Strategic implications of IT, Technology, Business Environment, Business Capability, Existing Business strategy, Strategy Formulation and Complementation Planning, e-commerce implementation, e-commerce & evaluation.

MODULE - IV

B2B e-Commerce Part1: Inter-organizational Transactions, The credit transaction trade cycle, Variety of transactions, Electronics Market, Advantage and disadvantage of electronics markets, Electronic Data Interchange, Benefits of EDI.

MODULE - V

B2B e-Commerce Part2: EDI technology, standards, communications, implementation, agreements, security, EDI and business, Organizations, Trading pattern, Transactions, Adoption and maturity, Inter-organizational e-Commerce, Purchasing online, After sales online.

MODULE – VI

B2C e-Commerce Part1: Consumer trade transactions, Internet e-Commerce, The e-Shop, Internet shopping and trade cycle, other e-Commerce technologies, Advantages and disadvantages of consumer e-Commerce

MODULE – VII

B2C e-Commerce Part2: The elements of e-Commerce, e-Visibility, Online payments, delivering the goods, After-sales service, Internet e-Commerce security.

E-Business: Introduction, Internet bookshop, Grocery Supplies, Software supplies and support, Electronics Newspaper, Internet Banking, Online share sealing, Gambling on the Net, e-diversity.

Conclusions.

Text Book :

2. David Whiteley - E-COMMERCE: Strategy, Technologies and Applications, TMH, New Delhi,2000.

Reference Book :

1. Ravi Kalakota & Andre B. Whinston - Electronic Commerce A Manager's Guide Pearson Education, 2005.
2. Efraim Turban, Dennis Viehland, David King, Jae Lee – Electronics Commerce: A Managerial Perspective, Pearson Education Asia, 2006/4E

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Syllabus M.Tech CS Non-CBCS

TCS1001 DATABASE MODELLING AND DESIGN

Module 1

Introduction ER Model: Fundamental ER constructs, Advanced ER constructs, Object Oriented Data Modelling.

Module 2

ER Modelling in Logical Database Design: Introduction, Requirements analysis and ER Modelling, View Integration, Entity clustering, Relational database concepts, Overview of SQL.

Transformation of the ER Model to SQL: Transformation Rules & SQL constructs Transformation steps.

Module 3

Normalization: Fundamentals of Normalization, Design of Normalised Tables, Normalization of Candidate Tables derived from ER diagram, Determining the minimum set of 3NF tables, Fourth & Fifth normal forms.

Module 4

Access Methods: Sequential Access Methods, Random Access Methods, Secondary Indexes, Denormalization, Join Strategies.

Example of Relational DB design: Requirements specification, Logical Design, Physical Design.

Module 5

Distributed Data Allocation: Introduction, Distributed & Multi database Design, General Data Allocation problem, Data allocation strategies.

Module 6

Data Warehousing, OLAP and Data Mining: Overview of Data warehousing, Logical Design, Physical Design, OLAP, Data Mining.

Module 7

Advanced Database Technology: Architecture for advanced technology, Object-oriented & Object – Relational Database, Spatial and Geographic Databases, Multimedia Databases, Temporal Databases, Text Databases, Active Databases, Real – Time Databases.

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Text Book :

T.J.Teorey - Database Modeling & Design, 3rd edition, Harcourt Asia Pte. Ltd., New Delhi, 2002

Reference Books :

1. A.Silberchatz et.al. – Database System Concepts 3rd Edn. McGraw Hill Inc., 1997.
2. R.Elmasri et.al. – Fundamentals of Database Systems, Addison Wesley, Indian Reprint,New Delhi, 2000.
3. R.Rama Krishnan – Database Management Systems, McGraw Hill International Edn., New York, 1998.

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TCS1025 ADVANCED OPERATING SYSTEM CONCEPTS

Module 1 **[4 periods]**

Overview, Functions of an Operating System, Design Approaches, Types of Advanced Operating Systems. Synchronization Mechanisms, Concept of a Process, Concurrent Processes, Critical Section Problem, Other Critical Section Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Algorithms.

Module 2 **[4 periods]**

Process Deadlocks, Models of Deadlock, Models of Resources,A graph theoretic model of a System State, Necessary and Sufficient conditions for a Deadlock, Systems with Single unit requests, Systems with only consumable resources, Systems with reusable resources.

Module 3 **[8 lectures]**

Distributed Operating Systems, Introduction, System ArcitectureTypes, Issues in Distributed Operating Systems, Communication Networks, Communication Primitives, Theoretical Foundations, Limitations of a distributed system, Lamport's logical clocks, Vector Clocks, Causal ordering of messages, Global state, Cuts of a distributed Computation, Termination detection.

Module 4 **[8 lectures]**

Distributed Mutual Exclusion, Classification of Mutual ExclusionAlgorithms, Preliminaries, Non token based algorithms, Lamport's algorithm, Token based algorithms, Suzuki Kasami's Broadcast algorithm, Singhal's heuristic algorithm, Raymond's tree based algorithm, Comparative performance analysis.

Module 5 **[8 lectures]**

Distributed Deadlock Detection, Preliminaries, Deadlock handling strategies, Issues with deadlock detection and resolution, Control organizations, Centralized, distributed and hierarchical algorithms, Agreement Protocols System models, A classification of agreement problems, Byzantine Agreement problem and its solution, Application of agreement algorithms.

Head of Department

Module 6 [6 lectures]

Distributed File Systems Mechanisms for building distributed file systems, Design issues, Distributed Shared Memory, Architecture, Algorithms for Implementing DSM, Memory Coherence and Coherence Protocols, Design Issues, Distributed Scheduling, Failure Recovery and Fault Tolerance, Resource Security and Protection, Access and Flow Control,

Module 7 [7 lectures]

Multiprocessor Operating Systems, Introduction, Basic Architecture, Interconnection networks for multi processor O/S, Caching, Hypercube Architectures, Structure of multi processor O/S, Threads, Process Synchronization, Processor Scheduling, Memory Management, Reliability and Fault tolerance

Text Book

M. Singhal, N. Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw- Hill, 2008.

Refernce Books

W. Stallings, Operating Systems - Internals and Design Principles, Prentice Hall, 2008.

W. Stallings, Operating Systems, Macmillian Publishing, 2008.

Head of Department

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MSE1005 PROBABILITY AND STATISTICAL ANALYSIS

Module 1

Probability Theory: Random Experiment Mathematical or Apriori Definition of Probability, Statistical or Aposteriori Definition of Probability, Axiomatic Definition of Probability, Conditional Probability Independent Events, Theorem of Total Probability, Baye's Theorem or Theorem of Probability of Causes, Bernoulli's Trails De Moivre-Laplace Approximation, Generalisation of Bernoulli's Theorem Multinomial Distribution.

Module 2

Random Variables: Discrete Random Variable, Probability Function, Continuous Random Variable, Probability Density Function Cumulative Distribution Function, (cdf), Properties of the cdf F (x), Special Distributions, Discrete Distributions, Continuous Distributions, Two-Dimensional Random Variables, Probability Function of (x ,y),Joint Probability Density Function, Cumulative Distribution Function,Properties of F (x, y), Marginal Probability Distribution, Conditional Probability Distribution, Independent RVs, Random Vectors, Marginal Probability Distribution of X {i, pi*}, Marginal Probability Distribution of Y: {j, P*j}.

Module 3

Functions of Random Variables: Function of One Random Variable, One Function of Two Random Variables,Two Functions of Two Random Variables, Statistical Averages Expected Values of a Two-Dimensional RV, Properties of Expected Values, Covariance and Correlation, Properties, Conditional Expected Values, Characteristic functions, Properties of MGF, Properties of Characteristic Function ,Comulant Generating Function (CGF), Joint Characteristic Function (`CGF).

Module 4

Special Probability Distributions: Introduction, Special Discrete Distributions - Binomial, Poission, Geometric and Hyper geometric Distributions and their Properties (mean, Variance etc) Special Continuos Distributions- Uniform, Exponential, Erlang and Normal Distributions as There Properties.

Module 5

Tests of Hypotheses: Parameters and Statistics, Sampling Distribution, Estimation and Testing of Hypotheses, Tests of significance, errors, Tailed Tests, critical values, Student's T- Distribution, Snedecor's F- Distribution and Chi- square Distribution and Their uses and Properties.

Head of Department

Module 6

Random Processes: Classification of Random Processes, Methods of Description of a Random Process, Special Classes of Random Processes, A verge Values of Random Processes, Stationarily, Example of a SSS Process, Analytical Representation of a Random Process, Autocorrelation Function and Its Properties of R (t),

Module 7

Special Random Processes: Definition of Gaussian Process, Properties, Processes Depending on Stationary Gaussian Process, Poisson Process, Probability Law for the poison Process {X (t)}, Second – Order Probability Function of a Homogeneous, Poisson Process, Mean and Autocorrelation of the Poisson Process, Properties of Poisson Process,Markov Process, Definition of a Markov Chain, Chapman – Kolmogorov Theorem, Classification of States of a Markov Chain

Reliability Engineering: Concepts of Reliability, Reliability of Systems, Maintainability and Availability.

Text Book:

T. Veerarajan – Probability, Statistical, Random Processes 2nd Ed., TMH, New Delhi, 2003.

Reference Books:

- A. Papoulis & S.V. Pillai – Probability, random Variables and Stochastic Processes, 4th Ed., TMH, New Delhi.

2. S.M.Ross- Probability Models , 6th Ed. Harcourt Asia Pte Ltd, New Delhi, 2000.

- R.V. Hogg and A.T. Craig – Introduction to Mathematical Statistics, 5th Ed, Pearson Education, New Delhi, 2004.
- J.E. Freund and R.E. Walpole, Mathematical Statistics, 5th Ed., PHI, New Delhi, 2000.

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MSE1023 COMPUTABILITY AND COMPLEXITY THEORY

Module 1

Universal Models of Computation: Encoding Instances, Choosing a Model of Computation, Model Independence, Turing Machines as Acceptors and Enumerators.

Module 2

Computability Theory: Primitive recursive functions, Partial Recursive Functions, Encoding a Turing machine, Programming Systems, Recursive and R,E, Sets, Rice's Theorem and the Recursive Theorem, Degrees of Insolvability.

Module 3

Markov Algorithms: An Alternative Model of Sequential Machine, Markov Algorithms as Language Acceptors and as language Recognisers, Markov Algorithms as Computers of Number, Theoretic Functions, Labelled Markov Algorithms, The Class of Markov Computable Functions Is Identical to the class of Partial Recursive Functions, Considerations of Efficiency.

Module 4

Post Systems and Vector Machines: Post Systems and Formal Language, The Class of Post – Computable Functions, Is Identical to the class of Partial Recursive Functions, Closure Properties of the Class of Languages Generated by Post Systems, The class of Languages Generated by Post Systems Is Identical to the class of Turing – Acceptable Language, Language Recognition and Post Systems , Parallel Computation, Vectors and Vector Operations, Vector Machines, Vector Machines and Function Computation, Vector Machines and Formal Languages.

Module 5

Complexity Theory: Foundation Reducibility Among Problems, Reductions and Complexity Classes, Hierardy Theorems, Model Independent Complexity Classes.

NP-Completeness: Cook's Theorem, Space Completeness, Intractable Problems.

Module 6

Proving Problems Hard: Important NP-Complete Problems, P-Completeness Proofs, Turing Reductions and Search Problems, The Polynomial Hierardy, Enumeration Problems.

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Module 7

Complexity Theory in Practice: Restrictions of Hard Problems, Promise Problems, Strong NP-Completeness, The Complexity Approximation, The Power of Randomization.

Text Books:

- Bernard M. Moret – The Theory of Computation, Pearson Education, New Delhi, 2002.
- R. Gregory Taylor – Models of Computation and Formal Languages, Oxford University Press, New York, 1998.

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MEE1003 DIGITAL SIGNAL PROCESSING

Module –1
Introduction : discrete time systems, Discrete time signals, Analysis of discrete-time linear time invariant systems, Difference equation description. (4)

Module –2
Z-transform, Properties of Z-transform, Invention of Z-transform, One-side Z-transform, Solution of difference equation, Zury's test for stability, Rational Z-transform, Digital filter structures : Direct form I & II< Cascade, Parallel and ladder realizations. (5)

Module –3
Frequency domain analysis, Discrete fourier transform (DFT), Properties of DFT, Inverse DFT, Inter relationship with Z-transform and Hilbert-transforms, Discrete Hilbert transform, FFT algorithms-Decimation in time and decimation in frequency. (9)

Module –4
Filter function approximation and transforms: Review of approximation of ideal analog filter response.

IIR filter: Designs based on analog filter approximation impulse invariant, Bilinear transformation, Direct design of IIR filters, Time domain design techniques. Buttorworth, Chebyshev type I & II, Elliptical filters. (8)

Module –5
Properties and design of FIR filters: Properties, Design techniques – window technique, Frequency sampling comparison of IIR and FIR filters. (4)

Module –6
Multirate digital signal processing, Introduction, Decimation by factor D, I sampling rate conversion by a rational factor I/D. (6)

Module –7
Introduction to continuous discrete and fast wavelet transforms. (6)

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Text Books

1. John G. Proakis, Dimitris G. Mamalakis, Digital Signal Processing, Principles, Algorithms and Applications
2. Alan V. Oppenheim Ronald W. Schafer, Digital Signal Processing, PHI, India.]

Reference Books

3. Antonious, digital filter Design, Mc-Graw-Hill International Editions.
4. Wavelate Transform, S. Rao.

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MSE1025 REAL TIME SYSTEMS

Module 1

Basic Real-Time Concepts: Terminology, Systems Concepts,Real-Time Definitions,Events and Determinism,CPU Utilization,Real-Time System Design Issues, Common Misconceptions, Brief History, Theoretical Advances,Early Systems,Hardware Developments,Early Software,Commercial Operating System Support

Module 2

Hardware Considerations for Real Time Systems: Basic Architecture, Hardware Interfacing, Latching,Edge versus Level Triggered,Tristate Logic,Wait States,Systems Interfaces and Buses,Central Processing Unit,Fetch and Execute Cycle,Microcontrollers, Instruction Forms, Core Instructions, Addressing Modes,RISC versus CISC,Memory, Memory, Access,Memory Technologies, Memory Hierarchy,Memory Organization, Input/Output, Programmed Input/Output, Direct Memory Access, Memory-Mapped Input/Output,Interrupts,Enhancing Performance Locality of Reference, Cache,Pipelining Coprocessors,Other Special Devices, Applications-Specific Integrated Circuits, Programmable Array Logic/Programmable Logic,Array, Field-Programmable Gate Arrays, Transducers,Analog/Digital Converters,Digital/Analog Converters,Non-von-Neumann Architectures, Parallel Systems, Flynn's Taxonomy for Parallelism

Module 3

Real-Time Operating Systems: Real-Time Kernels, Pseudokernels, Interrupt-Driven Systems, Preemptive-Priority Systems, Hybrid Systems, The Task-Control Block Model, Theoretical Foundations of Real-Time Operating Systems, Process Scheduling,Round-Robin Scheduling, Cyclic Executives,Fixed-Priority Scheduling–Rate-Monotonic Approach, Dynamic-Priority Scheduling: Earliest-Deadline–First Approach, Intertask Communication and Synchronization, Buffering Data, Time-Relative Buffering, Ring Buffers, Mailboxes, Queues,Critical Regions, Semaphores

Module 4

Memory Management: Process Stack Management, Run-Time Ring Buffer, Maximum Stack Size,Multiple-Stack Arrangements, Memory Management in the Task-Control-Block,Model, Swapping, Overlays, Block or Page Management, Replacement Algorithms, Memory Locking,Working Sets, Real-Time Garbage Collection, Contiguous File Systems, Building versus Buying Real-Time Operating, Selecting Real-Time Kernels

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Module 5

Performance Analysis And Optimization: Theoretical Preliminaries, NP-Completeness, Challenges in Analyzing Real-Time Systems, The Halting Problem, Amdahl's Law, Gustafson's Law, Performance Analysis, Code Execution Time Estimation, Analysis of Polled Loops, Analysis of Coroutines, Analysis of Round-Robin Systems, Response-Time Analysis for Fixed-Period Systems, Response-Time Analysis: RMA Example, , The M/M/1 Queue, Service and Production Rates, Some Buffer-Size Calculations, Response-Time Modeling, Little's Law, Erlang's Formula.

Module 6

I/O Performance Basic: Buffer-Size Calculation,Variable Buffer-Size Calculation, Performance Optimization, Compute at Slowest Cycle,Scaled Numbers, Binary Angular Measure,Look-Up Tables, Imprecise Computation, Optimizing Memory Usage

Module 7

Advanced Performance Optimaization: Postintegration Software Optimization, Results from Compiler Optimization, Use of Arithmetic Identifies, Reduction in Strength, Common Subexpression Elimination, Intrinsic Functions, Constant Folding,Loop Invariant Optimization, Loop Induction Elimination, Use of Registers and Caches,Removal of Dead or Unreachable Code,Flow-of-Control Optimization, Constant Propagation,Dead-Store Elimination, Dead-Variable Elimination, Short-Circuiting Boolean Code,Loop Unrolling, Loop Jamming, More Optimization Techniques, Combination Effects, Speculative Execution, Analysis of Memory Requirements,Reducing Memory Utilization, Variable Selection, Memory Fragmentation

Text Book:

Lapante P. A. , Real Time Systems Design and Analysis, 3rd Edition, Prentice Hall India, New Delhi

Reference Books:

1. Jane W. S. Liu, Real-Time Systems, 1st Edition, Pearson Education, New York.
2. Stallings W. , Operating Systems, Internals and Design Principles, 5th Edition, New Delhi.

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MEE1003 DIGITAL IMAGE PROCESSING TECHNIQUES

Module 1
Digital Image Fundamentals:
Fundamental steps in Digital Image Processing, Components of an Image processing system, Digital Image Representation , Basic relationship between pixels, Color Modules, RGB and HSI color modules, Application of Fuzzy logic in Digital Image Processing.

Module 2
Image Enhancement:
Image negatives, Histogram Equalization, Local Enhancement, Image Subtraction, Image Averaging, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement methods.

Module 3
Image Transform:
Fourier Transform ,Discrete Fourier Transform, Fast Fourier Transform, Smoothing Frequency Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering, Convolution and Correlation Theorems, Wavelet Transforms, The Fast Wavelet Transforms.

Module 4
Image Restoration:
Noise Models, Restoration in the presence of Noise-Only Spatial filtering , Mean filters , Adaptive filters Periodic Noise Reduction by Frequency Domain filtering , Inverse Filtering , Minimum Mean Square Error

(Wiener) Filtering, Geometric Mean Filter.

Module 5
Image Segmentation:
Detection of Discontinuities, Point Detection, Line detection, Edge Detection, Thresholding , Optimal Global and Adaptive thresholding, Region-based Segmentation, Textural Images, Textural Feature extraction from Co-occurrence matrices .

Module 6
Representation and Description:
Chain codes, Signatures, Boundary Segments, Skeletons, Boundary Descriptors, Regional Descriptors, Use of the Principal Components for Description, Relational Descriptors.

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Module 7

Image Compression:

Fundamentals, Redundancy , Image Compression Models, Coding Theorems, Error-free Compression techniques like Variable- length Coding and Lossless Predictive Coding , Lossy Compression techniques like Lossy Predictive Coding and Wavelet Coding, Image Compression standards.

Text Books:

1. Digital Image Processing. 2/E by Rafael C. Gonzalez and Richard E. Woods. Pearson Education
2. Digital Image Processing and Analysis. by B. Chanda and D. Dutta Majumder PHI

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TCS1027 GRAPH THEORY AND APPLICATIONS

Module 1

Introduction: What is graph, Application of graphs, Finite and infinite graphs, incidence and degree, isolated Vertex pendant Vertex, and Null graph, paths and circuits, isomorphism, sub graphs, a puzzle with multicolored cubes, walks, paths, and circuits, Connected graphs, disconnected graphs and components, Euler graphs, Operations on graphs, More on Euler graphs, Hamiltonian paths and circuits, The Traveling Salesman problem.

Module 2

Trees and Fundamental circuits: Trees, some properties of trees, pendant vertices in a tree, Distance and centers in a tree, Rooted and binary trees, On counting trees, Spanning trees, fundamental circuits, Finding all spanning trees of a Graph, Spanning trees in a Weighted graph.

Module 3

Cut set, and cut vertices: Properties of a cut set, all cut sets in a graph, Fundamental circuits and cut sets, connectivity and separability, Network flows, 1-Isomorphism, 2-Isomorphism.

Module 4

Planar and Dual Graphs: Combinatorial vs. Geometric Graphs, Planar graph, kuratowski's Two Graphs, Difference Representations of a planar graph, Detection of planarity, Geometric Dual, Combinatorial, Duel, More on criteria of planarity, Thickness and crossings.

Module 5

Matrix Representation of Graphs: Incidence Matrix Sub matrices of A(G), Circuits Matrix, Fundamental Circuit Matrix and Rank of B, An application to a switching Network, Cut-set Matrix, Relationships among Af , Bf and Cf . path Matrix, Adjacency Matrix.

Module 6

Coloring, Covering and partitioning: Chromatic number, Chromatic partitioning, Chromatics polynomial, Coverings, Four color problem.

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Module 7

Directed Graphs: What's a directed Graphs, Some types of Digraphs, Digraphs and binary Relations, Directed paths and connectedness, Euler Digraphs, Trees with Directed Edges, Fundamental Circuits in Digraphs, Matrices A, B and C of Digraphs, Adjacency Matrix of a Digraph, Paired Comparisons and Tournaments, Acyclic Digraphs and Decyelization.

Text Book:

Narasingh Deo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001.

Reference Book:

Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002.

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MSE2005 SOFTWARE PROJECT MANAGEMENT

Module 1

Introduction To Software Project Management And Step Wise Project Planning: Introduction, What is a Project? Software Projects Versus Other Types of Project, Contact Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods, and Methodologies, Some ways of Categorizing Software Projects, What is Management?, Problems with Software Projects, Setting Objectives, Stakeholders, The Business Case, Requirement Specification, Management Control, Overview of Project Planning (Step wise).

Module 2

Project Evaluation: Introduction, Strategic Assessment, Technical Assessment, Cost- Benefit Analysis, Cash Flow Forecasting, Cost- Benefit Evaluation Techniques, Risk Evaluation.

Selection Of An Appropriate Project Approach: Introduction, Choosing Technologies, Technical Plan Contents List, Choice of Process Models, Structure Versus Speed of Delivery, The Waterfall Model, The V- Process Model, The Spiral Model, Software Prototyping, Other ways of Categorizing Prototyping, Controlling Changes during Prototyping, Incremental Delivery, Dynamic Systems Development Method, Extreme Programming, Managing Iterative Processes.

Module 3

Software Effort Estimation: Introduction, Where are Estimates done? , Problems with Over-and Under- Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Expert Judgement, Estimating by Analogy, Albrecht Function Point Analysis, Function Point Mark II, Object Points, A Procedural Code- Oriented Approach, COCOMO: A Parametric Model.

Activity Planning: Introduction, The Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, The Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity- On – Arrow Networks.

Module 4

Risk Management: Introduction, The Nature of Risk, Types of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning and Control, Evaluating Risks to the Schedule.

Resource Allocation: Introduction, The Nature of Resources, Identifying Resources Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resources Schedule, Cost Schedules, The Scheduling Sequence.

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Module 5

Monitoring And Control: Introduction, Creating the Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting the Project Back to Target, Change Control.

Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.

Module 6

Managing People And Organizing Teams: Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods, Motivation, The Oldham- Hackman Job Characteristics Model, Working In Groups, Becoming A Team, Decision Making, Leadership, Organizational Structures.

Module 7

Software Quality: Introduction, The Place Of Software Quality In Project Planning, The Importance Of Software Quality, Defining Software Quality, ISO 9126, Practical Software Quality Measures, Product Versus Process Quality Management, External Standards, Techniques To Help Enhance Software Quality, Quality Plans.

Text Book:

B.Huges and M.Cotterell- Software Project Management 3rd Edn, TMH, New Delhi, 2004.

Reference Book:

P.Jolote- Software Project Management in Practice, Pearson Education, New Delhi, 2002.

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(*)REAL TIME EMBEDDED SYSEM DESIGN

Module – 1:
Introduction to Embedded Systems:
Embedded system overview, Design challenges, Common design metrics, Time-to-market design metric, NRE and unit cost design metrics, Performance design metric, Processor technology, General purpose processors – software and hardware, Application specific processors, IC technology, Semi-custom ASIC.

(7)

Text Book:

5. "Embedded System Design A Unified HW.SW Introduction", by Vahid G Frank and Givargis Tony, John Wiley & Sons, 2002. Chapter 1 (1.1-1.4)

Reference Book:

- "Fundamental of Embedded System Design & Applications" by Vijay Nath, K.S. Yadav, L.K. Singh, ACM Learning, New Delhi.
- INTRODUCTION TO EMBEDDED SYSTEMS, K. Shibu, TMH Edition.

Module – 2:
Embedded System Processors:
Combinational logic and transistors, RT-level combinational and sequential components, Custom single purpose processor design. RT-level custom single– purpose processor design, Optimization, Optimization of FSMD, Optimization of data path.

(7)

Text Book:

3. "Embedded System Design A Unified HW.SW Introduction", by Vahid G Frank and Givargis Tony, John Wiley & Sons, 2002. Chapter 2 (2.1-2.6)

Reference Book:

4. "Fundamental of Embedded System Design & Applications" by Vijay Nath, K.S. Yadav, L.K. Singh, ACM Learning, New Delhi.

Module-3:
Memory:
Write ability and data permanence, memory devices type of memory and basic form, EEPROM, flash memory, SRAM and DRAM, basic DRAM characteristics, memory selection for embedded systems, allocation of memory to the program segment blocks.

(6)

Head of Department

Text Book:

- "Embedded Systems Architecture, Programming and Design", by Raj Kamal, TMH-2003.

Module – 4:

Device and Interrupt service:

Bus models, time multiplexed bus, strobe and handshake protocols, strobe handshake compromise priority arbiter multilevel bus, and architecture.

(5)

Text Book:

1. "Embedded Systems Architecture, Programming and Design", by Raj Kamal, TMH-2003.

Module -5

Embedded System Peripherals:

Timers, Counters, Watch-dog timers, Example of reaction timer, Watchdog timer, UART, PWM, Controlling a dc motor using a PWM. General purpose processor, ASIP's and ASIC's, semiconductor IC's programmable logic devices of CGD, Processor selection for embedded systems, special purpose processor.

(6)

Text Book:

1. "Embedded System Design A Unified HW.SW Introduction", Vahid G. Frank and Givargis Tony, John Wiley & Sons, 2002. Chapter 4 (4.1-4.4)

2. "Embedded Systems Architecture, Programming and Design", by Raj Kamal, TMH-2003.

Reference Book:

5. "Fundamental of Embedded System Design & Applications" by Vijay Nath, K.S. Yadav, L.K. Singh, ACM Learning, New Delhi.

Module – 6:

Interfacing:

Communication basics, Basic protocol concepts, ISA bus protocol, Microprocessor interfacing, I/O addressing, Interrupts, Example of DMA I/O and ISA Bus protocol, Arbitration, Priority arbiter, Daisy-chain arbiter, Parallel, Serial and Wireless communication, infrared-TRDA, radio frequency, error detection, CAN, USB, Blue tooth, IEEE 802-II, shared memory models

(8)

Text Book:

1. "Embedded System Design A Unified HW.SW Introduction", Vahid G Frank and Givargis Tony, John Wiley & Sons, 2002. Chapter 6 (6.1-6.8).

2. "Embedded Systems Architecture, Programming and Design", by Raj Kamal, TMH-2003.

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Module – 7:

Digital Camera and Systems

Simple digital camera, User's perspective, Designer's perspective, Requirement specification, Design, Micro controller alone, Micro controller and CCDPP Digital thermometer, handhold computer, navigation system, IP phone, software defined-radio, smart card.

(6)

Text Book:

1-"Embedded System Design A Unified HW.SW Introduction", Vahid G Frank and Givargis Tony, John Wiley & Sons, 2002. Chapter 7 (7.1-7.4)

2. "Embedded Systems Architecture, Programming and Design", by Raj Kamal, TMH-2003.

Head of Department

TCS2041 OBJECT ORIENTED MODELLING AND DESIGN

Module 1

*Introduction and Modelling**: What Is Object-Oriented ? What Is Object Oriented Development ? Object Oriented Themes, Evidence for Usefulness of Object Oriented Development, Modeling, The Object Modeling Technique, Objects and Classes, Links and Associations, Advanced Link and Association Concepts, Generalization and Inheritance, Grouping Constructs, A Sample Object Model.***

Module 2

*Advanced Object Modelling**: Aggregation , Abstract Classes, Generalization as Extension and Restriction Multiple Inheritance, Metadata, Candidate Keys, Constraints.***

Module 3

*Dynamic Modelling**: Events and States, Operations, Nested State Diagrams, Concurrency, Advanced Dynamic Modelling Concepts, A Sample Dynamic Model, Relation of Object and Dynamic Model.***

Module 4

Functional Modelling: Functional Models, Data Flow Diagrams, Specifying Operations. Constraints A Sample Functional Model, Relation of Functional to Object and Dynamic Models.

Module 5

Methodology Preview and Analysis:OMT as a Software Engineering Methodology, The OMT Methodology, Impact of an Object-Oriented Approach, Overview of Analysis, Problem Statement, Automated Teller Machine Example, Object Modeling, Dynamic Modeling, Functional Modeling, Adding Operations, Iterating the Analysis.

Module 6

System Design: Overview of System Design, Breaking a System into Subsystems, Identifying Concurrency.Allocating Subsystems to Processor and Tasks Management of Data Stores, Handling Global Resources, Choosing Software Control Implementation, Handling Boundary conditions, Setting Trade-off Priorities, Common Architectural Frameworks, Architecture of the ATM System

Module 7

*Object Design and Implementation**: Overview of Object Design, Combining the Three Models, Designing, Algorithms, Design Optimization, Implementation of Control, Adjustment of Inheritance, Design of Associations, Object Representation, Physical Packaging, Documenting Design Decisions. Implementation Using a Programming Language, Implementation using a Database System, Implementation Outside a Computer. Object-Oriented Style, Reusability, Extensibility, Robustness, Programming – in-the-Large.***

Text Book:

J.Rumbaugh et.al – Object Oriented Modeling and Design, PHI, New Delhi,2003

Reference Book:

B. Bruegge and A. H. Dutoit. Object Oriented Software Engineering, 2nd Ed., Pearson Education, New Delhi, 2004.

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TCS2001 DATA AND COMPUTER COMMUNICATION NETWORKS

Module 1

Data Communication: Data Communications, Data Networking and Internet, Protocol Architecture, TCP/IP and Internet based Applications, Data Transmission, Data and Signals- periodic analog, Digital signals, Transmission Impairments, Data Rate Limits, Performance.

Module 2

Transmission Methodologies: Digital Transmission- Digital to digital Conversion, Analog to digital conversion, Transmission Modes. Analog Transmission- Digital to Analog conversion, Analog to Analog conversion. Bandwidth utilization- Multiplexing, Spread Spectrum

Module 3

Data Link Layer: Error detection and correction, Block Encoding, Linear Block Encoding, Cyclic codes, Checksum. Data link Control- Framing, Flow and Error Control, Noiseless Channel, Noisy Channel, HDLC, Point to point protocol.

Module 4

Multiple Access & Local Area Networks: Multiple Access, Random Access-CSMA, CSMA/CD, CSMA/CA. Controlled Access-Reservation, Polling, Token Passing in FDDI and CDDI. Channelization- FDMA, TDMA, CDMA. Wired LANs: Ethernet, IEEE standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet.

Module 5

Connecting Devices and Backbone Networks: Bridges, Functions of a bridge, Bridge Protocol Architecture, Fixed routing, Spanning tree approach, Connecting devices like Repeaters, Hubs, Bridges, Two-layer switches, Routers and Three layer switches, Backbone networks, Bus Backbone, Star Backbone, Connecting remote LANs, Wireless LANs, Applications, Architecture, IEEE 802.11, Architecture and Services, Medium Access Control, Physical layer.

Module 6

Network Layer and Transport Layer: Internetwork protocols, principles of Internetworking, Internet protocol operation, IPV4:ICMP, ARP, IPV6, Internetwork Operations, Multicasting, IGMP, Routing Protocols- distance Vector, Link State routing, path-vector routing, Border Gateway Routing, OSPF, Integrated service Architecture, Differentiated services, service level agreements. Connection oriented transport protocol mechanism, TCP, TCP congestion control, UDP

Module 7

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Application Layer: Domain Naming System, Remote Logging- Electronic mail & File Transfer, WWW and HTTP, web documents, HTTP transactions, Network Management system, SNMPV2, V3.

Text Books:

1. Data and Computer communications Eighth edition by William Stallings
2. Data communication and Networking Fourth edition by Behrouz A Forouzan

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TCS2039 HIGH PERFORMANCE COMPUTER ARCHITECTURE

Module 1:

Parallel Computer Models : The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Module 2:

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Module 3:

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

Module 4:

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models

Module 5:

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear Pipeline Processor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

Module 6:

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques, Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.

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Module 7:

Parallel Models, Languages, and Compilers: Parallel Programming Models, Parallel languages and Compilers, Dependence Analysis of Data Arrays, Code Optimization and Scheduling, Loop Parallelization and Pipelining, Parallel Programming Environments, Shared-Variable Program Structures, Message-Passing Program Development, Mapping Programs onto Multicomputers, Instruction Level Parallelism.

Text Book:

Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata McGrawhill, India, 2010

Reference Book:

Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA.

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TCS2021 PATTERN RECOGNITION AND IMAGE ANALYSIS

Module 1

Introduction: Applications of Pattern Recognition, Statistical Decision Theory, Image Processing and Analysis, The Internet, Pointers to the Literature.

Module 2

Statistical Decision Making: Introduction, Bayes' Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries, Unequal Costs of Error, Estimation of Error Rates, The Leaving- One-Out Technique, Characteristic Curves, Estimating the Composition of Populations.

Module 3

Nonparametric Decision Making: Introduction, Histograms, Kernel and Window Estimators, Nearest Neighbor Classification Techniques, Adaptive Discriminant Functions, Minimum Squared Error Discriminant Functions.

Module 4

Clustering: Introduction, Hierarchical Clustering, Partitional Clustering.

Module 5

Artificial Neural Networks: Introduction, Nets without Hidden Layers, Nets with Hidden Layers, The Back- Propagation Algorithm, Hopfield Nets, An Application: Classifying Sex from Facial Images.

Module 6

Processing Of Waveforms And Images: Introduction, Gray Level Scaling Transformations, Equalization, Geometric Image Scaling and Interpolation, Smoothing Transformations, Edge Detection, Laplacian and Sharpening Operators, Line Detection and Template Matching, Logarithmic Gray Level Scaling, The Statistical Significance of Image Features.

Module 7

Image Analysis: Introduction, Scene Segmentation and Labeling, Counting Objects, Perimeter Measurement, Following and Representing Boundaries, Hough Transforms, Least Squares and Eigenvector Line Fitting, Fourier Transforms.

Text Book:

Head of Department

E.Gose et.al- Pattern Recognition and Image Analysis, PHI, New Delhi- 2004.

Reference Books:

1. R.O.Duda et.al- Pattern Classification 2nd Edn, John Wiley, New York, 2002.
2. R.C.Gonzalez and R.E.Woods- Digital Image Processing, 2nd Edn, Pearson Education, New Delhi- 2004.
3. M.Sonka et.al- Image Processing, Analysis, and Machine Vision- Vikas Publication, New Delhi- 2003.

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TCS2023 COMPUTATIONAL GEOMETRY

Module 1

Introduction: Convex Hull, Degeneracies and Roubustness, Application Domains, Line Segment intersection, The Doubly-Connected Edge List, Computing the Overlay of Two Subdivisions.

Module 2

Polygon Triangulation, Guarding and Triangulations, Partitioning a Polygon into Monotone Pieces, Triangulating a Monotone Polygon.

Module 3

Linear Programming, The Geometry of Casting, Half-Plane Intersection, Incremental linear Programming, Randomized Linear Programming, Unbounded Linear Programs, Linear Programming in Higher Dimensions.

Module 4

1- Dimensional Range Searching, Kd- Tress, Range Trees, Higher Dimensional Range Trees, General Set of Points, Fractional Cascading

Module 5

Point location and Trapezoidal Maps, A Randomized Incremental Algorithm, Dealing with Degenerate Cases, Definition and basic properties of Voronoi Diagrams, Computing the Voronoi Diagram.

Module 6

Arrangements and Duality, Computing the Discrepancy, Duality, Arrangements of Lines, Levels and Discrepancy.

Module 7

More Geometric Data Structures, Interval Trees, Priority Search Trees, Segment Trees.

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Text Book:

Mark de Berg, Marc van Kreveld, Mark Overmars, Otfried Schwarzkopf," Computational Geometry Algorithms and Applications", Springer, 2000.

Reference Book:

Michael J. Laszlo, "Computational Geometry and Computer Graphics in C++", PHI, New Delhi, 1999.

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TCS2025 MOBILE COMPUTING

Module 1

Mobile Computing Architecture: Internet – The ubiquous network; Schematic representation of mobile computing environment; The Three-Tier mobile computing architecture; Design considerations for mobile computing; Mobile computing through Internet; Making existing applications mobile-enabled.

Module 2

Mobile Communications: Introduction; The GSM architecture; Call routing in GSM; Network aspects in GSM; GSM frequency allocation; Authentication and security; GPRS system architecture and routing.

Module 3

Mobility Management: Mobility management; Location Management Principles and Techniques; Location Management Case studies: PCS, Mobile IP.

Module 4

Data Dissemination and Management: Challenges; Data Dissemination; Mobile Data Caching; Mobile Cache Maintenance Schemes; Mobile Web Caching; Case studies.

Module 5

Mobile Middleware: Introduction; Adaption: The spectrum of adaption, Resource monitoring, Characterizing adaption strategies, Odyssey-An application aware adaption architecture, Sample Odyssey application; Mobile Agents: Agent architectures, Migration strategies, Communication strategies.

Module 6

Service Discovery Middleware: Middleware services: Universally unique identifiers, Standardization, Textual Descriptions, Interfaces for standardization; Discovery and Advertisement Protocols: Unicast discovery, Multicast discovery and advertisement, Service catalogs; Garbage collection: Leasing, Advertised expirations; Eventing; Security: Jini, Service location protocol, Ninja; Interoperability.

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Module 7

Device Operating System: Introduction to Symbian Operating System; Symbian OS architecture; Applications for Symbian; Special feature:- Event Driven Multitasking using Active objects; Client-Server framework model on Symbian OS.

Text Books:

2. **[Modules: 1, 2, and 7]**
Asoke K Talukder and Roopa R. Yavagal; Mobile Computing – Technology, Applications and Service Creation; TMH Publication, New Delhi, 2006

3. **[Modules: 3, 4, 5, and 6]**
Frank Adelstein et.al.; Fundamentals of Mobile and Pervasive Computing; TMH Publication, New Delhi, 2005

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TCS2027 GRID COMPUTING

Module 1

Introduction: Motivation; Definitions of Grid Computing; Evolution of the Grid; Differences with similar efforts (Meta, cluster, heterogeneous, Internet); Examples of usage; Research possibilities / scope in Grid Computing; Thrust areas.

Module 2

High Performance computing: PACX-MPI, MPI-Connect, P-MPI; I-WAY experiment.

Module 3

Earliest Grid Tools / Projects: Condor Part 1, Part 2; Globus Part 1, Part 2; Nimrod.

Module 4

Grid Basics - Technologies / Challenges: Security - Different models: SSL, Kerberos, SASL, GSI, Others; Information Services: NWS.

Module 5

HPC: Scheduling HPC applications in Grids: AppLeS, Scheduling Parameter sweep applications, Metascheduling Part1, Part2; Grid RPC mechanisms - Part1, Part2; Rescheduling; Computational Steering,

Module 6

Grids: Scientific visualization of Grid applications; Grid Applications - Everywhere and Cactus experiments; Data management: Data distribution, Redistribution, Data cache maintenance.

Module 7

Recent Efforts / Challenges: Grid economy; Grid simulation - SimGrid, GridSim, MicroGrid; Grid standards and forums - OGSA, GGF and Other topics.

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Text Books:

1. **[Module: 1]**
   Ian Foster, Carl Kesselman; The Grid: Blueprint for a New Computing Infrastructure (2nd edition)**;** Morgan Kaufmann Publishers; 2nd edition, 2003.

2. **[Module: 2, 3, and 4]**
   Francine Berman, Geoffrey Fox, Tony Hey; Grid Computing: Making the Global Infrastructure a Reality; John Wiley & Sons, 2003.

3. **[Modules: 5, 6, and 7]**
   Jarek Nabrzyski, Jennifer M. Schopf, Jon Weglarz; Grid Resource Management: State of the Art and Future Trends; Kluwer Academic Publishers, 2003.

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TCS2033 INTERCONNECTION NETWORKS

Module 1

Introduction: Parallel computing and network, Parallel Computer Architectures, Network Design considerations, Classification of interconnection Network, Shared Medium networks, Direct Networks, Indirect Network, Hybrid Network, A unified view of direct and Indirect networks.

Module 2

Network and Router Model: Basic concept, Basic switching techniques, Virtual channels, Hybrid switching techniques, Optimizing Switching Techniques, A Comparisons of switching techniques, Engineering Issue.

Module 3

Deadlock, live lock, and Starvation: A theory of dead lock avoidance, Extensions, Alternative Approaches, Deadlock Avoidance in Switch Based networks, Deadlock prevention in Circuit switching and PCS, Dead lock Recovery, Live lock Avoidance Engineering issues.

Module 4

Routing Algorithms: Taxonomy of Routing algorithms, Deterministic Routing algorithms, Partially Adaptive algorithms, Fully adaptive algorithms, Maximally adaptive Routing algorithms Nonminimal Routing algorithms, Backtracking protocols, Routing in MINs, Routing in switch based networks with irregular Topologies, Engineering Issues.

Module 5

Collective Communication Support: Collective communication services, System support for collective communication, preliminary consideration, Models for Multicast Communication, Hardware Implementations of Multicast, Hardware support for barrier Synchronization and reduction, Software Implementation of Multicast , Engineering issues.

Module 6

Fault Tolerant Routing: Fault Induced Deadlock and Livelock, Channel and Network Redundancy, Fault Models, Fault Tolerant Routing in SAG and VCT Networks, Fault Tolerant Routing in Wormhole Switched networks, Fault Tolerant Routing in PCS and Scouting Networks, Dynamics Fault Recovery, Engineering Issues.

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Module 7

Network Architectures: Network Topology and Physical Constraints, Router Architectures, Engineering Issues.

Text Book:

Jose Duato et al., "Interconnection Networks an Engineering Approach", Morgan Kaufman Publishers, 2003.

Reference Book:

Dally et al., "Principles And Practices of Interconnection Networks", Elsevier Science Publications, 2005.

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MEC2009 COMPUTER COMMUNICATION NETWORKS

Module 1
Local Area Networks:
Background, Topologies and Transmission Media, LAN standards IEEE 802 Reference Model, Logical Link Control, Medium Access Control, IEEE 802.3 Medium Access Control, Ethernet , Bridged Ethernet and Switched Ethernet, Fast Ethernet, Gigabit Ethernet, Token Ring and FDDI, IEEE 802.5 Transmission Medium Options. Fiber Channel Elements, Fiber Channel Protocol Architecture, Fiber Channel Physical Media and Topologies.

Text Books:

1. Data and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.
3. Communication Networks. 2/E by Alberto Leon-Garcia & Indra Widjaja.

Module 2
Connecting devices and Backbone Networks:
Bridges, Functions of a Bridge, Bridge Protocol Architecture, Fixed routing, Spanning tree approach, Connecting devices like Repeaters, Hubs, Bridges, Two layer switches , Transparent Bridges, Source Routing Bridges, Merced- Media Bridges , Virtual LANs, Router and Three layer switches, Backbone Networks, Bus Backbone, Star Backbone, Connecting Remote LANs, Wireless LANs, Applications , IEEE 802.11, Architecture and Services, Medium Access Control, Physical layer.

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.
3. Communication Network 2/E by Alberto Leon-Garcia & Indra Widjaja.

Module 3
Internetworking:
Principle, Requirements, Architectural approaches, Connectionless Internetworking, Routing techniques, Dynamic routing, Internet Protocol (IP), Internal Control Message Protocol (ICMP), IPV6 structure, Address and Header Formats, ICMPV6, Unicast and Multicast Routing , Autonomous Systems, Unicast Routing Protocol OSPF, Internet Group Management Protocol (IGMP) , Border Gateway Protocol.

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.
3. Communication Network. 2/E by Alberto Leon-Garcia & Indra Widjaja.

Module 4
Transport Protocols:
Connection Oriented Transport Protocol Mechanisms, Reliable Sequencing Networks Services, Unreliable

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Network Services, TCP Services, TCP Header format, TCP Mechanisms, TCP Implementation Policy options, TCP Congestion Control, Retransmission Timer Management, Window Management, Quality of service, User Datagram Protocol (UDP).

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.

Module 5
Network Security:
Passive and Active Attacks, Symmetric Encryption, Encryption Algorithms, Key distribution, Traffic padding, Message Authentication, Hash function, Secure Hash function, Public-key Encryption, Digital Signature, RSA Public key Encryption Algorithm, Key Management, Secure Socket layer and Transport layer Security, SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol, IP level Security IPSEC, Application layer Security PGP, Firewall, Virtual Private Networks.

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.

Module 6
Distributed Applications:
Electronic Mail, Simple Mail Transfer Protocol (SMTP), Multipurpose Internal Mail Extension (MIME), Client Server Model, Socket Interface, Socket Programming, File Transfer, Simple Network Management Protocol (SNMP), SNMP V_2 and SNMP V_3, Hypertext Transfer Protocol (HTTP) overview , Message Entities, World Wide Web (WWW), HTML, Common Gateway Interface (CGI).

Text Books:

1. Date and Computer Communication .7/E by William Stallings.
2. Data Communication and Networking .3/E by Behrouz A. Forouzan.

Module 7
Advanced Network Architectures:
Integrated Services in Internet, Resource Reservation Protocol (RSVP), Receiver initiated Reservation, Reservation Merging, RSVP Message format, Differentiated Services , DS field , Network Interconnection Models, Overlay Model, Peer-to-Peer Model, Multi-protocol Label Switching (MPLS) , Generalized MPLS (GMPLS), Real-Time Transport Protocols (RTP), RTP Control Protocol, Session Control Protocols, Session Initiation Protocol.

Text Book:

1. Communication Network. 2/E by Alberto Leon-Garcia & Indra Widjaja

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TCS2037 DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS

Module 1

Introduction to Parallel Computing and Programming: Motivating Parallelism, Scope of Parallel Computing, Implicit Parallelism, Limitations of Memory system performance, Dictionary of Parallel Computing Platforms Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process – Processor Mapping and Mapping Techniques.

Module 2

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for containing Interaction Overloads, Parallel Algorithm Models.

Module 3

Dense Matrix Algorithms: Matrix Vector Multiplication, Matrix – Matrix Multiplication, Solving a system of Linear Equations.

Module 4

Sorting: Issues in sorting on Parallel Computers, Sorting Networks, Bubble Sort and its variants, Quick Sort, Bucket and sample sort, other sorting Algorithms.

Module 5

Graph Algorithms: Definitions and Representation, Minimum Spanning Tree, Prim's Algorithm, Single Source shortest path : Dijkrtra's Algorithms All-pairs shortest paths, Transitive closure, Connected Components, Algorithms for Sparse Graphs.

Module 6

Search Algorithms for Discrete Optimization Problems: Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth – First Search, Parallel Best – First Search, Speedup Anomalies in Parallel Search Algorithms.

Module 7

Dynamic Programming: Overview of Dynamic Programming, Serial Monadic DP Formulations, Nonserial Monadic DP Formulations, Serial Polyadic DP Formulations, Nonserial Polyadic DP Formulations.

Fast Fourier Transform: The serial Algorithm, The Binary – Exchange Algorithm, The Transpose Algorithm.

Text Book:

A Grama et.al – Introduction to Parallel Computing, 2nd ed. Pearson Education, New Delhi 2003.

Reference Books:

M.J. Quinn – Parallel Computing : Theory and Practice, 2nd ed., McGraw Hill, New York, 1994.

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Syllabus M.Tech IT Non- CBCS

Semester-I

TIT 1101 COMPUTABILITY AND COMPLEXITY THEORY

Module-I +II

Basic background on automata and languages, Types of automata and languages, Turing machines, k-tape Turing machines, non-deterministic Turing machines, Universal Turing machine, Halting problem. Recursive enumerable languages, Recursive languages, Decidable and recognizable language, Turing-decidable languages, Turing-recognizable languages, Context Sensitive Language and Chomosky Hierarchy.

Module-III+IV

Primitive recursive function, partial recursive function, Recursive and recursive enumeration sets, Programming systems, Unsolvable problems, a non-recursive language and an unsolvable problem, Reducing one problem to another problem, Rice Theorem, More unsolvable problems, PCP.

Module-V+VI

Measuring complexity- Big Oh, small oh and other notations, Analyzing algorithms, Time and space complexity of a Turing machine, Complexity analysis of multi-tape TM Complexity classes: P, NP, NP-C, NP-Complete problem, Additional NP-complete problems- clique, vertex cover, Hamiltonian cycle, coloring problem, graph isomorphism, Reduction from NP-C problem to another problem.

Module-VII

Tractable and Intractable problems.

Text Books

1. Lewis H.R., Papadimitriou C.H.- Elements of the Theory of Computation:, PHI Publ. , 2nd edition, New Delhi

2. John Martin. *Introduction to Languages and the Theory of Computation, 3rd ed.* McGraw Hill, New York, NY, 2003.

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TIT 1003 ADVANCED DATABASE

Module -I

Review of basic concepts, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL.

Module -II

Concurrency Control Techniques, Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking, Using Locks for Concurrency Control in Indexes, Other Concurrency Control Issues.

Module -III

Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Recovery in Multidatabase Systems, Database Backup and Recovery from Catastrophic Failures.

Module -IV

Overview of Object-Oriented ConceptsObject Identity, Object Structure, and Type Constructors, Encapsulation of Operations, Methods and Persistence, Type and Class Hierarchies and Inheritance, Complex Objects, Overview of the Object Model of ODMG, The Object Definition Language ODL, The Object Query Language, OQL, Overview of the c++ Language Binding, Object Database Conceptual Design.

Module -V

Overview of SQL and Its Object-Relational Features Evolution and Current Trends of Database Technology The Informix Universal Server, Implementation and Related Issues for Extended Type Systems The Nested Relational Model, Active Database Concepts and Triggers Temporal Database Concepts Multimedia Databases, Introduction to Deductive Databases.

Module -VI

Distributed Databases and Client-Server Architectures, Distributed Database Concepts, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Types of Distributed Database Systems, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, An Overview of 3-Tier Client-Server Architecture.

Head of Department

Module -VII

Data Modeling for Data Warehouses Characteristics of Data Warehouses Introduction, Definitions, and TerminologyBuilding a Data WarehouseTypical Functionality of a Data WarehouseData Warehouse Versus ViewsProblems and Open Issues in Data Warehouses, Mobile Databases Multimedia Databases Geographic Information Systems Genome Data Management

TEXT BOOK:

1. Elmasri R., Navathe S.B., Fundamentals of Database Systems, 5th Edn., Pearson Education/Addison Wesley, 2007.

REFERENCE BOOKS:

6. C.J. Date , An introduction to Database Systems, 7th Edn., Pearson Education, New Delhi, 2004.
7. H. Korth et al. ,Database Management System Concepts, 3rd Ed., TMH, New Delhi, 2002.
8. B.Desai, Database Management Systems, Galgotia Publications, New Delhi, 1998.

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TIT 1005 COMUTATIONAL INTELLIGENCE

Module -I

Introduction: Computational Intelligence paradigms, artificial neural network, evolutionary computation swarm intelligence, artificial immune system, fuzzy systems.

Module –II

Artificial Neural Networks: Artificial neuron, supervised neural network, supervised learning rules, functioning of hidden Modules, ensemble neural networks. Unsupervised learning neural networks: Hebbian learning rule, self-organizing feature maps.

Module -III

Radial Basis Function Network: Learning Vector Quantizer, Radial basis function network, training algorithms.
Reinforcement Learning: Model free reinforcement learning model, neural networks and reinforced learning.

Module -IV and V

Evolutionary Computation: Generic evolutionary algorithm, chromosome representation, initial population, fitness function, selection, reproduction operators, stopping criteria, evolutionary computation versus classical optimization, genetic algorithms and its variants,building blocks of genetic programming, basic evolutionary programming.

Module -VI

Computational Swarm Intelligence: Basic Particle swarm intelligence and its variants, PSO parameters, single solution PSO, multiobjective optimization using PSO, introduction to ant colony optimization, foraging behavior of ants.

Module -VII

Artificial Immune System: Natural immune system, artificial immune models, application of AIS.

TEXT BOOK:

1. Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley.

REFERENCE BOOK:

1. Amit Konar, Computational Intelligence: Principles, Techniques and Applications, Springer.

Head of Department

Semester-II

TIT 2001 INFORMATION THEORY

Module -I

Information, Entropy, Relationship between entropy and information, Information measures of discrete and continuous variables, Joint entropy, Conditional entropy, Relative Entropy and Mutual Information, Chain rules of entropy, The log sum inequality and its application, Data processing inequality, Kraft's inequality

Module -II

Kolmogorov complexity: definitions and examples, Models of computation, Kolmogorov complexity and entropy, Kolmogorov complexity of integers, Algorithmically random and incompressible sequences, Universal probability

Module - III & IV

Classification of codes, Prefix codes, Huffman Codes, Lempel-ziev (LZ) codes, Optimality of these codes, Information content of these codes, Source coding theorem, Shannon-Fano coding

Channel models, Channel capacity, Symmetric channels, Properties of channel capacity, Channel coding theorem, Information Capacity Theorem, Discrete memoryless channels – BSC, Shannon limit

Module -V

Error Control Coding: Introduction, Forward and Backward error Correction, Hamming Weight and Hamming Distance, Linear Block Codes, Encoding and decoding of Linear Block-codes, Parity Check Matrix, Syndrome Decoding, Hamming Codes

Module -VI

Cyclic Codes: Introduction, Method for generating Cyclic Codes, Matrix description of Cyclic codes, Burst error correction, Cyclic redundancy check (CRC) codes, Circuit implementation of cyclic codes

Module -VII

BCH: Primitive elements, Minimal polynomials, Generator polynomials in terms of minimal polynomials, Examples of BCH codes

Convolutional Codes: Introduction, Polynomial description of Convolutional Codes, Generating function, Matrix description of Convolutional Codes, Viterbi Decoding of Convolutional codes.

TEXT BOOKS:

1. Ranjan Bose, Information Theory, Coding and Cryptography, TMH, New Delhi, India, 2007.
2. Cover Thomas and Joy Thomas, *Elements of Information Theory*, Wiley India Pvt. Ltd., 2006.

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TIT 2003 COMMUNICATION THEORY

Module – I

Introduction: The Communication process, Sources of Information, Communication Channels, Baseband and Passband Signals, Representation of Signals and Systems, Probabilistic Considerations, The Modulation Process, Primary Communication Resources, Information Theory and Coding, Analog Versus Digital Communications, Networks.

Module -II

Representation of Signals and Systems: The Fourier Transform, Properties of the Fourier Transform, Rayleigh's Energy Theorem, The Inverse Relationship Between Time and Frequency, Dirac Delta Function, Fourier Transforms of Periodic Signals, Transmission of Signals Through Linear Systems, Filters, Hilbert Transform, Pre-Envelop, Canonical Representations of Band-Pass Signals, Band-Pass Systems, Phase and Group Delay, Numerical Computation of the Fourier Transform, Summary.

Module -III

Continuous-Wave Modulation: Introduction, Amplitude Modulation, Virtues, Limitations, and Modifications of Amplitude Modulation, Double Sideband-Suppressed Carrier Modulation, Filtering of Sidebands, Vestigial Sideband Modulation, Single Sideband Modulation, Frequency Translation, Frequency-Division Multiplexing, Angle Modulation, Frequency Modulation, Phase-Locked Loop, Nonlinear Effects in FM Systems, The Super heterodyne Receiver, Summary and Discussion.

Module-IV

Noise in CW Modulation Systems: Introduction, Receiver Model, Noise in DSB-SC Receivers, Noise in SSB Receivers, Noise in AM Receivers, Noise in FM Receivers, Pre-emphasis and De-emphasis in FM, Summary and Discussion.

Module -V

Pulse Modulation: Introduction, The Sampling Process, Pulse-Amplitude Modulation, Time-Division Multiplexing, Pulse-Position Modulation, Bandwidth-Noise Trade-off, The Quantization Process, Pulse-Code Modulation, Noise Considerations in PCM Systems, Virtues, Limitations and Modifications of PCM, Delta Modulation, Differential Pulse-Code Modulation, Coding Speech at Low Bit Rates, Summary and Discussion.

Head of Department

Module -VI

Baseband Pulse Transmission: Introduction, Matched Filter, Error Rate due to Noise, Intersymbol Interference, Nyquist's Criterion for Distortion less Baseband Binary Transmission, Correlative-Level Coding, Baseband M-ary PAM Transmission, Tapped-Delay-Line Equalization, Adaptive Equalization, Eye Pattern, Summary and Discussion.

Module -VII

Digital Passband Transmission: Introduction, Passband Transmission Model, Gram-Schmidt Orthogonalization Procedure, Geometric Interpretation of Signals, Response of Bank of Correlators to Noisy Input, Coherent Detection of Signals in Noise, Probability of Error, Correlation Receiver, Detection of Signals with Unknown Phase, Hierarchy of Digital Modulation Techniques, Coherent Binary PSK, Coherent Binary FSK, Coherent Quadriphase-Shift Keying, Differential Phase-Shift Keying, Comparison of Binary and Quaternary Modulation Schemes, M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency, Synchronization, Summary and Discussion.

TEXT BOOK:

1. Simon Haykin ,Communication Systems, 3rd Edition, 2008.

REFERENCE BOOKS:

1. Signals, Systems, and Communication by B.P.Lathi
2. Communication Theory by Dr. J.S.Chitode, 2010.

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TIT 2005 DATA COMPRESSION AND DATA HIDING

Module-I

Basic techniques: Run length encoding, RLE text compression, RLE image compression

Statistical methods: Shanon Fano coding, Huffman coding, Adaptive Huffman coding

Module -II

Dictionary methods: String compression, LZW, Zip, Gzip, CRC

Image compression: Approaches, image transform, JPEG, Progressive image compression

Module -III

Wavelet methods: Fourier transform, Fourier image compression, Haar transform

Video compression: Analog video, Digital video, video compression, MPEG

Module-IV

Audio compression: Sound, Digital audio, μ law and A- law companding , human auditory system, ADPCM data compression, MLP Audio, Speech compression

Module -V

Introduction: What is Data Hiding? Forms of Data Hiding Properties of Steganographic Communications , The Steganographic Channel

Frameworks for Data Hiding : Signal Processing Framework

Module -VI

Communication with Side Information and Data Hiding : Costa's Framework ,A Framework Based on Channel Adaptive Encoding and Channel Independent Decoding , On the Duality of Communications and Data Hiding Frameworks

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Module -VII

Type I (Linear) Data Hiding : Linear Data Hiding in Transform Domain , Problem Statement 4.3 Capacity of Additive Noise Channels 4.4 Modeling Channel Noise ,Visual Threshold , Channel Capacity vs. Choice of Transform

Type II and Type III (Nonlinear) Data Hiding Methods , Type II Embedding and Detection ,Type III Embedding and Detection Methods

TEXT BOOKS:

1. David Saloman, Data Compression, 4th edition, Springer

2. Husrev Sencar, Ali Akansu, Data Hiding Fundamentals and applications Content security in digital multimedia, Elsevier Academic Press

REFERENCE BOOKS:

1. Nelson, The Data Compression Book, BPB.

2. Atul Kahate , Cryptography & Network Security, TMH.

3. B. Forouzan , Cryptography and Network Security, Tata McGraw-Hill.

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List of Electives

Elective-I

TIT 1011 STOCHASTIC PROCESS AND SIMULATION

Module -I

Probability Theory: Axiomatic construction of probability spaces, random variables and vectors, probability distributions, functions of random variables; mathematical expectations, transforms and generating functions, modes of convergence of sequences of random variables, laws of large numbers, central limit theorem.

Introduction to Stochastic Processes (SPs): Definition and examples of SPs, classification of random processes according to state space and parameter space, types of SPs, elementary problems.

Module -II

Discrete-time Markov Chains (MCs): Definition and examples of MCs, transition probability matrix, Chapman-Kolmogorov equations; calculation of n-step transition probabilities, limiting probabilities, classification of states, ergodicity, stationary distribution, transient MC; random walk and gambler's ruin problem, applications.

Continuous-time Markov Chains (MCs): Kolmogorov- Feller differential equations, infinitesimal generator, Poisson process, birth-death process, Applications to queuing theory, inventory analysis, communication networks, finance and biology.

Module -III

Introduction to Simulation and Modeling: System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation. Examples: Simulation of Queuing systems, Other examples of simulation. General Principles: Concepts of discrete event simulation, List processing. Simulation Software: History of simulation software, selection of software.

Module -IV

Statistical Models: Useful statistical model, Discrete distribution, Continuous distribution, Poisson

process, Empirical distribution. Queuing Models: Characteristics of Queuing systems, Queuing notations, Long run measures of performance of Queuing systems, Steady state behavior of infinite population Markovian models, Steady state behavior finite population model, Network of Queues.

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Module -V

Input Modeling and Verification and Validation of Simulation Model Input Modeling: Data Collection, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models. Verification and Validation of Simulation Model: Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models.

Module -VI

Output Analysis for a single model,Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation.

Module -VII

Comparison and Evaluation of Alternative System Design: Comparison of two system design, Comparison of several system design, Meta modeling, Optimization via simulation.

TEXT BOOKS:

1. S.M. Ross, Stochastic Processes, 2nd Edition, Wiley, 1996 (WSE Edition).

2. Jerry Banks, John Carson, Barry Nelson, David Nicol, Discrete Event System Simulation, 5th Edition.

REFERENCE BOOKS:

1. J. Medhi, Stochastic Processes, 3rd Edition, New Age International, 2009.

2. Averill Law, W. David Kelton, Simulation Modeling and Analysis, McGRAW HILL.

3. Geffery Gordon, System Simulation, PHI.

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MESRA, RANCHI – 835 215 (INDIA)

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TIT 1013 COMPUTER ALGORITHMS

Module -I

Introduction: What is an Algorithm? Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures: stack, queue, Dequeue, Linked Lists, etc.

Module-II

Algorithm Analysis,Mathematical Induction,ummation Techniques,Time Space Trade-off , Asymptotic Notation , Properties of big-Oh notation, Recurrence equations – Solving recurrence equations , Mathematical Analysis of Non-recursive and Recursive Algorithms,Master Theorem and its applications

Module –III and IV

Brute Force approach: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Divide and Conquer: General Method – Binary Search – Finding Maximum and Minimum, Binary tree traversals and related properties, Merge Sort, Strassen's Matrix Multiplication, Quicksort

Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting,

Transform and Conquer: Balanced Search Trees, Heaps and Heapsort, Problem Reduction

Module -V

Greedy Algorithms: General Method, Knapsack Problem, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees

Module -VI

Dynamic Programming: General Method , Multistage Graphs , All-Pair shortest paths,Optimal binary search trees,0/1 Knapsack ,Travelling salesperson problem

Module -VII

Backtracking: General Method , 8 Queens problem ,Sum of subsets , graph colouring,Hamiltonian problem, knapsack problem

Head of Department

Branch and Bound: General Methods (FIFO & LC),0/1Knapsack problem,

Introduction to NP-Hard and NP-Completeness, KMP string matching algorithm,Maximal Network Flow problem,Bipartite graphs, Hashing

TEXT BOOK:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L.Rivest,Clifford Stein, Introduction to Algorithms,2nd Edition, PHI, 2006.

REFERENCE BOOKS:

1. Horowitz E., Sahni S., Rajasekaran S.,Computer Algorithms,Galgotia Publications, 2001.
2. Alfred V. Aho,John E.Hopcroft and Jeffrey D.Ullman,The Design and Analysis of Computer Algorithms, Pearson Education, 1999.

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TIT 1015 CRYPTOGRAPHY

Module –I

Overview of Cryptography and its Applications: Secure Communications, Cryptographic Applications.

Module –II

Classical Cryptosystems: Shift Ciphers, Affine Ciphers, The Vigenere Cipher, Substitution Ciphers, Sherlock Holmes, The Playfair and ADFGX Ciphers, Block Ciphers, Binary numbers and ASCII, One-Time Pads, Pseudo-Random Bit Generation, LFSR Sequences, Enigma.

Module –III

The Data Encryption Standard: Introduction, A Simplified DES-Type Algorithm, Differential Cryptanalysis, DES, Modes of Operation, Breaking DES, Meet-in-the-Middle Attacks, Password Security.

Module –IV

The RSA Algorithm: The RSA Algorithm, Attacks on RSA, Primality Testing, Factoring, The RSA Challenge, An Application to Treaty Verification, The Public Key Concept.

Module –V

Discrete Logarithms: Discrete Logarithms, Computing Discrete Logs, Bit Commitment, Diffie-Hellman Key Exchange, The ElGamal Public Key Cryptosystem.

Module –VI

Hash Functions: Hash Functions, A Simple Hash Example, The Secure Hash Algorithms, Birthday Attacks, Multicollisions, The Random Oracle Model, Using Hash Functions to Encrypt.

Module –VII

Digital Signatures: RSA Signatures, The ElGamal Signatures Scheme, Hashing and Signing, Birthday Attacks on Signatures, The Digital Signature Algorithm.

TEXT BOOK:

1. Wade Traple , Lawrence C. Washington-Introduction to Cryptography with Coding Theory, Pearson Education.

REFERENCE BOOKS:

1. Behrouz A. Forouzan and D. Mukhopadhyay- Cryptography & Network Security, McGraw Hill, New Delhi.
2. William Stallings- Cryptography & Network Security Principles and Practice, Pearson Education.

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TIT 1017 MOBILE AND WIRELESS NETWORK

Module -I

Introduction: Fundamentals of Wireless Communication - Transmission fundamentals – Wireless Communication Technology - Antennas and Propagation, Spread Spectrum, Modulation Techniques, Coding and Error Control.

Module -II

Wireless Networking, Wireless LANS & PANS: Wireless Networking – Satellite Communication, Cellular Wireless Networks, Mobile IP and Wireless Access Protocol, Wireless LANs -Wireless LAN Technology, IEEE 802.11 Wireless LAN Standards, Bluetooth, HIPERLAN Standard, HomeRF.

Module -III

Ad-Hoc Wireless Networks & Security : Introduction - Issues in Ad Hoc Wireless Networks - Classifications of MAC Protocols -Classifications of Routing Protocols - Classifications of Transport Layer Protocols - Classification of Energy Management Schemes – Wired Equivalent Privacy(WEP) – The Extensible Authentication Protocol - Security in Ad Hoc Wireless Networks.

Module -IV

Wireless Sensor Networks: Introduction - Sensor Network Architecture - Data Dissemination - Data Gathering -MAC Protocols for Sensor Networks - Location Discovery - Quality of a Sensor Network Evolving Standards - Other Issues.

Module -V

Recent Advances in Wireless Networks: Ultra-Wide-Band Radio Communication - Wireless Fidelity Systems - Optical Wireless Networks - The Multimode 802.11 -IEEE 802.11a/b/g - The Meghadoot Architecture - Next-Generation Hybrid Wireless Architectures.

Module -VI

Cellular Mobile Wireless Networks: Systems and Design Fundamentals, Propagation Models
Description of cellular system, Frequency Reuse, Cochannel and Adjacent channel interference, Propagation

Head of Department

Models for Wireless Networks, Multipath Effects in Mobile Communication, Models for Multipath Reception.

Module -VII

Evolution of Modern Mobile Wireless Communication System: First Generation Wireless Networks, Second Generation (2G) Wireless Cellular Networks, Major 2G standards, 2.5G Wireless Networks, Third Generation 3G Wireless Networks, Wireless Local Area Networks (WLANs), Cellular –WLAN Integration, All-IP Network: Vision for 4G.

TEXT BOOKS:

1. William Stallings, Wireless Communications and Networking, Pearson Education, 2nd Edition, 2005.
2. Theodore S. Rappaport, Wireless Communication: Principles and Practice, 2nd Edition. Prentice Hall of India, 2005.

REFERENCE BOOKS:

1. Siva Ram Murthy C, Manoj B.S, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall, 2004.
2. William C.Y.Lec, Mobile Cellular Telecommunication, Analog and Digital Systems, McGraw Hill Inc.
3. Kaveh Pahlavan and Prashant Krishnamurthy, Principles of Wireless Networks, 1st Edn., Pearson Education Asia, 2002.
4. Rappaport T.S, Wireless Communications: Principles and Practice, Prentice Hall., 2nd Edition.

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TIT 1019 MOBILE COMPUTING

Module -I

Introduction: Mobility of bits and bytes, wireless the beginning, mobile computing, dialogue control, Networks, middleware and gateways, application and services, developing mobile computing applications, security in mobile computing, standard bodies. Mobile Computing Architecture: architecture for mobile computing, three tier architecture, design consideration, mobile computing through internet, making existing applications –mobile enabled.

Module -II

Mobile Computing through Telephony: evolution of telephony, multiple access procedures, mobile computing through telephone, developing an IVR application, voice XML, telephone application programming interface. Emerging Technologies: introduction, Bluetooth, radio frequency identification, wireless broadband, mobile IP, IPV6, java card.

Module -III

Global System for Mobile Communications GSM: introduction, GSM architecture , call routing in GSM, PLMN interface, GSM address and identifiers, network aspect in GSM, GSM frequency allocation, authenticity and security. Short Message Service SMS : Mobile computing over SMS, Short message services(SMS) , value added services through SMS, Accessing the SMS bearer.

Module -IV

General Packet Radio Service GPRS:GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, applications for GPRS, limitations for GPRS, billing and charging in GPRS. Wireless Application Protocol WAP: introduction , WAP, MMS, GPRS applications.

CDMA and 3G: Introduction, spread spectrum technology,ls-95,CDMA vs GSM, wireless data, 3rd generation network, applications on 3G.

Module -V

Client Programming: introduction, moving beyond the desktop, a peak under the hood: hardware overview, mobile phone, PDA, design constraints in application for handheld devices. Programming for the Palm OS,Wireless Devices with Symbian OS,J2ME,Wireless Devices with Windows CE.

Head of Department

Module -VI

Voice Over Internet Protocol and Convergence: VoIP, H 323 framework for VoIP 564, SIP, comparision between H.323 and SIP 570, Real time protocol, convergence technologies, call routing, voice over IP applications, IP multimedia subsystem, Mobile VoIP.

Module -VII

Security Issues in Mobile Computing: Introduction, information security, security techniques and algorithm, security protocols, public key infrastructure, trust, security models, security framework for mobile environment.

TEXT BOOK:

1. Ashok Talukedar, Hasan Ahmed, Roopa R Yavagal, Mobile Computing Technolgy , Applications and Service Creation,Tata McGraw - Hill Education ,2010.

REFERENCE BOOKS:

1. Jochen H. Schiller, Mobile Communications, 2nd Edition,Addison wesley.
2. Rajkamal, Mobile **Computing**,2nd Edn., Oxford University Press
3. Reza Behravanfar, Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, ISBN: 0521817331, Cambridge University Press, October 2004.
4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren, Fundamentals of Mobile and Pervasive Computing, ISBN: 0071412379, McGraw-Hill Professional, 2005.
5. Hansmann, Merk, Nicklous, Stober, Principles of Mobile Computing, 2nd Edn., Springer, 2003.

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TIT 1021 CLUSTER AND GRID COMPUTING

Module-I&II

Overview of Cluster Computing: The Role of Clusters, Definition and Taxonomy, Distributed Computing, Limitations

Cluster Planning: Architecture and Cluster Software, Design Decisions, Network Hardware, Network Software, Protocols, Distributed File Systems, Virtualization technologies

Module -III Introduction-Parallel and Distributed Computing- Cluster Computing-Grid Computing: Anatomy and Physiology of Grid-Review of Web Services-OGSA-WSRF.

Module -IV

Grid Monitoring : Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems-GridICE
– JAMM -MDS-Network Weather Service-R-GMA-Other Monitoring Systems- Ganglia and GridMon

Module- V

Grid Security And Resource Management: Grid Security-A Brief Security Primer-PKI-X509 Certificates-Grid Security-Grid
Scheduling and Resource Management-Scheduling Paradigms- Working principles of Scheduling -A Review of Condor, SGE, PBS and LSF-Grid Scheduling with QoS.

Module Vi Data Management And Grid Portals: Data Management-Categories and Origins of Structured Data-Data Management
Challenges-Architectural Approaches-Collective Data Management Services-Federation Services-Grid Portals-First-Generation Grid Portals-Second-Generation Grid Portals.

Module VII

Grid Middleware: List of globally available Middlewares - Case Studies-Recent version of Globus Toolkit and gLite - Architecture, Components and Features.

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TEXT BOOKS

1. High Performance Cluster Computing (Vol. 1-2), R. Buyya (ed.), ISBN 0-13-013784-7, Prentice Hall, 1999.

2. Maozhen Li, Mark Baker, The Grid Core Technologies, John Wiley & Sons ,2005.

REFERENCE BOOKS

1. Ian Foster & Carl Kesselman, The Grid 2 – Blueprint for a New Computing Infrastructure , Morgan Kaufman – 2004.

2. Joshy Joseph & Craig Fellenstein, "Grid Computing", Pearson Education 2004.

3. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, "Grid Computing: Making the Global Infrastructure a reality", John Wiley and sons, 2000

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TIT 1023 DISTRIBUTED COMPUTING

Module -I

Distributed Computing- An Introduction: Definitions, The History of Distributed Computing, Different Forms of Computing, The Strengths and Weaknesses of Distributed Computing, Basics of Operating Systems, Network Basics, Software Engineering Basics.

Module -II

Interprocess Communications: An Archetypal IPC Program Interface, Event Synchronization, Timeouts and Threading, Deadlocks and Timeouts, Data Representation, Data Encoding, Text Based Protocols, Request-Response Protocols, Event Diagram and Sequence Diagram, Connection-Oriented versus Connectionless IPC.

Module -III

Distributed Computing Paradigms: Paradigms and Abstraction, Paradigms for Distributed Applications, Trade-offs.

The Socket API: Background, The Socket Metaphor in IPC, The Datagram Socket API, The Stream- Mode Socket API, Sockets with Nonblocking I/O Operations, Secure Socket API.

Module -IV

The Client-Server Paradigm: Background, Client-Server Paradigm Issues, Software Engineering for a Network Service, Connection-Oriented and Connectionless Servers, Iterative Server and Concurrent Server, Stateful Servers.

Module -V

Group Communication: Uni-casting versus Multicasting, An Archetypal Multicast API, Connectionless versus Connection-Oriented Multicast, Reliable Multicasting versus Unreliable Multicasting, The Java Basic Multicast API, Reliable Multicast API.

Head of Department

Module -VI

Distributed Objects: Message Passing versus Distributed Objects, An Archetypal Distributed Object Architecture, Distributed Object Systems, Remote Procedure Calls, Remote Method Invocation, The Java RMI Architecture, The API for the Java RMI, A Simple RMI Application, Steps for Building an RMI Application, Testing and Debugging, Comparison of RMI and Socket APIs.

Module -VII

Advanced RMI: Client Callback, Stub-downloading, RMI Security Manager

Advanced Distributed Computing Paradigms, Message Queue System, Mobile Agent

TEXT BOOK:

1. M.L.Liu, Distributed Computing, Principles and Applications, 1st Indian Reprint, Pearson Education, 2004.

REFERENCE BOOK:

1. SModulea Mahajan and Seema Shah, Distributed Computing, Oxford Unv. Press, New Delhi, 2010.

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TIT 1025 SPEECH PROCESSING

Module -I

Speech Production: *Introduction, Speech production process, Representing speech in time and frequency domains, Speech sounds and features, Approaches to automatic speech recognition by machine.*

Module –II

Time Domain Methods for Speech Processing: Time domain parameters of speech, Method for extracting the parameters, Zero crossing, Auto correlation function, Pitch period estimation, Magnitude difference function.

Module -III

Liner Predictive Coding of Speech: *The liner predictive coding Model, Liner predictive coding analysis equations, The autocorrelation method, The covariance method, Liner predictive coding processor for speech recognition.*

Module -IV

Classification Techniques: *Elements of vector quantization implementation, The VQ training set, The similarity or distance measure, Clustering the training vectors, Vector classification procedure, Comparison of vector and scalar quantizers.*

Module -V

Hidden Markov Models: *Introduction, Discrete-time markov process, Extensions to HMM, Basic problems for HMM, Types of HMMs, Continuous observation densities in HMM, Auto regressive HMMs, Variants on HMM structures, Comparisons of HMMs.*

Module -VI

Speech Coding Techniques: Structure of speech coding systems, Desirable properties of a speech coder, Classification of speech coders, Regular- Pulse Excitation Coders (RPEC), Code Book Excited Linear Prediction (CELP).

Head of Department

Module -VII

Speech Quality Assessment: Introduction, The scope of quality and measuring conditions, objective quality measurements for coders, subjective quality measures, objective quality measures, objective versus subjective measures.

TEXT BOOKS:

1. Lawrence Rabiner, Biing ,Hwang Juang, Fundamentals of Speech Recognition Pearson Education India 2008.
2. Wai C. Chu, Speech Coding Algorithms, Foundation and Evolution of Standardize Coders, John Wiley & Sons, Inc., Publication, Ist Edition 2003.

REFERENCE BOOK:

1. L.R. Rabiner and R.E Schafer, Digital processing of speech signals, Pearson Education Eduction India, Ist Edition.

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TIT 1027 DATA MINING & WAREHOUSING

Module -I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Module -II

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

Module -III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining

Module -IV

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods

Module -V

Cluster Analysis Introduction :Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

Module -VI

Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multirelational Data Mining:

Module -VII

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web. Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.

Head of Department

TEXT BOOKS:

1. Jiawei Han & Micheline Kamber, Data Mining – Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publishers, Elsevier, 2006.

2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson Education.

REFERENCE BOOKS:

1. Arun K Pujari, Data Mining Techniques, 2nd edition, Universities Press.
2. Sam Aanhory & Dennis Murray, Data Warehousing in the Real World, Pearson Edn. Asia.
3. K.P.Soman,S.Diwakar,V.Ajay, Insight into Data Mining, PHI, 2008.
4. Paulraj Ponnaiah, Data Warehousing Fundamentals, Wiley Student Edition.

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TIT 1029 HUMAN COMPUTER INTERACTION

Module -I

Foundations: Introduction, Historical evolution of the field, Input-Output channels, Human memory, Thinking, Emotion, Psychology and design of interactive systems, Text entry devices, Display Devices,Devices for virtual reality and 3D interactions, models of interaction, ergonomics, interaction styles, HCI paradigms.

Module - II and III

Design Process: Interaction design basics, HCI in the software process, The software life cycle, Usability engineering, Iterative design and prototyping, Design rules: Principles to support usability, Standards and guidelines, golden rules and heuristics, HCI patterns.

Module -IV

Design Process: Implementation support, evaluation techniques, universal design, user support.

Module-V

Models and Theories: Cognitive models, Socio organizational issues and stake holder requirements.

Module -VI

Communication and Collaboration Models: Face- to-face communication, conversation, text based communication, group working.

Module -VII

Groupware systems, ubiquitous computing and augmented realities, hypertext, multimedia and world wide web.

TEXT BOOK:

Human Computer Interaction by Alan Dix, Janet Finley, Gregory Abowd, Russell Beale, Pearson India.

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TIT 1031 DIGITAL SIGNAL PROCESSING

Module -I

Introduction to Digital Signal Processing: Discrete-Time Signals, Shanon's sampling theorem, Difference equation description, characteristics of digital filters and time domain analysis, properties of discrete time system (linearity, time-variance, convolution), BIBO stability, Z-transformation and their application in solving difference equations, Relationship between Laplace and Z-transforms

Module -II

Frequency domain analysis: Discrete Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT), Periodic convolution, Direct evaluation of DFT, FFT algorithms- decimation in time and frequency, Relationship between Fourier and Z-transforms.

Module -III

Fast Fourier Transforms: Fast Fourier transforms (FFT) - Radix-2 decimation-in-time and decimation-in-frequency FPT Algorithms, Inverse FFT and FFT with general Radix-N

Module - IV

Realization of Digital Filters: Applications of Z - transforms, solution of difference equations of digital filters, System function. Stability criterion. Frequency response of stable systems, Realization of digital filters - Direct, Canonic, Cascade and Parallel forms

Module -V

IIR Digital Filters: Analog filter approximations - Butterworth and Chebyshev, Design of IIR Digital filters from analog filters. Step and Impulse invariant techniques. Bilinear transformation method, Spectral transformations.

Module -VI

FIR Digital Filters: Structures of FIR – Linear phase FIR filter – Filter design using windowing techniques, Frequency sampling techniques – Finite word length effects in digital Filters.

Module -VII

Applications: Multirate signal processing – Speech compression – Adaptive filter – Musical sound processing – Image enhancement.

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TEXT BOOK:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications: Pearson Education / PHI. 2007.

REFERANCE BOOKS:

1. A. V. Oppenheim and R.W. Schaffer, Discrete Time Signal Processing-. PHI, 2009
2. Loney Ludeman , Fundamentals of Digital Signal Processing, John Wiley, 2009
3. Li Tan, Digital Signal Processing - Fundamentals and Applications, Elsevier. 2008
4. Robert J. Schilling. Sandra L, Harris, Thomson. Fundamentals of Digital Signal Processing using Matlab - 2007
5. S.Salivahanan. A.Vallavaraj and Gnanapriya , Digital Signal Processing -.TMH.2009
6. Taan S.EIAli, Discrete Systems and Digital Signal Processing with MATLAB CRC press. 2009.

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TIT 1033 SOFT COMPUTING

Module -I

Introduction: Soft Computing vs. hard computing, soft computing paradigms, Basic mathematics of soft computing, learning and statistical approaches to classification and regression.

Module -II

Neural Networks: Introduction, Biological neural network, learning paradigms. Artificial Neural Network (ANN): Evolution of Basic neuron modeling, Difference between ANN and human brain, McCulloch-Pitts neuron models, Learning paradigms, activation function, Single layer Perceptron, Perceptron learning, Windrow-Hoff/ Delta learning rule, Multilayer Perceptron, Adaline, Madaline, different activation functions, Back propagation network, momentum, limitation.

Module -III

Fuzzy Logic: Introduction, Need, classical sets (crisp sets) and operations on classical sets Interval Arithmetic's,Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Membership functions, fuzzification and defuzzification.

Module -IV

Fuzzy Rule Base System: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making.
Applications: Fuzzy logic in modeling and control, image processing.

Module -V

Genetic Algorithms: Introduction, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems such as TSP (Travelling salesman problem),

Applications: Genetic Algorithm based Back propagation Networks.

Module -VI & VII

Particle Swarm Optimization: Background, Operations of Particle Swarm Optimization, Basic Flow of Particle Swarm Optimization, Comparison between GA and PSO, Applications of PSO.

Ant Colony Optimization: Ant Colony Optimization Algorithm, Ant System, Ant Colony System, Basic Flow of Ant colony Optimization, Applications of ACO.

Head of Department

TEXT BOOK:

1. S.N. Sivanandam, Principle of Soft Computing, Wiley India.

REFERENCE BOOKS:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley-India Edition, 2007.
2. Davis E.Goldberg, Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley, N.Y., 1989.
3. Sumati S., Hamsapriya T., Surekha P., Evolutionary Intelligence: An Introduction to Theory and Applications with MATLAB.

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TIT1035 BIG DATA ANALYSIS

Module- I

Introduction to Big data : Concept & Terminology, Big data Characteristics, different type of data, Case-study.

Module- II

Architecture of Big data: Explain the Big data stack, data sources layer, Ingestion layer, Storage layer, Physical layer, Platform layer , Security layer, Monitoring layer, Virtualization of Big data.

Module-III

Marketing Analytics : Market Place dynamics, Business Architecture, Business Process Management, Information & Communication Technology and Internet of everything, Big data Adaption & Planning , Case Study.

Module-IV

Big-data Storage : Clusters, File System , NOSQL, Sharding, Replication, CAP Theorem , ACID, BASE, Case Study example.

Module-V

Big data Processing: Parallel data Processing, Distributed data Processing , Hadoop, Processing Workloads, Clusters, Processing in Batch mode, Processing in real time mode, Case Study.

Module –VI

Computing for Big data Analysis: On Disk storage Device, In-Memory Storage Device Qualitative Analysis , Qualitative Analysis, Data Mining, Statistical Analysis, Machine Learning, Semantic Analysis, Visual Analysis.

Module – VII

Big data Security: Big data privacy, ethics & Security, Compliance auditing & protection , Security Design, eco-System Security, data Security & event logging

Book for Module-VI- Mark Van Rismenam

* Think Bigger: Developing a Successful Big data Startefy for your Business, Amazon, 1 edition 2014

* Sherif Sakr, “Large Scale & Big data Processing and Management”, CRC Press, 2014

* DT Edoforial Services, Big data

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TIT 1037 GENETIC ALGORITHM

Module I

Evolutionary Computation: Introduction, The Historical Development of EC, Features of Evolutionary Computation, Advantages of Evolutionary Computation. Application Evolutionary Computation.

Module II

Genetic Algorithm: Introduction, Biological Background, What is Genetic Algorithm, Conventional Optimization and Search Techniques, A Simple Genetic Algorithm, Comparison of Genetic Algorithm with other Optimization Techniques, Advantages and Limitations of Genetic Algorithm, Applications of Genetic Algorithm.

Module III

Terminologies and Operators of GA: Introduction, Key Elements, Individuals, Genes, Fitness, Populations, Data Structures, Search Strategies, Encoding, Breeding, Search Terminations.

Module IV

Advanced Operators and Techniques in Genetic Algorithm: Introduction, Diploidy, Dominance and Abeyance, Multiploid, inversion and Reordering, Niche and Specification, Few Micro-operators, Non-binary Representation, Multi-Objective Optimization, Combinatorial Optimizations.

Module V

Classification of Genetic Algorithm: Introduction, Simple Genetic Algorithm (SGA), Parallel and Distributed Genetic Algorithm (PGA and DGA), Hybrid Genetic Algorithm (HGA), Adaptive Genetic Algorithm (AGA).

Module VI

Genetic Algorithm Optimization Problems: Introduction, Fuzzy Optimization Problems, Multiobjective Reliability Design Problem, Combinatorial Optimization Problem, Scheduling Problems, Transportation Problems.

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Module VII

Introduction to Particle Swarm Optimization and Ant Colony Optimization: Introduction, Particle Swarm Optimization, Ant Colony Optimization.

Text Book:

1. Sivanandam S. N., Deepa S. N., Introduction to Genetic Algorithm, Spriniger-Verlag Berlin Heidelberg, 2008.

Reference Books:

1. Melanic Mitchell, An Introduction to Genetic Algorithms, MIT Press, 1998.
2. Goldberg D.E., Genetic Algorithms in search, Optimization and Machine Learning, Pearson India, 2002.

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Elective –II

TIT 2011 WIRELESS ADHOC AND SENSOR NETWORKS

Module -I

Introduction: History of Wireless Networks: Introduction ,Different Wireless Networks. Wireless Transmission Fundamentals :Wireless Channels ,The Wireless Communication Graph, Power Assignment and Topology Control ,The Wireless Interference Graph, Related Graph Problems and Geometry Concepts ,Energy-Consumption Models, Mobility Models.

Module -II

Wireless MACs: 3 Wireless Medium-Access Control Protocols: Introduction, IEEE 802.11 Architecture and Protocols ,WiMAX, Bluetooth, MAC Protocols for Wireless Sensor Networks. TDMA Channel Assignment: Introduction, System Model and Assumptions , Centralized Scheduling , Distributed Algorithms, Weighted Coloring and Schedulable Flows . Spectrum Channel Assignment :Introduction , Network System Model , List-Coloring for Access Networks , List-Coloring for Ad Hoc Networks, Transition Phenomena on Channel Availability.CDMA Code Channel Assignment :Introduction ,System Model and Assumptions

Throughput and Bottleneck of General Graphs , Approximation Algorithms for Interference GraphsMaximum Weighted Independent Set for a General Wireless Network Model.

Module -III

Topology Control and Clustering : Clustering and Network Backbone :Introduction

Network Models and Problem Formulation , Centralized Algorithms for a Connected Dominating Set , Message Lower Bound for Distributed-Backbone Construction ,Some Backbone-Formation Heuristics ,Efficient Distributed-Nontrivial-Backbone-Formation Method ,Efficient Distributed-Backbone-Formation Method ,Linear-Programming-Based Approaches ,Geometry-Position-Based Approaches . Weighted Network Backbone : Introduction ,Study of Typical Methods ,Centralized Low-Cost Backbone-Formation Algorithms ,Efficient Distributed Low-Cost Backbone-Formation Algorithms , Performance Guarantee .

Module -IV

Topology Control with Flat Structures : Introduction ,Current State of Knowledge , Planar Structures ,Bounded-Degree Spanner and Yao's Family , Bounded-Degree Planar Spanner , Low-Weighted Structures , A Unified Structure: Energy Efficiency for Unicast and Broadcast ,Spanners for Heterogeneous Networks , Fault-Tolerant Structures . Power Assignment : Introduction , Power Assignment for Connectivity , Power Assignment for Routing Critical Transmission Ranges for Connectivity : Introduction ,Preliminaries ,Critical Range for Connectivity Critical Range for *k*-Connectivity , Connectivity with Bernoulli Nodes .

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Module -V

Wireless Network Routing Protocols : Energy-Efficient Unicast Routing : Introduction

Proactive Approaches Reactive Approaches , Geographic Approaches ,Clustering and Hierarchical Routing .Energy-Efficient Broadcast/Multicast Routing : Introduction , Centralized Methods , Efficient Distributed or Localized Methods , Scheduling Active and Sleep Periods , Energy-Efficient Multicast . Routing with Selfish Terminals :Introduction , Preliminaries and Network Model, Truthful Payment Schemes for Multicast Sharing Multicast Costs or Payments Among Receivers, Existence of Truthful Payment Scheme ,Joint Routing, Channel Assignment, and Link Scheduling , Introduction ,System Model and Assumptions ,Problem Formulation for Cross-Layer Optimization , Efficient Link, Channel Scheduling .

Module -VI

Localization and Location Tracking : Introduction ,Available Information, Computational Complexity of Sensor Network Localization ,Progressive Localization Methods , Network-Wide Localization Methods Target Tracking and Classification , Experimental Location and Tracking Systems .

Module -VII

Performance Limitations of Random Wireless Ad Hoc Networks: Introduction , Capacity of Unicast for an Arbitrary Network ,Capacity of Unicast for Randomly Deployed Networks Capacity of Broadcast for an Arbitrary Network ,Capacity of Broadcast for Randomly Deployed Networks.Security of Wireless AdHoc Networks :Introduction ,Cryptography Fundamentals ,Key-Predistribution Protocols , Secure Routing Protocols.

TEXT BOOK:

1. XiangYang Li, Wireless Adhoc and Sensor Networks Theory and Applications, CAMBRIDGE UNIVERSITY PRESS.

RERENCE BOOKS:

1. Holger Kerl, Andreas Willig, Protocols and Architectures for Wireless Sensor Network, John Wiley and Sons.
2. Feng Zhao, Leonidas Guibas, Wireless Sensor Network, Elsevier, 1st Ed. 2004.
3. Kazem, Sohraby, Daniel Minoli, Taieb Zanti, Wireless Sensor Network: Technology, Protocols and Application, 1st Ed., John Wiley and Sons, 2007.
4. B. Krishnamachari, Networking Wireless Sensors, Cambridge University Press.
5. N. P. Mahalik, Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications Springer Verlag.

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TIT 2013 CLOUD COMPUTING

Module-I
Introduction:

Cloud computing at a glance, Historical Developments, Building cloud computing environments, Computing Platforms and Technologies

Module-II

Principles of Parallel and Distributed Computing

Eras of computing, Parallel vs. Distributed computing, Elements of parallel computing, Elements of distributed computing, Technologies for distributed computing

Module-III

Virtualization

Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples

Module-IV

Cloud computing architecture

Introduction, Cloud reference model, Types of clouds, Economics of the cloud, Open challenges

Module-V

Cloud platforms in industry and Cloud applications

Amazon web services, Google app engine, Microsoft azure, Observations, Scientific applications, Business and Consumer applications

Module-VI

Cloud Breaks

Cloud compliance, Data confidentiality and interoperability challenges, Security issues to cloud computing, securing the cloud

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Module-VII

Advanced Topics in cloud computing

Energy efficiency in clouds, market based management of clouds, Federated clouds/ InterCloud, Third party cloud services

Text Books:

1. Rajkumar Buyya, C. Vecchiola, S. Thamarai Selvi,Mastering Cloud Computing, McGraw Hill
2. Nick Antonopoulos and Lee Gillam, Cloud Computing: Principles, Systems and Applications, Editors, springer publication

Reference Books:

1. Borko Furht Armando Escalante, Hand book of Cloud Computing, Editors, springer Publication.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publication.
3. John W. Rittinghouse, JamesF. Ran some, Cloud Computing: Implementation, management and security, CRC Press, Taylor and Francis Publication.

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TIT 2015 COMPUTATIONAL BIOLOGY

Module -I

Computational Gene Hunting: Introduction, Genetic Mapping, Physical Mapping, Sequencing, Similarity Search, Gene Prediction, Mutation Analysis, Comparative Genomics.

Module -II

Restriction Mapping: Introduction, Double Digest Problem, Multiple Solution of Double Digest Problem, Alternating Cycles in Coloured Graphs, Physical Maps and Alternating Eulerian Cycles, Partial Digest Problem, Homometric Sets, Some Other Problems.

Module -III

Map Assembly: Introduction, Mapping with Non-Unique Probes, Mapping with Unique Probes, Interval Graphs, Mapping with Restriction Fragment Fingerprints.
Sequencing: Introduction, Overlap, Layout and Consensus, Shortgun Sequencing, Shortest Superstring Problem.
Module -IV

Sequence Comparison: Introduction, Longest Common Subsequence Problem, Sequence alignment, Local Alignment, Gap Penalties, Space Efficient Alignment, Generalized Sequence Alignment and Duality, Approximate String Matching, Comparing a Sequence Against a Database, Multiple Filtration.
Module -V

Multiple Alignment: Introduction, Scoring a Multiple Alignment, Assembling Pairwise Alignment, Approximation Algorithm for Multiple Alignments, Assembling l-way alignments, Dot-Matrices and Image Reconstruction, Multiple Alignment via Dot-Matrix Multiplication.

Module -VI

Gene Prediction: Introduction, Statistical Approach to Gene Prediction, Similarity-Based Approach to Gene Prediction, Spliced Alignment, Reverse Gene Finding, Alternative Splicing, Hidden Markov Model.

Module -VII

Genome Rearrangements: Introduction, Breakpoint Graph, "Hard-to-Sort" Permutations, Reversal Distance, Signed Permutations, Interleaving Graphs and Hurdles, Safe Reversals, Clearing Hurdles, Sorting by Reversals, Duality Theorem, Genome Duplications.

TEXT BOOK:

1. Pavel A. Pevzner, Computational Molecular Biology - An Algorithmic Approach MIT Press, 2000.

REFERENCE BOOKS:

1. An Introduction to Bioinformatics Algorithms by Neil C. Jones and Pavel A. Pevzner, MIT Press, 2004.
2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bioinformatics Benjamin Cummings, 2003.

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TIT 2017 SOFTWARE METRICS

Module –I

Introduction: Quality - Software Quality - Total Quality Management - Software Development Process Models. Fundamentals in Measurement - Basic Measures - Reliability and Validity - Measurement Errors - Assessing Reliability - Correction for Attenuation. Software Quality Metrics - Product Quality – Defect Density -Customer Problems, Satisfaction - In-Process Quality - Defect Density - Defect Removal -Defect Arrival - Metrics for Software Maintenance.

Module –II

Tools in Software Development: Tools in Software Development - Ishikawa's Seven Basic Tools – Checklist - Pareto Diagram – Histogram - Run Charts - Scatter Diagram - Control Chart - Cause-and-Effect Diagram - Relations Diagram. Defect Removal Effectiveness - Phase-Based - Process Maturity Level. The Rayleigh Model - Reliability Models - Reliability and Predictive Validity. Exponential Distribution and Reliability Growth Models - Jelinski-Moranda Model - Little wood Models - Goel-Okumoto Model - Musa-Okumoto Model – Model Evaluation.

Module -III

Process Metrics: In-Process Metrics for Software Testing - Test Progress S Curve - Testing Defect Arrivals Over Time - Product Size Over Time - CPU Utilization - Effort/Outcome Model. Complexity Metrics and Models - Lines of Code - Halstead's Software Science - Cyclomatic Complexity. - Syntactic Constructs – Structure Metrics. Metrics for Object-Oriented Projects - Concepts and Constructs - Design and Complexity Metrics- Lorenz Metrics and Rules of Thumb - CK OO Metrics Suite - Productivity Metrics.

Module -IV

Metrics & Assessments: Availability Metrics - Definition and Measurements - Reliability, Availability, and Defect Rate.Measuring and Analyzing Customer Satisfaction - Surveys - Data Collection - Sampling Methods - Analyzing Satisfaction Data. Conducting In-Process Quality Assessments - Preparation - Evaluation - Quantitative Data - Qualitative Data - Evaluation Criteria - Overall Assessment - Recommendations and Risk Mitigation. Conducting Software Project Assessments - Audit and Assessment - Process Maturity – Process Assessment Cycle - Assessment Results - Reports.

Module –V

Software Process Improvement: Measuring Process Maturity - Process Capability - Value of Process Improvement - Process Adoption - Process Compliance. Function Point Metrics to Measure Software Process Improvement – Software Process Improvement Sequences - Process Improvement Economics - Measuring Process Improvements at Activity Levels.

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Module -VI&VII

Evaluating Software Engineering Technologies Through Measurement: The Uncertainty of Reliability Achievement methods, Actual Promotional Claims for Formal Methods, Use of Measurement in evaluating methods, Empirical evidence about Software Engineering, Management before technology, Formal methods for safety critical systems, Efficacy of formal methods, Class size driven metrics supported for risk management and decision making.

TEXT BOOKS:

1. Stephen H. Kan, Metrics and Models in Software Quality Engineering, Addison Wesley, 2002.

2. Norman E. Fenton, Shari Lawrence Pfleeger, Software Metrics: A Rigorous and Practical Approach, PWS Pub. Co., 1998.

REFERENCE BOOKS:

1. Mark Lorenz, Jeff Kidd, Object-Oriented Software Metrics, Prentice Hall, 2000.

2. Robert B. Grady, Deborah L. Caswell, Software Metrics: Establishing a Company-wide Program, Prentice Hall, 1987.

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TIT 2019 APPLIED COMPUTR VISION

Module –I

Image Formation and Image Models: Human eye, Cameras, Camera models, Camera Calibration, Light sources, Color, Color models.

Module –II

Early Vision: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Normalized Correlation and Finding Patterns, Scale and Image Pyramids.

Module –III

Edge Detection and Texture : Noise, Estimating Derivatives, Detecting Edges, Representing Texture, Analysis using Oriented Pyramids, Application: Synthesizing Textures for Rendering, Shape for Texture for Planes.

Module -IV

Segmentation: Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering, segmentation by fitting a model.

Tracking: Tracking with linear dynamic model.

Module –V

Finding Templates using Classifiers: Method for Building Classifiers, Building Classifiers from class histograms,

Feature Selection, Neural Networks, Support Vector Machine.

Module -VI and VII

Recognition by Relations between Templates: Finding Objects by Voting on Relationsbetween Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to PruneSearch, Hidden Markov Models, HMM and

Application: Sign Language understanding using HMM, automated recognition of people withHMM.

TEXT BOOK:

1. David A.Forsyth, Jean Ponce, Computer Vision-A Modern Approach, PHI, 2003.

REFERENCE BOOK:

1. Digital Image Processing and Computer Vision, 1/e, by Sonka.

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TIT 2021 PATTERN RECOGNITION AND APPLICATION

Module -I

Introduction: Machine perception, pattern recognition examples, structure of a pattern recognition system, design cycle, learning and adaptation.

Module -II & III

Bayesian Decision Theory: Introduction**,** Bayesian decision theory-continuous features, minimum error rate classification, classifiers, discriminant functions and decision surfaces, normal density, discriminant functions for the normal density, Bayes decision theory-discrete features.

Maximum Likelihood and Bayesian Parameter Estimation: Maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation: Gaussian case, Problems of dimensionality, Hidden Markov Models.

Module -IV

Nonparametric Techniques: Density estimation, parzen windows, k-nearest neighbor estimation, nearest neighbor
rule, nearest neighbor classification.

Module -V

Linear Discriminant Functions: Linear Discriminant Functions and decision surfaces, generalized linear discriminant functions, The two category linearly separable case, minimizing the perceptron criterion function, relaxation procedures, nonseparable behavior, minimum squared error procedures, support vector machines.

Module -VI

Supervised Learning: Multilayer neural network, Backpropagation algorithm, error surfaces, Backpropagation as feature mapping.

Module -VII

Unsupervised Learning and Clustering: Mixture densities and identifiably, maximum likelihood estimates, applications to normal mixtures, Bayes classifier, similarity measures, criterion functions for clustering.

Application of Pattern recognition: Handwritten digitrecognition using pattern recognition principle.

TEXT BOOK:

2. R.O.Duda et.al- Pattern Classification 2nd Edn, John Wiley, New York, 2002.

REFERENCE BOOKS:

1. Theodoridis & Koutroumbas, Pattern Recognition, Academic Press.
2. Maddipati Narasimha Murty, V. Susheela Devi, Pattern Recognition: An Algorithmic Approach, Springer.
3. Sankar K. Pal, Amita Pal, Pattern Recognition: From Classical to Modern Approaches, World Scientific.

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TIT 2023 OPERATION RESEARCH

Module –I and II

Formulation of Engineering Optimization Problems: Decision variables, objective function and constraints.Example of typical design, operation and maintenance problems in engineering : Design of a water tank,design of a truss, design of a network (electrical, communication sewerage and water supply networks),product mix problem, transportation and assignment problems, shift scheduling of employees, design of reliable devices, design of reactors, shortest route problem, set covering problem, traveling salesman problems.

ModulE –III

Linear Programming Problem: Formulation, Graphical solution, Simplex method, Duality theory, Dual simple method, Formulation and solution of engineering problems of planning and scheduling.

Module -IV

Sensitivity Analysis, Transportation Problem, Assignment Problem, Network Models: Minimal Spanning Tree Problem, Maximal Flow Problem, Shortest Route Problem, Minimum Cost Flow Problem, Algorithms and applications.

Module –V

Integer Linear Programming Problem: Branch and Bound and Cutting Plane Methods,Zero-one Programming Problem, Knapsack Problem, Set covering Problem, Set Partitioning Problem, Traveling Salesman Problem.Deterministic Dynamic Programming Problems. Applications and algorithms.

Module -VI and VII

Queuing theory, Game theory, Simulation, Monte Carlo Simulation, Decision theory and Sequencing Problem.

TEXT BOOK:

1. Hamdy A. Taha, *Operations Research*: An Introduction, Pearson India.

REFERENCE BOOKS:

1. D. T. Phillips, A Ravindran and J.J. Solaberg, Principles of Operation Research, John Wiley and Sons.
2. B.E Gillett, Introduction to operations research, TMH.

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TIT 2025 PARALLEL COMPUTING

Module –I

Need for Parallel Computing, Scope of Parallel Computing, Issues in Parallel Computing.

Module –II & III

Models of Parallel Computing: Taxonomy of Parallel Architectures, Networks: Dynamic Interconnection Networks, Static Interconnection Networks, Message Transfer, Reduction, Parallel Prefix, process and thread models.

Module -IV

Performance Modelling: Metrics, Granularity, Scalability, Overhead, Iso-efficiency

Principles of parallel algorithm design, decomposition techniques, mapping & scheduling computation.

Module -V

Matrix Algorithms: Matrix Partitioning, Matrix Transposition, Matrix Vector Multiply, Matrix Multiply, CUDA, vector add, matrix multiply, sequence alignment, Linear Equations, LU(P) Decomposition.

Module -VI

Searching and Optimization: The knapsack problem, Branch and Bound, Dynamic Programming.

Sorting: Sorting networks, Radix / Bucket sorts.

Module -VII

Graph algorithms: Minimum Spanning Tree, Single Source Shortest Paths, All Pairs Shortest Paths

Fast Fourier Transforms: Fourier Series, basis functions, Euler, Discrete and Fast Fourier Transforms.

TEXT BOOK:

1. Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, Introduction to Parallel Computing, Second Edition, Addison-Wesley, 2003, ISBN: 0201648652.

REFERENCE BOOK:

1. M. J. Quin, *Parallel Computing: Theory and Practice*, McGraw Hill, New York, 1994.

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TIT 2027 NATURAL LANGUAGE PROCESSING

Module-I

Introduction to NLP, NLP tasks in syntax, semantics, and pragmatics, Applications such as information extraction, question answering, and machine translation, The problem of ambiguity,The role of machine learning. Brief history of the field.

Module-II

N-gram Language Models, The role of language models, Simple N-gram models, Estimating parameters and smoothing, Evaluating language models.

Module-III

Parts of Speech Tagging and Sequence Labeling : Lexical syntax, Hidden Markov Models, Maximum Entropy Models, Conditional Random Fields.

Module-IV

Syntactic parsing : Grammar formalisms and treebanks, Efficient parsing for context-free grammars (CFGs),Statistical parsing and probabilistic CFGs (PCFGs), Lexicalized PCFGs.

Module-V

Semantic Analysis: Lexical semantics and word-sense disambiguation, Compositional semantics, Semantic Role Labeling and Semantic Parsing.

Module-VI

Information Extraction (IE): Named entity recognition and relation extraction, IE using sequence labeling.

Module-VII

Machine Translation (MT): Basic issues in MT, Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

TEXT BOOK:

1. Jurafsky, D. and J. H. Martin, Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Second Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.

REFERNCE BOOKS:

1. Tanveer Siddique and U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford Unv. Press, New Delhi, India, 2008.
2. Allen, J.: Natural Language Understanding, The Benajmins/Cummings Publishing Company Inc. 1994.

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TIT 2117 SOFTWARE METRICS

Module-I

Measurement: Measurement in everyday life, The scope of software metrics, The basics of measurement- The representational theory of measurement, measurement and models, measurement scales and scales types.

Module-II

Goal based framework for software measurement: Classifying software measure, determining what to measure, applying the framework, software measurement validation, software measurement validation in practice.

Module-III and IV

Measuring internal product attributes: Size- Aspect of software size, Length, reuse, functionality, complexity, Measuring internal product attributes: structure-Types of structural measures, control flow structure, modularity and information flow attributes, object-oriented metrics, data structure, difficulties with general complexity measures.

Module V

Measuring external product attributes: Modeling software quality, measuring aspects of quality.

Module VI

Resource management: Productivity, Teams and tools- the meaning of productivity, productivity of what, measuring productivity, teams, tools and methods.

Module VII

Making process predictions: good estimates, cost estimation: problems and approaches, models of effort and cost, problems with existing modeling methods, dealing with problems of concurrent estimation methods, implications for process prediction.

Text Book:

1. Norman E. Fenton and James Bieman, Software Metrics: A Rigorous and Practical Approach , Third Edition, 2015, CRC Press, Taylor and Francis Group, Newyork, London.

Reference Book

1. Capers Jones, Applied Software Measurement, Third Edition, McGraw Hill, 2008.
2. Stephan. H. Kan, Metrics and Models in Software Quality Engineering, Addison Wesley, 2002.

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Syllabus M.Tech IS Non-CBCS

TIS1101 MATHEMATICAL FOUNDATION OF INFORMATION SECURITY [3(3-0-0)]

Module 1 & 2

Fundamentals & Divisibility Theory: Well Ordering Principle, The Division Algorithm, Prime and Composite Numbers, Greatest Common Divisor, The Euclidean Algorithm, Least Common Multiple, Linear Diophantine Equations,.

Module 3&4

Congruence: Congruence, Linear Congruence, Divisibility Tests, Check Digits, Chinese Remainder Theorem, General Linear System, Wilson's Theorem, Fermat's Factorization Theorem, Fermat's Little Theorem, Fermat's Last Theorem, Euler's Theorem.

Module 5

Quadratic Congruence: Quadratic Residues, Legendre Symbol, Quadratic Reciprocity, The Jacobi Symbol, Quadratic Congruence with Composite Moduli.

Module 6&7

Multiplicative Functions: The Tau and Sigma Functions, Perfect Numbers, The Mobius Function, The greatest Integer Function, Euler's Function, Euler's Theorem, The Primality Tests, Primitive Roots for Prime, Pythagorean Tingles, Fermat's Last Theorem, Sum of Squares.

Text Book:

1. Thomas Koshy, "Elementary Number Theory with Applications", 2nd Edition, Academic Press, An Imprint of Elsevier.

Reference Book:

1. S.G. Telang, "Number Theory", Tata McGraw-Hill, New Delhi, 1996.
2. Hari Kishan, "Number Theory", Krishna Prakashan Media (P) Ltd.

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TIS1103 CODING AND INFORMATION THEORY [4(3-1-0)]

Module 1

Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measure for Continuous Random Variables, Source coding theorem, Huffman Coding, Shannon- Fano -Elias Coding, Arithmetic Coding , The Lempel-Ziv ,Algorithm , Run Length Encoding ,

And the PCX Format, Rate Distribution Function, Optimum Quantizer Design, Entropy Rate of a Stochastic Process, Introduction to Image Compression, The JPEG Standard for Lossless Compression, The JPEG Standard for Lossy Compression.

Module 2

Channel Capacity and Coding: Introduction, Channel Model, Channel Capacity, Channel Coding, Information Capacity Theorem, the Shannon Limit, Channel Capacity for MIMO System, Random Selection of Code. Error Control Coding (Channel Coding)

Module 3

Linear Block Codes for Error Correction: Introduction to Error Correction Codes, Basic Definitions, Matrix Description of Linear Block Codes , Equivalent Codes , Parity Check Matrix , Decoding of Linear Block Code ,Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check (LDPC) Codes , Optimal Linear Codes, Maximum Distance Separable (MDS) Codes, Bound on Minimum Distance, Space Time Block Codes.

Module 4

Cyclic Codes: Introduction to the Cyclic Codes, Polynomials, The Division Algorithm for Polynomials ,A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Burst Error Correction , Fire Codes, Golay Codes, Cyclic Redundancy Check(CRC) Codes, Circuit Implementation of Cyclic Codes.

Module 5

Bose –Chaudhuri Hocquenghem(BCH)Codes: introduction to the Codes , Primitive Elements, Minimal Polynomials, Generator Polynomials , in Terms of Minimal Polynomials, Some Examples if BCH Codes, Reed –Solomon Codes, Implementation of Reed –Solomon Encoders and Decoders, Performance of RS Codes Over Real Channels, Nested Codes.

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Module 6 & 7

Convolutional Codes: Introduction to the Convolutionnal Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolution Codes(Analytical Representation), Distance Notions for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Viterbi Decoding and Convolutional Codes , Distance Bounds for Convolutional Codes , Turbo Codes.

Trellis Coded Modulation : Introduction to TCM , The concept of Coded Modulation , Mapping by Set partitioning.

Text Book:

1. R. Bose, "Information theory Coding and Cryptography", 2nd Edn, McGraw-Hill, 2008

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TIS1019 CRYPTOGRAPHY AND NETWORK SECURITY **[3(3-0-0)]**

Module I
Introduction to the Concept of Security: Introduction, The Need of Security, Security Approaches, Principal of Security, Types of Attacks

Module II
Cryptographic Techniques: Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks

Module III
Computer-based Symmetric Key Cryptographic Algorithms: Introduction, Algorithm Types and Models, An Overview of Symmetric Key Cryptography, Data Encryption Standard(DES), International Data Encryption Algorithm(IDEA), RC5, Blowfish, Advanced Encryption Standard(AES), Differential and Linear Cryptanalysis

Module IV
Computer-based Asymmetric Key Cryptographic Algorithms: Introduction, Brief History of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm, Some Other Algorithms

Module V
Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography standard(PKCS), XML, PKI and Security

Module VI
Internet Security Protocols : Basic Concepts, Security Socket Layer (SSL), Secure Hyper Text Transfer Protocol (SHTTP), Time stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol(WAP) Security, Security in GSM

Module VII
Network Security: Brief Introduction to TCP/IP, Firewalls, IP Security, Virtual Private Networks (VPN)

Text Book:

Atul Kahate – Cryptography and Network Security , 2nd Edition Tata McGraw Hill Publication, New Delhi-2006

Reference Book:

1. Behrouz A. Forouzan and D. Mukhopadhyay- Cryptography & Network Security, 2nd Edition - 1st reprint 2010, McGraw Hill, New Delhi.
2. Wade Trapple, Lawrence C. Washington- Introduction to Cryptography with coding Theory, 2nd Edition pearson Education

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Semester – II

TIS2003 DATABASE SECURITY **[3(3-0-0)]**

Module -1

Introduction- Trends, Supporting technology for database and application security, Discretionary security in database systems, Multilevel secure data management, Multilevel secure relational data models and systems, Inference problem, Secure distributed database system, Secure object and multimedia data systems, Data warehousing, data mining security & privacy , Secure web information management technologies.

Module –2

Data management technologies –Relational and E-R data models, Architectural issues , database design , database administration, data management system functions, distributed database, heterogeneous database integration, federated databases, client/server databases, migrating legacy databases and applications, data warehousing, data mining, impact of the web, object technology, other database systems.

Module-3

Information security- Access control and other security concepts, secure systems, secure operating systems, secure networks, emerging trends, impact of the web, steps to building secure systems.

Information Management Technologies- Overview, information retrieval systems, multimedia data and information management, Digital libraries, knowledge Management, collaboration and data management, E-commerce technologies , semantic web technologies, wireless and sensor information management, real time processing and QOS aspects, high-performance computing technologies, other information management technologies.

Module-4

Security policies –Access control policies , administration policies, identification and authentication, auditing a database system , views for security.

Policy enforcement & related issues– Overview, SQL extensions for security, query modification, discretionary security and database functions, visualization of policies, prototypes and products.

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Module-5

Historical developments- Early efforts, Air force summary study, major research and development efforts , trusted database interpretation , types of multilevel secure database systems, hard problems, emerging technologies .

Design principles– Mandatory access control, security architectures.

Module-6

Multilevel relational data models–Granularity of classification , polyinstantiation, developing a standard multilevel relational model

Security impact on database function–Query processing, transaction processing, storage management, metadata management, other functions.

Module-7

A perspective of the inference problem- Statistical database inference , discussion on approaches for handling inference in a MLS/DBMS, complexity of the inference problem.

Text Book:

1. Bhavani Thuraisingham, "Database & application security (Integrity information security & Data Management)", Auer bach Publication Taylor & Francin Group

Head of Department

TIS2105 DISTRIBUTED SYSTEMS [4(3-1-0)]

Module 1

Characterization of Distributed System : Introduction, example of distributed system, Resources sharing the web, challengers.

Module 2

Networking & Internetworking : Types of network, network principles, internet protocol, network care studies, Ethernet, wireless LAN & ATM.

Module 3

Models of Distributed Systems : Shared Memory Systems, Message Passing Systems, Parallel Programming Concepts.

Module 4

Time & Global states : Introduction, clocks, events & process status, synchronizing physical clocks, logical time & logical clocks, global states.

Module 5

Coordination & agreement : Distributed mutual exclusion, elections, multicast communication

Module 6

Transaction & concurrency control : Introduction, transactions, flat & noted Distributed transaction transactions, clocks, optimistic, concurrency control, time stamp ordering, atomic commit protocols, concurrency control in Distributed transaction

Module 7

Distributed deadlocks, transaction recovery, Replications: Introduction, system model & group communication, fault- tolerant services

Text Book :

1. George Couluris, Jean Dollimore, "Distributed Systems Concepts & Design", Pearson education, 3rd edition, 2006.
2. N.A. Lynch: Distributed Algorithms, Morgan Kayfmann Publishing Inc., CA, 1996.

Reference Book :

1. Andrew S. Tanenbaum, Maarten Van Steen, "Distributed System: Principles & Paradigms, Prentice Hall, 2007

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TIS2031 DATA COMPRESSION AND DATA HIDING [3(3-0-0)]

Module 1

Basic techniques: Run length encoding, RLE text compression, RLE image compression

Statistical methods: Shanon Fano coding, Huffman coding, Adaptive Huffman coding

Module 2

Dictionary methods: String compression, LZW, Zip, Gzip, CRC

Image compression: Approaches, image transform, JPEG, Progressive image compression

Module 3

Wavelet methods: Fourier transform, Fourier image compression, Haar transform

Video compression: Analog video, Digital video, video compression, MPEG

Module 4

Audio compression: Sound, Digital audio, u law and A- law companding , human auditory system, ADPCM data compression, MLP Audio, Speech compression

Module 5

Introduction: What is Data Hiding? Forms of Data Hiding Properties of Steganographic Communications , The Steganographic Channel

Frameworks for Data Hiding : Signal Processing Framework

Module 6

Communication with Side Information and Data Hiding : Costa's Framework ,A Framework Based on Channel Adaptive Encoding and Channel Independent Decoding , On the Duality of Communications and Data Hiding Frameworks

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Module 7

Type I (Linear) Data Hiding : Linear Data Hiding in Transform Domain , Problem Statement 4.3 Capacity of Additive Noise Channels 4.4 Modeling Channel Noise ,Visual Threshold , Channel Capacity vs. Choice of Transform

Type II and Type III (Nonlinear) Data Hiding Methods , Type II Embedding and Detection ,Type III Embedding and Detection Methods

Text books:

1. David Saloman, "Data Compression", 4th edition, Springer

2. Husrev Sencar, Ali Akansu, "Data Hiding Fundamentals and applications Content security in digital multimedia" , Elsevier Academic Press

Reference Books:

1. Nelson, "The Data Compression Book", BPB.

2. Atul Kahate , "Cryptography & Network Security", TMH.

3. B. Forouzan , "Cryptography and Network Security", Tata McGraw-Hill.

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Elective – I

TIS1007 SECURITY IN COMPUTING **3[3-0-0]**

Module 1

Introduction : What does Secure mean? Attacks , The meaning of computing security Computer criminals, Methods of defense .

Program Security: Secure Programs, Nonmalicious program Errors, Viruses and other Malicious code , Targeted Malicious code, controls against program threats.

Module 2

Protection in general –purpose operating systems: protected objects and Methods of protection , Memory and Address protection control of access to general objects, File protection Mechanisms , user authentication.

Module 3

Designing Trusted Operating Systems : what is a Trusted system? Security Policies Methods of security, trusted operating system design, Assurance in Trusted operating system.

Module 4

Database Security : Introduction to database , Security Requirements, Reliability and Integrity , Sensitive data, Inference, Multilevel databases, Proposals for Multilevel security.

Module 6

Administrating Security: Security planning , Risk analysis , Organization and security Policies, Physical Security.

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Module 7

Legal , Privacy and Ethical Issues in Computer Security: protecting Protecting Programs and data, Information and law , Rights of Employer Security , Case studies of Ethics .

Text Book :

C.P.Pfleeger and S.L. Pfleeger, "Security in Computing", Pearson Edition, 3rd Edition , 2005.

Head of Department

TIS1009 MOBILE & WIRELESS NETWORKS 3[3-0-0]

Module-1

INTRODUCTION

Fundamentals of Wireless Communication - Transmission fundamentals – Wireless Communication Technology - Antennas and Propagation, Spread Spectrum, Modulation Techniques, Coding and Error Control.

Module-2

WIRELESS NETWORKING, WIRELESS LANS & PANS

Wireless Networking – Satellite Communication, Cellular Wireless Networks, Mobile IP and Wireless Access Protocol, Wireless LANs -Wireless LAN Technology, IEEE 802.11 Wireless LAN Standards, Bluetooth, HIPERLAN Standard, Home RF.

Module-3

AD-HOC WIRELESS NETWORKS & SECURITY

Introduction - Issues in Ad Hoc Wireless Networks - Classifications of MAC Protocols-Classifications of Routing Protocols - Classifications of Transport Layer Protocols-Classification of Energy Management Schemes – Wired Equivalent Privacy(WEP) – The Extensible Authentication Protocol - Security in Ad Hoc Wireless Networks.

Module-4

WIRELESS SENSOR NETWORKS

Introduction - Sensor Network Architecture - Data Dissemination - Data Gathering -MAC Protocols for Sensor Networks - Location Discovery - Quality of a Sensor Network Evolving Standards - Other Issues.

Module-5

RECENT ADVANCES IN WIRELESS NETWORKS

Ultra-Wide-Band Radio Communication - Wireless Fidelity Systems - Optical Wireless Networks - The Multimode 802.11 -IEEE 802.11a/b/g - The Meghadoot Architecture - Next-Generation Hybrid Wireless Architectures.

Module -6

Cellular Mobile Wireless Networks: Systems and Design Fundamentals, Propagation Models Description of cellular system, Frequency Reuse, Co channel and Adjacent channel interference, Propagation Models for Wireless Networks, Multipath Effects in Mobile Communication, Models for Multipath Reception

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Module -7

Evolution of Modern Mobile Wireless Communication System -First Generation Wireless Networks, Second Generation (2G) Wireless Cellular Networks, Major 2G standards, 2.5G Wireless Networks, Third Generation 3G Wireless Networks, Wireless Local Area Networks (WLANs), Cellular –WLAN Integration, All- IP Network: Vision for 4G

TEXT BOOKS

(Modules 1-5)

1. William Stallings, Wireless Communications and Networking, Pearson Education,2nd Edition, 2005.(Modules 6&7)

2. Theodore S. Rappaport, "Wireless Communication": Principles and Practice,2nd Edition. Prentice Hall of India, 2005.

REFERENCE BOOKS

1. Siva Ram Murthy C, Manoj B.S, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall, 2004.

2. William C.Y.Lec, Mobile Cellular Telecommunication, Analog and Digital Systems, McGraw Hill Inc.

3. Kaveh Pahlavan and Prashant Krishnamurthy, Principles of Wireless Networks,

Pearson Education Asia, First Edition, 2002.

4. Rappaport T.S, Wireless Communications: Principles and Practice, Prentice Hall.,

2nd Edition.

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TIS1011 SECURITY IN GRID COMPUTING 3[3-0-0]

Module 1

Grid Computing Overview, Characteristics of secure system, security threats, Different Encryption & Authentication Schemes, Different Integrity, Message Authentication Code (MAC) Keyed MAC, Standard Protocols, Public Key Infrastructure, Secure Socket Layer (SSL), Kerberos , IP Security (IPSec).

Module 2

Grid Security Taxonomy, Architecture Related Issues, Information Security, Authorization, Service Security, Infrastructure Related Issues, Host Security Issues, Network Security Issues, Credential Management, Trust Management, Monitoring.

Grid Security Infrastructure (GSI), Grid Security Model, Authorization in GSI, Certificate based Authentication, Password based Authentication, Integration with Kerberos, Delegation in GSI,

Module 3

Different Access Control Models, Push vs. Pull Authorizations, Characteristics of Grid Authorization Systems, Scalability Issues, Security Issues, Revocation Issues, Inter-Operability Issues, Grid Authorization systems, Community Authorization Service (CAS), Virtual Organization Membership Service (VOMS), Enterprise Authorization and Licensing Service (EALS), Resource Level Authorization Systems, Akenti, Privilege and Role Management Infrastructure Standards validation (PERMIS) project comparison.

Module 4

Components of Service, Service Vulnerabilities, DoS Attacks and Countermeasures, Effect of DoS Attacks, Distributed Denial-of–Service Attacks, Existing DoS Countermeasures, Preventive DoS Countermeasures, Reactive DoS Countermeasures, Comparison between DoS Countermeasures, QoS Violation Attacks and Countermeasures, Different types of QoS Violation Attacks.

Data Protection Issue, Application Level Sandboxing, Virtualization, Flexible Kernel Systems, Sandboxing, Job Starvation Issue, Advanced Reservation Techniques, Priority Reduction Techniques.

Module 5

Grid Network Security Issues, Firewalls, Firewalls and Grid Issues, Firewalls and Web Services, Virtual Private Networks (VPN), VPN and Grid –Types of VPNs, VPNs and Grid-Issues, VPNs and Grid-some Solutions, Secure Routing, Impacts of Routing Table “Poisoning”, Different Routing Protocols, Routing Attacks and Countermeasures, Multicasting, Secure Multicasting, Sensor Grids, Security in Sensor Networks-Issues, High Performance Interconnects, 10-Gigabit Ethernet, Infiniband Architecture(IBA).

Module 6

Types of Credentials, Characteristics of Credential Management Systems, Different Credential Management Systems, Centralized Vs. Federated Credential Management, Credential Repositories, Smart Cards, Virtual Smart Cards, My Proxy Online Credential Repository, Federated Credential Management Systems, Virtualized Credential Manager (VCMan), KX.509.

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Module 7

Reputation and Trust, Categories of Trust Functions, Trust Management Systems, Life Cycle, Characteristics, Reputation-Based Trust Management Systems, PeerTrust-A P2P Trust Management System, XeonTrust, NICE, Secure Grid Outsourcing (SeGO) System, Policy-Based Trust Management Systems, PeerTrust Trust Negotiation, TrustBuilder, Trust Negotiation for the Grid, Comparing the Trust Management Systems, Applicability of the Trust Management Systems. Stages of Monitoring, Requirements of Distributed Monitoring System, Grid Monitoring Architecture (GMA)

Text Book :

1. Anirban Chakrabarti ,"Grid Computing Security", Spinger Verlag Berlin Heidelberg, NewYork, 2007

Reference Books :

1. Joshy Joseph & Craig Fellenstein, "Grid Computing", Pearson/PHI PTR- 2003.

2. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, "Grid Computing: Making

the Global Infrastructure a reality", John Wiley and Sons, 2003.

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TIS1013 ADVANCED COMPUTER NETWORKS 3[3-0-0]

Module 1 & 2

FUNDAMENTALS OF COMMUNICATION NETWORKS

Layers and standards-Packet and circuit switching- Protocols TCP/IP-Ipv6 addressing and routing.-Technical background- Signals and interference- Modulation and encoding-Switching and Multiplexing- Coding and error control.

Module 3

NETWORK SECURITY

Requirement-Encryption- Decryption- Message authentication and digital signature-Security in IP- QoS principles and protocols-Differential Service-RSVP and MPLS

Module 4 & 5

INTERNETWORKING

VLAN-Addressing and routing-network layer protocols-unicast and multicast routing-Mobile IP routing-Ad hoc networks routing-Evolution in the Ethernet-Switched and fast Ethernet-Infrastructure-Scaling to Gigabit architectures-Performance consideration-Physical components and wire protocols.

Module 6

OPTICAL NETWORKS

Optical layers- Services and interfacing- Photonic packet switching- Access networks-Network survivability- Protection- Optical IP- OTN/SONET/SDH layers structure and design relation to 10 Gigbps Ethernet.

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Module 7

ADVANCED TOPICS

SAN (Storage Area Networks) and Infiniband architectures-Home networking- DSLcable modems- Zero copy systems-Intelligent networks-Future directions.

TEXT BOOK

1. Fourouzan B, “Data Communication and Networking”, McGraw-Hill, 2004.

REFERENCE BOOKS

1. Ramaswami R and Sivarajan K, “Optical Networks: A Practical Perspective”, Morgan Kaufmann, 2001.

2. Clark T, “IP SANs”, Addison Wesley, 2002.

3. Kurose J.F, Ross K.W, “Computer Networking, Top-down Approach Featuring the Internet”, Addison Wesley, 2005.

4. Tanenbaum A. S, “Computer Networks”, Prentice-Hall, 2003.

5. Stallings W, “High Speed Networks, Internet Performance and QoS”, Prentice-Hall, 2002.

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TIS1015 ADVANCED COMPUTER ARCHITECTURE 3[3-0-0]

Module 1

Parallel Computer Model

The State of Computing: Computer Development Milestones, Elements of Modern Computers, Evolution of Computer Architecture, System Attributes to Performance

Multiprocessors and Multicomputers: Shared-Memory Multiprocessors, Distributed memory Multicomputers, Taxonomy of MIMD Computers

Multivector and SIMD Computers: vector Supercomputers, SIMD Supercomputers

PRAM and VLSI Models: Parallel Random-Access Machines,VLSI Complexity Models

Architectural Development Tracks: Multiple-Processor Tracks, Multi vector and SIMD Tracks, Multithreaded and Dataflow Tracks

Module 2

Principles of Scalable Performance

Performance Metrics and Measures: Parallelism Profile in Programs, Harmonic Mean Performance, Efficiency, Utilization and Quality, standard Performance Measures

Parallel Processing Applications: Massive Parallelism for Grand Challenges, Application Models of Parallel Computers, Scalability of Parallel algorithms

Speedup Performance Laws: Amdahl's Law for a fixed Workload, Gustafson's Law for scaled Problems, Memory-Bounded speedup Model

Scalability analysis and Approaches: Scalability Metrics and goals, evolution of Scalable computers

Module-3

Processors and Memory Hierarchy

Advanced Processor Technology: Design Space of Processors, Instruction-set architectures, CISC Scalar Processors, RISC scalar Processors

Superscalar and Vector Processors: Superscalar Processors, The VLIW Architecture, Vector and Symbolic Processors

Module-4

Bus, cache, and shared Memory

Backplane Bus Systems: Backplane Bus Specification, Addressing and Timing Protocols, Arbitration, Transaction, and Interrupt, The IEEE Futurebus+ Standards

Cache Memory Organizations: Cache Addressing Models, direct Mapping and associative caches, set-associative and Sector caches, cache Performance Issues

Shared-Memory Organizations: Interleaved Memory Organization, Bandwidth and Fault tolerance, Memory allocation schemes

Sequential and weak consistency Models: atomicity and Event ordering, Sequential Consistency Model, Weak Consistency Models

Module-5

Head of Department

Pipelining and Superscalar techniques

Linear Pipeline Processors: asynchronous and synchronous Models, Clocking and timing control, Speedup, efficiency, and throughput

Nonlinear Pipeline Processors: reservation and Latency analysis, Collision-free Scheduling, Pipeline Schedule Optimization

Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction scheduling, Branch handling techniques

Arithmetic Pipeline Design: Computer arithmetic Principles, Static Arithmetic Pipelines, Multifunctional Arithmetic Pipelines

Superscalar and Superpipeline Design: Superscalar Pipeline Design, Superpipelined Design, Supersymmetry and design Tradeoffs

Module-6 & 7

Multiprocessors and Multicomputers

Multiprocessors system Interconnects: Hierarchical Bus Systems, Crossbar Switch and Multiport Memory, Multistage and Combining Networks

Cache Coherence and Synchronization Mechanisms: The cache Coherence Problem, Snoopy Bus Protocols, Directory-Based Protocols, Hardware Synchronization Mechanisms

Three Generations of Multicomputers: design Choices in the Past, Present and Future Development, The Intel Paragon System, Deadlock and virtual Channels, Flow Control Strategies, Multicast Routing Algorithms

Text Book:

1. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", Tata Mc-graw Hill, 2001.

Reference Books:

1. Nicolas P Carter, Computer Architecture and Organization, Tata McGraw Hill, 2nd Edition.

2. D. Sima, T Fountain and P Kacsuk, Advanced Computer Architecture: A Design space approach, Pearson education, 2000.

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Elective – II

TIS2007 STANDARDS AND EVALUATION CRITERIA **3[3-0-0]**

Module 1

Standards and the Standardization Process : Why Bother with Standards? International, National and Industrial Standards Bodies.

Security Mechanisms and Security Services : Introduction. The OSI Security Architecture. Security Services. Security Mechanisms.

Module 2

Non-Repudiation Mechanisms: Introduction. Standards for Non-Repudiation. Non-Repudiation Model and Services. Non-Repudiation using Symmetric Cryptography. Non-Repudiation using Asymmetric Cryptography.

Module 3

Authentication Protocols : Definitions and Notation. Standards for Entity Authentication Protocols. Cryptographic Mechanisms. Timeliness Checking Mechanisms. Authentication Using Symmetric Cryptography. Authentication Using Asymmetric Cryptography.

Module 4

Key Management Framework: Standards for Key Management. Definitions and Basic Properties. The General Framework. The ANSI X9.24 Framework.

Module 5 & 6

Key Establishment Mechanisms : Definitions and Basic Properties. Standards for Key Establishment. Physical Mechanisms. Mechanisms Using Symmetric Cryptography. Mechanisms Using Asymmetric Cryptography. Key Establishment Based on Weak Secrets. Key Establishment for Mobile Networks. Choosing a Key Establishment Scheme.

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Module 7

Cryptographic APIs : Standards for Crypto APIs. GSS-API. PKCS #11. Security Issues.

Text book :

1. Alex W. Dent and Chris J.Mitchell, Users guide to cryptography and standards

Reference books :

1. Boyd and Mathuria, “Protocols for authentication and Key establishment”, Springer, Berlin Heidelberg
2. Menezes, Vanoorchsot, Vanstone, “Handbook of applied cryptography”, CRC Press

Head of Department

TIS2009 SECURITY ENGINEERING **3[3-0-0]**

Module 1 & 2

Intoduction to Security Engineering Usability and Psychology: Introduction ,A Framework ,Example 1–A Bank ,Example –A Military Base,Example –A Hospital ,Example –The Home ,Definitions. Attacks Based on Psychology , Pretexting , Phishing , Social Psychology Passwords Naive Password Choice, User Abilities and Training, Design Errors, Operational Issues , Social-Engineering, Attacks, Trusted Path, Phishing Countermeasures, Password Manglers, Client Certs or Specialist Apps, Browser's Password Database , Soft Keyboards , Customer Education, Microsoft Passport, Phishing Alert Toolbars , Two-Factor Authentication, Trusted Computing, Fortified Password Protocols, Two-Channel Authentication , The Future of Phishing, System Issues, Attacks on Password Entry, Interface Design, Eavesdropping, Technical Defeats of Password Retry Counters , Attacks on Password Storage, One-Way Encryption , Password Cracking

Module 3

Access Control :

Introduction , Operating System Access Controls , Groups and Roles , Access Control Lists , Unix Operating System Security , Apple's OS/X , Windows—Basic Architecture , Capabilities , Windows—Added Features Middleware , Database Access Controls , General Middleware Issues , ORBs and Policy Languages , Sandboxing and Proof-Carrying Code , Virtualization, Trusted Computing.

Module 4

Multilevel Security :

Introduction , Security Policy Model, The Bell-LaPadula Security Policy Model , Classifications and Clearances , Information Flow Control, The Standard Criticisms of Bell-LaPadula , Alternative Formulations

The Biba Model and Vista , Historical Examples of MLS Systems , SCOMP , Blacker MLS Unix and Compartmented Mode Workstations , The NRL Pump , Logistics Systems, Sybard Suite , Wiretap Systems Future MLS Systems , Vista , Linux , Virtualization , Embedded Systems , Composability.

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Module 5

Multilateral Security :

Introduction , Compartmentation, the ChineseWall and the BMA Model Compartmentation and the Lattice Model , The Chinese Wall , The BMA Model , The Threat Model , The Security Policy , Pilot Implementations

Current Privacy Issues , Inference Control , Basic Problems of Inference Control in Medicine , Other Applications of Inference Control , The Theory of Inference Control , Query Set Size Control , Trackers , More Sophisticated Query Controls , Cell Suppression , Maximum Order Control and the Lattice Model, Audit Based Control, Randomization , Limitations of Generic Approaches , Active Attacks , The Value of Imperfect Protection , The Residual Problem

Module 6

Emission Security :

Introduction , Technical Surveillance and Countermeasures , Passive Attacks Leakage Through Power and Signal Cables , Red/Black Separation , Timing Analysis . Power Analysis , Leakage Through RF Signals , Active Attacks, Tempest Viruses , Nonstop , Glitching , Differential Fault Analysis , Combination Attacks , Commercial Exploitation , Defenses , Optical, Acoustic and Thermal Side Channels .

Module 7

System Evaluation and Assurance :

Introduction, Assurance , Perverse Economic Incentives , Project Assurance , Security Testing , Formal Methods , Quis Custodiet , Process Assurance, Assurance Growth , Evolution and Security Assurance Evaluation Evaluations by the Relying Party , The Common Criteria , Ways Forward , Hostile Review.

Text Book:

1. Ross Anderson, "Security Engineering", Wiley, 2nd, 2001.

Reference Book:

1. Ross Anderson, "Security Engineering - A Guide to Building Dependable Distributed Systems", Wiley, 2nd, 2008.

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TIS2015 SOFTWARE SECURITY **3[3-0-0]**

Module 1 & 2

Software Security Fundamentals

Defining a discipline: The security problem, security problem in software, Solving the problem 3 pillars of software security, The rise of security Engineering.

A Risk Management Framework: The five stages of activity , Applying the RFM, The importance of Measurement .

Module 3

Code review with a tools: Catching implementation Bugs early (with a tool),

Approaches to static analysis , Tools from researcheland , Commercial tools vendors.

Module 4

Architectural risk analysis : Traditional risk analysis , Modern risk analysis**,** Architectural risk analysis ,

Module 5

Software penetrating testing : Peneteratration testing today , Incorporating findings
Back into development .

Risk Based security Testing: Risk management and security Testing , How to approach security testing , Thinking about (modeling) Input, Getting over Input.

Abuse Cases: Creating useful abuse cases,

Module 6

An Enterprise S/W security program: The Business climate building blocks of changes, Establishing a metric program, A three – step Enterprise Roll out Knowledge for S/W security

Security knowledge: A unified view.

Module 7

A Taxanomy of coding errors : Input validation & representation . API abuse Security Features, Errors handling, Code Quality, Encapsulation Environment

TEXT BOOK:

1. “SOFTWARE SECURITY: Building security In Gary McGraw”, Addison – Wesley Software Security Series, 2006

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TIS2017 INTRUSION DETECTION **3[3-0-0]**

Module 1

Defining Intrusion Detection , The history of intrusion & Detection: Audit: Setting The Stage for Intrusion Detection , The birth of intrusion Detection.

Module 2

Security concepts intrusion Detection concept, determining strategies for Intrusion Detection

Module 3

Information Sources : Host based information sources , Network based information sources, Information other security products,

Analysis Scheme: A model for intrusion Analysis, Techniques

Module 4

Responses: Requirement of Responses, types of responses, covering tracks during investigation, mapping responses of Policy

Module 5

Vulnerability Analysis, Credentialed approaches , Technical issues.

Module 6

Building Case for security , Defining Requirement for Ids, Integrating security into legacy environment

Module 7

For designer : Requirement, Security Design principles , Surviving the designing process. Future trends in technology, a vision for intrusion Detection.

Text Book :

1. Rebecca Gurley Bace, "Intrusion Detection", Macmillan Technical Publishing, 2000

Reference Book :

1. Stephen Northcutt & Jady Novak, "Network Intrusion Detection, 3rd Edition, New Riders Publishing, 2003

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TIS2121 BIOMETRIC SECURITY 3[3-0-0]

Module 1 & 2

Biometric Fundamentals: Introduction, Why biometrics, How Authentication Technologies work, Benefits of biometrics over traditional authentication systems, How Biometrics work, Benefits of biometrics in identification systems, Selecting a biometric for a system, Applications, Key biometric terms and processes, How biometric matching works, Accuracy in biometric systems.

Module 3

Types of Biometrics:

Fingerprints and Hand Geometry: Technical description, Characteristics, Competing technologies, Strengths–Weaknesses, Deployment.

Facial and Voice Recognition: Technical description, Characteristics, Strengths-Weaknesses, Deployment.

Module 4

Iris and Retina scanning: Technical description, Characteristics, Strengths – Weaknesses, Deployment. Retina vascular pattern.

Signature Recognition and Keystroke Dynamics: Signature Recognition and keystroke Dynamics

Module 5

Behavioral and Esoteric Biometric Technologies: Vein Pattern, Facial Thermography, DNA, Body Oder, Ear, Footprint and Foot Dynamics

Module 6

Issues Involving Biometrics: Biometric Liveness Testing, Biometric in Large-Scale Systems, Biometrics in Large-Scale Systems, Biometric Standards, Biometric Testing and Evaluation

Module 7

Privacy, Policy and Legal Concerns Raised by Biometrics: Biometrics and Privacy, Legal considerations of Government Use of Biometrics, Biometrics and the Feasibility of a National ID card, Case studies on Physiological, Behavioral and multifactor biometrics in identification systems.

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TEXT BOOKS :

1. John D. Woodward, Jr. Nicholas M. Orlans Peter T. Higgins, "Biometrics**",** dreamtech, 2003.

2. Samir Nanavathi,Michel Thieme,Raj Nanavathi,"Biometrics -Identity verification in a network", Wiley Eastern, 2002.

REFERENCE BOOKS :

1. John Chirillo and Scott Blaul," Implementing Biometric Security", Wiley EasternPublications, 2005.

2. John Berger," Biometrics for Network Security", Prentice Hall, 2004.

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TIS2025 CYBER CRIME **3[3-0-0]**

Module 1

Information Age and Cyber Crime: Cyber space-Historical Root of the Internet –Relationship between Computers and Law –Information Age: The Third Wave –The Economy: Knowledge-based From Information Super-Highway to the Information Society

The Nature and Concept Crime: Mental Element of crime- Brief History of Perspective of Criminal Law-Classification of Crimes –Criminals Responsibility –Theories of Aetiology of Crime –Theories and Objectives of Punishment- The "White-Collar" Crime Terrorism

Module 2

Cyber Crime: Definition of " Computer Crime"-Computer Crime categories : How Techno-Criminals Operate –Types of Computer Crime- Another System of Classification of Computer Crime on web – Special Problems Related with Computer –related Crime-Indian Scenario

Cyber Jurisdiction: Definition of Cyber Jurisdiction –The Model for Jurisdiction Analysis –Cyber jurisdiction –The Indian Context of Cyber Jurisdiction

Module 3 & 4

Cyber Crime and Criminal Codification in India: Offences by or Relating to Public Servants-Offences against the Public Tranquility –Offences Relating to the Army, Navy and Air Force – Offences against State – Offences Relating to Elections – Contempt of Lawful Authority of Public Servant-False Evidence and Offences against Public Servant- False Evidence and Offences against Public Justice –Offences Relating to Coin and Government Stamps –Offences Affecting the Public Health ,Safety ,Convenience ,Decency and Morals –Of Offences Relation to religion –Of Offences Affecting the Human Body-Offences against property –Offences Relation to documents and Property Marks- Of the Criminal Breach of Contract of Services- Of defamation-Of Criminal Intimidation, Insult and Annoyance-Of Attempts to Commit Offences

Module 5

Protection of Intellectual Property-II(Copyrights): Copyrights

Module 6

Cyber Fraud and Electronic Misuse: Definition of Computer Fraud or Cyber Fraud – Characteristics Cyber Fraud Offence –How victim are Deceived?- How the Victims of Cyber Fraud are Deceived?- fraud related Offenses

Module 7

Protection of Cyber Crimes: Encryption in Crime and Terrorism- Law Enforcement Options- Other Technologies for Hiding Evidence – Concealing Crimes though Anonymity

TEXT BOOK:

1. R.K.Suri and T.N. Chhabra ,"Cyber Crime", Pentagon Press New Delhi ,2002.

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TIS2027 DIGITAL FORENSICS **3[3-0-0]**

Module 1 & 2

Digital Investigation Foundations: Digital Investigations and Evidence, Digital Crime Scene Investigation Process, Data Analysis, Overview of different Toolkits.

Computer foundations: Data organizations, Booting Process, Hard Disk Technology.

Hard Disk Data Acquisition: Introduction, Reading the source Data, Writing the output data, A case study using the dd Tool.

Module 3 & 4

Volume Analysis: Introduction, Volume Concepts, General Theory of Partitions, General Theory of Volume Assembly, Sector Addressing.

PC-based Partitions: DOS Partitions, Analysis Considerations, Apple Partitions,Removable Media

Server-based Partitions: BSD Partitions, Sun Solaris Slices, GPT Partitions.

Multiple Disk Volumes: RAID, Disk Spanning.

Module 5

File System Analysis and FAT Concepts and Analysis: File System Category, Content Category, Metadata Category, File Name Category, Application Category, Application-level Search Techniques, Specific File Systems, FAT Data Structure.

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Module 6

New Technology File System Concepts: MFT Concepts, MFT Entry Attribute Concepts, Different Attribute Concepts, Indexes, NTFS Analysis, NTFS Data Structures.

Module 7

Ext2 and Ext3, UFS1 and UFS2 Concepts and Analysis, Ext2 and Ext3, UFS1 and UFS2 Data Structures.

Text Book :

1. Brain Carrier, "File System Forensic Analysis", Addison Wesley Professional, 2005

Reference Book :

1. Dan Farmer & Wietse Venema, "Forensic Discovery", Addison Wesley, 2005

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TIS2029 SECURITY MANAGEMENT, AUDIT ASSURANCE AND RISK MANAGEMENT

3[3-0-0]

Module 1 & 2

Essentials of computer security - Sources of security threats – Intruders, Viruses, Worms and related threats - Threat identification - Threat analysis - Vulnerability identification and Assessment - Components of Computer Security - Physical security – System access control - Goals of Security - Efforts to secure computer networks – Ethical issues in Computer Security- Operational issues, Human issues.

Module 3

Cryptography - Public Key Cryptography – Principles of Public Key Cryptosystems – The RSA Algorithm – Key Management – Authentication – Elements, types and methods – Digital Signature – Intrusion Detection System (IDS) – Types and challenges – Intrusion prevention system (IPS) – Firewalls - Design Principles, Scanning, filtering and blocking.

Module 4 & 5

Vulnerabilities – Sources of vulnerabilities, Vulnerability identification and Assessment, Cyber crime and Hackers, Viruses and content filtering - Security Assessment, Analysis and Assurance – Computer network security protocol and standards - Security Policies – Integrity policies – confidentiality policies - Security models - Access Control Matrix Model, Take-Grant Protection Model.

Module 6

Security Monitoring and Auditing - Assurance and Trust, Need for Assurance, Role of Requirements in Assurance, Audit Assurance in Software Development Phases, Building Secure and Trusted Systems - Designing an Auditing System, Implementation Considerations, Auditing to Detect Violations of a security Policy, Auditing Mechanisms, Audit Browsing.

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Module 7

Risk management and security planning – Risk management Process Overview- Cost-Benefit Analysis, Risk Analysis, Laws and Customs, Human Issues, Organizational issues - Information system Risk analysis – System approach to risk management, Threat assessment, Assets and safeguards, modes of risk analysis – Effective risk analysis, Qualitative Risk analysis, Value analysis

TEXT BOOK

1. Matt Bishop, "Computer Security: Art and Science", Addison-Wesley Professional, 2003.

REFERENCE BOOKS

1 Joseph M.Kizza, "Computer Network security", Springer, 2005

2. Matt Bishop, "Introduction to Computer Security", Addison-Wesley Professional, 2005.

3. Thomas R.Peltier, "Information Security Risk Analysis", CRC Press, 2001.

4. C.A.Roper, "Risk management for Security professional", Elsevier,1999.

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Syllabus ME SE Non-CBCS

MSE 1101 ADVANCED DATABASE MANAGEMENT SYSTEMS

Module 1 [5 lectures]

Review of basic concepts, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL

Module 2 [6 lectures]

Concurrency Control Techniques, Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking, Using Locks for Concurrency Control in Indexes, Other Concurrency Control Issues

Module 3 [5 lectures]

Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Recovery in Multidatabase Systems, Database Backup and Recovery from Catastrophic Failures

Module 4 [8 lectures]

Overview of Object-Oriented ConceptsObject Identity, Object Structure, and Type Constructors, Encapsulation of Operations, Methods and Persistence, Type and Class Hierarchies and Inheritance, Complex Objects, Overview of the Object Model of ODMG, The Object Definition Language ODL, The Object Query Language, OQL, Overview of the c++ Language Binding, Object Database Conceptual Design

Module 5 [8 lectures]

Overview of SQL and Its Object-Relational Features Evolution and Current Trends of Database Technology The Informix Universal Server, Implementation and Related Issues for Extended Type

Systems The Nested Relational Model, Active Database Concepts and Triggers Temporal Database Concepts Multimedia Databases, Introduction to Deductive Databases

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Module 6 [8 lectures]

Distributed Databases and Client-Server Architectures, Distributed Database Concepts, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Types of Distributed Database Systems, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, An Overview of 3-Tier Client-Server Architecture

Module 7 [5 lectures]

Data Modeling for Data Warehouses Characteristics of Data Warehouses Introduction, Definitions, and TerminologyBuilding a Data WarehouseTypical Functionality of a Data WarehouseData Warehouse Versus ViewsProblems and Open Issues in Data Warehouses, Mobile Databases Multimedia Databases Geographic Information Systems Genome Data Management

Text Book

Elmasri, Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education, India

Reference Books:

9. C.J. Date , An introduction to Database Systems, 7th Ed. Pearson Education, New Delhi, 2004
10. H. Korth et al. ,Database Management System Concepts, 3rd Ed., TMH, New Delhi,2002
11. B.Desai, Database Management Systems, Galgotia Publications, New Delhi,1998

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MSE1003 OBJECT ORIENTED MODELLING AND DESIGN

Module 1

Introduction and Modelling: *What Is Object-Oriented ? What Is Object Oriented Development ? Object Oriented Themes, Evidence for Usefulness of Object Oriented Development, Modeling, The Object Modeling Technique, Objects and Classes, Links and Associations, Advanced Link and Association Concepts, Generalization and Inheritance, Grouping Constructs, A Sample Object Model.*

Module 2

Advanced Object Modelling: *Aggregation , Abstract Classes, Generalization as Extension and Restriction Multiple Inheritance, Metadata, Candidate Keys, Constraints.*

Module 3

Dynamic Modelling: *Events and States, Operations, Nested State Diagrams, Concurrency, Advanced Dynamic Modelling Concepts, A Sample Dynamic Model, Relation of Object and Dynamic Model.*

Module 4

Functional Modelling: Functional Models, Data Flow Diagrams, Specifying Operations. Constraints A Sample Functional Model, Relation of Functional to Object and Dynamic Models.

Module 5

Methodology Preview and Analysis: OMT as a Software Engineering Methodology, The OMT Methodology, Impact of an Object-Oriented Approach, Overview of Analysis, Problem Statement, Automated Teller Machine Example, Object Modeling, Dynamic Modeling, Functional Modeling, Adding Operations, Iterating the Analysis.

Module 6

System Design: Overview of System Design, Breaking a System into Subsystems, Identifying Concurrency. Allocating Subsystems to Processor and Tasks Management of Data Stores, Handling Global Resources, Choosing Software Control Implementation, Handling Boundary conditions, Setting Trade-off Priorities, Common Architectural Frameworks, Architecture of the ATM System

Head of Department

Module 7

Object Design and Implementation: *Overview of Object Design, Combining the Three Models, Designing, Algorithms, Design Optimization, Implementation of Control, Adjustment of Inheritance, Design of Associations, Object Representation, Physical Packaging, Documenting Design Decisions. Implementation Using a Programming Language, Implementation using a Database System, Implementation Outside a Computer. Object-Oriented Style, Reusability, Extensibility, Robustness, Programming – in-the-Large.*

Text Book:

J.Rumbaugh et.al – Object Oriented Modeling and Design, PHI, New Delhi, 2003

Reference Book:

B. Bruegge and A. H. Dutoit. Object Oriented Software Engineering, 2nd Ed., Pearson Education,

New Delhi, 2004.

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MSE 1005 PROBABILITY AND STATISTICAL ANALYSIS

Module 1

Probability Theory: Random Experiment Mathematical or Apriori Definition of Probability, Statistical or Aposteriori Definition of Probability, Axiomatic Definition of Probability, Conditional Probability Independent Events, Theorem of Total Probability, Baye's Theorem or Theorem of Probability of Causes, Bernoulli's Trails De Moivre-Laplace Approximation, Generalisation of Bernoulli's Theorem Multinomial Distribution.

Module 2

Random Variables: Discrete Random Variable, Probability Function, Continuous Random Variable, Probability Density Function Cumulative Distribution Function, (cdf), Properties of the cdf F (x), Special Distributions, Discrete Distributions, Continuous Distributions, Two-Dimensional Random Variables, Probability Function of (x ,y),Joint Probability Density Function, Cumulative Distribution Function,Properties of F (x, y), Marginal Probability Distribution, Conditional Probability Distribution, Independent RVs, Random Vectors, Marginal Probability Distribution of X {i, pi*}, Marginal Probability Distribution of Y: {j, P*j}.

Module 3

Functions of Random Variables: Function of One Random Variable, One Function of Two Random Variables,Two Functions of Two Random Variables, Statistical Averages Expected Values of a Two-Dimensional RV, Properties of Expected Values, Covariance and Correlation, Properties, Conditional Expected Values, Characteristic functions, Properties of MGF, Properties of Characteristic Function ,Comulant Generating Function (CGF), Joint Characteristic Function (`CGF).

Module 4

Special Probability Distributions: Introduction, Special Discrete Distributions - Binomial, Poission, Geometric and Hyper geometric Distributions and their Properties (mean, Variance etc) Special Continuos Distributions- Uniform, Exponential, Erlang and Normal Distributions as There Properties.

Module 5

Tests of Hypotheses: Parameters and Statistics, Sampling Distribution, Estimation and Testing of Hypotheses, Tests of significance, errors, Tailed Tests, critical values, Student's T- Distribution, Snedecor's F- Distribution and Chi- square Distribution and Their uses and Properties.

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Module 6

Random Processes: Classification of Random Processes, Methods of Description of a Random Process, Special Classes of Random Processes, A verge Values of Random Processes, Stationarily, Example of a SSS Process, Analytical Representation of a Random Process, Autocorrelation Function and Its Properties of R (t),

Module 7

Special Random Processes: Definition of Gaussian Process, Properties, Processes Depending on Stationary Gaussian Process, Poisson Process, Probability Law for the poison Process {X (t)}, Second – Order Probability Function of a Homogeneous, Poisson Process, Mean and Autocorrelation of the Poisson Process, Properties of Poisson Process,Markov Process, Definition of a Markov Chain, Chapman – Kolmogorov Theorem, Classification of States of a Markov Chain

Reliability Engineering: Concepts of Reliability, Reliability of Systems, Maintainability and Availability.

Text Book:

T. Veerarajan – Probability, Statistical, Random Processes 2nd Ed., TMH, New Delhi, 2003.

Reference Books:

5. A. Papoulis & S.V. Pillai – Probability, random Variables and Stochastic Processes, 4th Ed., TMH, New Delhi.
2. S.M.Ross- Probability Models , 6th Ed. Harcourt Asia Pte Ltd, New Delhi, 2000.

- R.V. Hogg and A.T. Craig – Introduction to Mathematical Statistics, 5th Ed, Pearson Education, New Delhi, 2004.
- J.E. Freund and R.E. Walpole, Mathematical Statistics, 5th Ed., PHI, New Delhi, 2000.

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ELECTIVES

MSE 1123 COMPUTABILITY AND COMPLEXITY THEORY

Module-I +II

Basic background on automata and languages, Types of automata and languages, Turing machines, k-tape Turing machines, non-deterministic Turing machines, Universal Turing machine, Halting problem. Recursive enumerable languages, Recursive languages, Decidable and recognizable language, Turing-decidable languages, Turing-recognizable languages, Context Sensitive Language and Chomosky Hierarchy.

Module-III+IV

Primitive recursive function, partial recursive function, Recursive and recursive enumeration sets, Programming systems, Unsolvable problems, a non-recursive language and an unsolvable problem, Reducing one problem to another problem, Rice Theorem, More unsolvable problems, PCP.

Module-V +VI

Measuring complexity- Big Oh, small oh and other notations, Analyzing algorithms, Time and space complexity of a Turing machine, Complexity analysis of multi-tape TM Complexity classes: P, NP, NP-C, NP-Complete problem, Additional NP-complete problems- clique, vertex cover, Hamiltonian cycle, coloring problem, graph isomorphism, Reduction from NP-C problem to another problem.

Module-VII

Tractable and Intractable problems.

Text Books

1. Lewis H.R., Papadimitriou C.H.- Elements of the Theory of Computation:, PHI Publ. , 2nd edition, New Delhi

2. John Martin. *Introduction to Languages and the Theory of Computation, 3rd ed.* McGraw Hill, New York, NY, 2003.

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TCS1005 DISTRIBUTED OPERATING SYSTEM

Module 1

Introduction: Distributed Systems, Goals of Distributed System, HW/SW concepts, Design Issues.

Module 2

Communication in Distributed Systems: Layered protocol, Client server model, Remote Procedure Call and Group Communication.

Module 3

Synchronization in Distributed Systems: Clock Synchronization, Mutual Exclusion, Election algorithm, Atomic transactions, Deadlocks in Distributed systems.

Module 4

Processes and Processors in Distributed System: Threads, System models, Processor allocation, Scheduling in Distributed systems, Fault tolerance, Real time distributed systems.

Module 5

Distributed File Systems: Distributed file system design, Distributed file system implementation, Trends in Distributed file system.

Module 6

Distributed Shred Memory: Shared memory consistency models, Page based distributed shared memory, Shared variable distributed shared memory, Object based distributed shared memory.

Module 7

Case Studies: Amoeba and MACH.

Text Book:

Andrew S. Tanenbaum – Distributed Operating Systems, Pearson Education Asia, New Delhi.

Reference Books:

P. K. Sinha - Distributed Operating Systems, Prentice-Hall India (ISBN 81-203-1380-1)

G. Coulouris et. al. – Distributed Systems: Concepts and Design, Pearson Education Asia, New Delhi.

Arno Puder et. al. – Distributed Systems Architecture: A Middleware approach, Morgan Kaufmann Publishers, Elsevier (Indian Reprint ISBN978-81-312-1665-1)

Head of Department

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MSE1025 REAL TIME SYSTEMS

Module 1

Basic Real-Time Concepts: Terminology, Systems Concepts,Real-Time Definitions,Events and Determinism,CPU Utilization,Real-Time System Design Issues, Common Misconceptions, Brief History, Theoretical Advances,Early Systems,Hardware Developments,Early Software,Commercial Operating System Support

Module 2

Hardware Considerations for Real Time Systems: Basic Architecture, Hardware Interfacing, Latching,Edge versus Level Triggered,Tristate Logic,Wait States,Systems Interfaces and Buses,Central Processing Unit,Fetch and Execute Cycle,Microcontrollers, Instruction Forms, Core Instructions, Addressing Modes,RISC versus CISC,Memory, Memory, Access,Memory Technologies, Memory Hierarchy,Memory Organization, Input/Output, Programmed Input/Output, Direct Memory Access, Memory-Mapped Input/Output,Interrupts,Enhancing Performance Locality of Reference, Cache,Pipelining Coprocessors.

Module 3

Real-Time Operating Systems: Real-Time Kernels, Pseudokernels, Interrupt-Driven Systems, Preemptive-Priority Systems, Hybrid Systems, The Task-Control Block Model, Theoretical Foundations of Real-Time Operating Systems, Process Scheduling,Round-Robin Scheduling, Cyclic Executives,Fixed-Priority Scheduling–Rate-Monotonic Approach, Dynamic-Priority Scheduling: Earliest-Deadline–First Approach, Intertask Communication and Synchronization, Buffering Data, Time-Relative Buffering, Ring Buffers, Mailboxes, Queues,Critical Regions, Semaphores

Module 4

Memory Management: Process Stack Management, Run-Time Ring Buffer, Maximum Stack Size,Multiple-Stack Arrangements, Memory Management in the Task-Control-Block,Model, Swapping, Overlays, Block or Page Management, Replacement Algorithms, Memory Locking,Working Sets, Real-Time Garbage Collection, Contiguous File Systems, Building versus Buying Real-Time Operating, Selecting Real-Time Kernels

Head of Department

Module 5

Performance Analysis And Optimization: Theoretical Preliminaries, NP-Completeness, Challenges in Analyzing Real-Time Systems, The Halting Problem, Amdahl's Law, Gustafson's Law, Performance Analysis, Code Execution Time Estimation, Analysis of Polled Loops, Analysis of Coroutines, Analysis of Round-Robin Systems, Response-Time Analysis for Fixed-Period Systems, Response-Time Analysis: RMA Example, , The M/M/1 Queue, Service and Production Rates, Some Buffer-Size Calculations, Response-Time Modeling, Little's Law, Erlang's Formula.

Module 6

I/O Performance Basic: Buffer-Size Calculation,Variable Buffer-Size Calculation, Performance Optimization, Compute at Slowest Cycle,Scaled Numbers, Binary Angular Measure,Look-Up Tables, Imprecise Computation, Optimizing Memory Usage

Module 7

Advanced Performance Optimaization: Postintegration Software Optimization, Results from Compiler Optimization, Use of Arithmetic Identifies, Reduction in Strength, Common Subexpression Elimination, Intrinsic Functions, Constant Folding,Loop Invariant Optimization, Loop Induction Elimination, Use of Registers and Caches,Removal of Dead or Unreachable Code,Flow-of-Control Optimization, Constant Propagation,Dead-Store Elimination, Dead-Variable Elimination, Short-Circuiting Boolean Code,Loop Unrolling, Loop Jamming, More Optimization Techniques, Combination Effects, Speculative Execution, Analysis of Memory Requirements,Reducing Memory Utilization, Variable Selection, Memory Fragmentation

Text Book:

Lapante P. A. , Real Time Systems Design and Analysis, 3rd Edition, Prentice Hall India, New Delhi

Reference Books:

- Jane W. S. Liu, Real-Time Systems, 1st Edition, Pearson Education, New York
- Stallings W. , Operating Systems, Internals and Design Principles, 5th Edition, New Delhi

Head of Department

MEC2009 COMPUTER COMMUNICATION NETWORKS

Module 1

Local Area Networks:

Background, Topologies and Transmission Media, LAN standards IEEE 802 Reference Model, Logical Link Control, Medium Access Control, IEEE 802.3 Medium Access Control, Ethernet , Bridged Ethernet and Switched Ethernet, Fast Ethernet, Gigabit Ethernet, Token Ring and FDDI, IEEE 802.5 Transmission Medium Options. Fiber Channel Elements, Fiber Channel Protocol Architecture, Fiber Channel Physical Media and Topologies.

Text Books:

1. Data and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.
3. Communication Networks. 2/E by Alberto Leon-Garcia & Indra Widjaja.

Module 2

Connecting devices and Backbone Networks:

Bridges, Functions of a Bridge, Bridge Protocol Architecture, Fixed routing, Spanning tree approach, Connecting devices like Repeaters, Hubs, Bridges, Two layer switches , Transparent Bridges, Source Routing Bridges, Merced- Media Bridges , Virtual LANs, Router and Three layer switches, Backbone Networks, Bus Backbone, Star Backbone, Connecting Remote LANs, Wireless LANs, Applications , IEEE 802.11, Architecture and Services, Medium Access Control, Physical layer.

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.
3. Communication Network 2/E by Alberto Leon-Garcia & Indra Widjaja.

Module 3

Internetworking:

Principle, Requirements, Architectural approaches, Connectionless Internetworking, Routing techniques, Dynamic routing, Internet Protocol (IP), Internal Control Message Protocol (ICMP), IPV6 structure, Address and Header Formats, ICMPV6, Unicast and Multicast Routing , Autonomous Systems, Unicast Routing Protocol OSPF, Internet Group Management Protocol (IGMP) , Border Gateway Protocol.

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.
3. Communication Network. 2/E by Alberto Leon-Garcia & Indra Widjaja.

Module 4

Transport Protocols:

Connection Oriented Transport Protocol Mechanisms, Reliable Sequencing Networks Services, Unreliable Network Services, TCP Services, TCP Header format, TCP Mechanisms, TCP Implementation Policy options, TCP Congestion Control, Retransmission Timer Management, Window Management, Quality of service, User Datagram Protocol (UDP).

Head of Department

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.

Module 5
Network Security:
Passive and Active Attacks, Symmetric Encryption, Encryption Algorithms, Key distribution, Traffic padding, Message Authentication, Hash function, Secure Hash function, Public-key Encryption, Digital Signature, RSA Public key Encryption Algorithm, Key Management, Secure Socket layer and Transport layer Security, SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol, IP level Security IPSEC, Application layer Security PGP, Firewall, Virtual Private Networks.

Text Books:

1. Date and Computer Communication. 7/E by William Stallings.
2. Data Communication and Networking. 3/E by Behrouz A. Forouzan.

Module 6
Distributed Applications:
Electronic Mail, Simple Mail Transfer Protocol (SMTP), Multipurpose Internal Mail Extension (MIME), Client Server Model, Socket Interface, Socket Programming, File Transfer, Simple Network Management Protocol (SNMP), SNMP V_2 and SNMP V_3, Hypertext Transfer Protocol (HTTP) overview , Message Entities, World Wide Web (WWW), HTML, Common Gateway Interface (CGI).

Text Books:

1. Date and Computer Communication .7/E by William Stallings.
2. Data Communication and Networking .3/E by Behrouz A. Forouzan.

Module 7
Advanced Network Architectures:
Integrated Services in Internet, Resource Reservation Protocol (RSVP), Receiver initiated Reservation, Reservation Merging, RSVP Message format, Differentiated Services , DS field , Network Interconnection Models, Overlay Model, Peer-to-Peer Model, Multi-protocol Label Switching (MPLS) , Generalized MPLS (GMPLS), Real-Time Transport Protocols (RTP), RTP Control Protocol, Session Control Protocols, Session Initiation Protocol.

Text Book:

1. Communication Network. 2/E by Alberto Leon-Garcia & Indra Widjaja

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Semester II

MSE2001 SOFTWARE DESIGN AND TESTING

Module 1

The Nature of the Design Process: What is design ? , The role of the design activity, Design as a problem –solving process, Design as a 'wicked' problem.

The Software Design Process: What is software ?, Building models, Transferring design knowledge , Constraints upon the design process and product, Recording design decisions, Designing with others.

Design in the Software Development Process : A context for design, Linear development process, Incremental development process, Economic factors, The longer term.

Module 2

Design Qualities : The quality concept, Assessing design quality, Quality attributes of the design product, Assessing the design process.

Describing a Design Solution : Representing abstract ideas, Design viewpoints for software, Forms of notation

Transferring Design Knowledge : The need to the share knowledge , The architecture concept, Design methods, Design patterns, A unified interpretation ?.

Some Design Representation : A problem of selection, Black box notations, White box notations, Developing a diagram.

Module 3

The Rationale for Method : What is software design method ?, The support that design method provide, Why methods don't work miracles, Problem domains and their influence.

Design processing and Design Strategies : The role of strategy in methods, Describing the design process – the D-Matrix. Design by top-down decomposition, Design by composition, Organizational influence upon design.

Design Patterns : Design by template and design reuse, The design pattern, Design with patterns, Patterns in the wider design context.

Head of Department

Module 4

Stepwise Refinement: The historical role of stepwise refinement, Architectural consequences, Strengths and weakness of the stepwise strategy.

Incremental Design : Black box to white box in stages, Prototyping , An example- DSDM.

Structured Systems Analysis and Structured Design: Origins, developments and philosophy, Representation forms for SSA/SD, The SSA/SD process, The role of heuristics in SSA/SD, Extended forms of SSA/SD, SSA/SD: an outline example.

Module 5

The purpose of Testing : What we Do, Productivity and Quality in Software, Goals for Testing, Phases in a tester's Mental life, Test Design, Testing Isn't Everything, The Pesticide Paradox and the complexity Barrier.

Some Dichotomies : Testing Versus Debugging , Function Versus Structure, The designer Versus the Tester, Modularity Versus Efficiency, Small Versus Large, The builder Versus the Buyer.

Module 6

A Model for Testing : The Project, Overview, The Environmental, The Program, Bugs, Tests, Testing and Levels, The Role of Models.

Flowgraphs and Path Testing: Path Testing Basics**,** Predicates, Path Predicates, and Achievable Paths, Path Sensitizing , Path Instrumentation, Complement and Application of Path Testing, Generalizations.

Transaction- Flow Testing: Transactions Flows, Transactions – Flows Testing Techniques, Implementation Comments.

Module 7

Data- Flow Testing: Data-Flow Testing Basics, Data – Flow Testing Strategies, Application, Tools, Effectiveness.

Text Books:

- D.Budgen- Software Design, 2nd Edn Pearson Education, New Delhi, 2004.
- B.Bezier- Software Testing 2nd Edn, Techniques, Dreamtech, New Delhi, 2004.

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MSE2025 SYSTEM SIMULATION AND MODELING

Module 1

Basic Simulation Modelling: The Nature of Simulation, System Models and Simulation , Discrete – Event Simulation, Simulation of Single – Server Queuing System.

Module 2

Simulation of Inventory Systems: Alternative Approaches to Modeling and Combing Simulations, Step in a Sound Simulation Study, Other Types of Simulation, Advantages, Disadvantages, and Pitfalls of Simulation

Module 3

Modelling Complex Systems: Introduction, List of Processing in Simulation, A Simple Simulation Language , Simlib, Single –Server Queuing Simulation with Simlib, Time Shared Computer Model, Multiteller Bank with Jockeying , Job-Shop Model, Efficient Event –List Manipulation

Module 4

Simulation Software: Introduction, Comparison of Simulation Packages with Programming Languages, Classification of Simulation Software, Desirable Software Features, General – Purpose Simulation Packages, Object Oriented Simulation

Module 5

Review of Basic Probability and Statistics: Introduction, Random Variables and Their Properties, Simulation Output Data and Stochastic Process, Estimation of Means, Variances, and Correlations, Confidence Interval and Hypothesis Test for the Mean,

Building Valid, Credible, and Appropriately Detailed Simulation Models: Introduction and definition**s,** Guidelines for Determining the Level of Model Detail, Verification of Simulation Computer Programs, Techniques for Increasing Model Validity and Credibility.

Module 6

Selecting Input Probability Distributions: Introduction, Useful Probability Distributions, Techniques for Assessing Sample Independence, Activity I : Hypothesizing Families of Distributions, Activity II : Estimation of Parameters , Activity are II: Determining How Representative, the Fitted Distributions.

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Module 7

Random-Number Generators: Introduction, Linear Congruential Generators, Other Kinds of Generators,, Testing Random –Number Generators.

Generating Random Variates: Introduction, General Approaches to Generating Random Variates, Generating Continuous Random Variates, Generating Discrete Random Variates.

Output Data Analysis for a Single System: Introduction, Transient and Steady-Style Behavior of a Stochastic process, Types of Simulation with Regard of Output Analysis, Statistical Analysis for Terminating Simulations, Statistical Analysis for Steady-State Parameters.

Text Book:

A.M.Lan & W.D.Kelton- Simulation Modeling and Analysis TMH, New Delhi- 2005.

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MSE2005 SOFTWARE PROJECT MANAGEMENT

Module 1

Introduction To Software Project Management And Step Wise Project Planning: Introduction, What is a Project? Software Projects Versus Other Types of Project, Contact Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods, and Methodologies, Some ways of Categorizing Software Projects, What is Management?, Problems with Software Projects, Setting Objectives, Stakeholders, The Business Case, Requirement Specification, Management Control, Overview of Project Planning (Step wise).

Module 2

Project Evaluation: Introduction, Strategic Assessment, Technical Assessment, Cost- Benefit Analysis, Cash Flow Forecasting, Cost- Benefit Evaluation Techniques, Risk Evaluation.

Selection Of An Appropriate Project Approach: Introduction, Choosing Technologies, Technical Plan Contents List, Choice of Process Models, Structure Versus Speed of Delivery, The Waterfall Model, The V- Process Model, The Spiral Model, Software Prototyping, Other ways of Categorizing Prototyping, Controlling Changes during Prototyping, Incremental Delivery, Dynamic Systems Development Method, Extreme Programming, Managing Iterative Processes.

Module 3

Software Effort Estimation: Introduction, Where are Estimates done? , Problems with Over-and Under- Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Expert Judgement, Estimating by Analogy, Albrecht Function Point Analysis, Function Point Mark II, Object Points, A Procedural Code- Oriented Approach, COCOMO: A Parametric Model.

Activity Planning: Introduction, The Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, The Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity- On – Arrow Networks.

Module 4

Risk Management: Introduction, The Nature of Risk, Types of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning and Control, Evaluating Risks to the Schedule.

Resource Allocation: Introduction, The Nature of Resources, Identifying Resources Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resources Schedule, Cost Schedules, The Scheduling Sequence.

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Module 5

Monitoring And Control: Introduction, Creating the Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting the Project Back to Target, Change Control.

Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.

Module 6

Managing People And Organizing Teams: Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods, Motivation, The Oldham- Hackman Job Characteristics Model, Working In Groups, Becoming A Team, Decision Making, Leadership, Organizational Structures.

Module 7

Software Quality: Introduction, The Place Of Software Quality In Project Planning, The Importance Of Software Quality, Defining Software Quality, ISO 9126, Practical Software Quality Measures, Product Versus Process Quality Management, External Standards, Techniques To Help Enhance Software Quality, Quality Plans.

Text Book:

B.Huges and M.Cotterell- Software Project Management 3rd Edn, TMH, New Delhi, 2004.

Reference Book:

P.Jolote- Software Project Management in Practice, Pearson Education, New Delhi, 2002.

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Electives

MSE2021 SOFTWARE RELIABILITY ENGINEERING

Module 1

Introduction: The Need for Software Reliability, Software Reliability Engineering, Why Does Software Cost So Much? Basic Definitions and Terminologies.

Reliability Engineering Measures: Reliability Definitions, System Mean Time to Failure, Failure Rate Function, Reliability Function for Common Distributions, Maintainability and Availability.

Module 2

Software Engineering Assessment: Introduction, Software Versus Hardware Reliability, Software Reliability and Testing Concepts, Software Lifecycle, Software Development Process and Its Applications, Software Verification and Validation, Data Collection and Analysis.

Module 3

Software Reliability Modelling: Introduction, Halstead's Software Metric, McCabe's Cyclomatic Complexity Metric, Error Seeding Models, Failure Rate Models, Curve Fitting Models, Reliability Growth Models, Non- Homogeneous Poisson Process Models, Markov Structure Models.

Module 4

Nhpp Software Reliability Models: Introduction, Parameter Estimation, NHPP Models, Applications, Imperfect Debugging Versus Perfect Debugging, A Generalized NHPP Software Reliability Model, Mean Time Between Failures for NHPP.

Module 5

Software Cost Models: Introduction, A Software Cost Model With Risk Factor, A Generalized Software Cost Model, A Cost Model With Multiple Failure Errors, Applications.

Module 6

Fault- Tolerant Software: Introduction, Basic Fault- Tolerant Software Techniques, Self- Checking Duplex Scheme, Reliability Modeling, Reduction Of Common- Cause Failures.

Module 7

Software Reliability Models With Environment Factors: Introduction, Definition Of Environmental Factors, Environmental Factors Analysis, A Generalized Model With Environmental Factors, Enhanced Proportional Hazard Jelinski- Moranda, An Application With Environmental Factors.

Text Book:

H.Pham- Software Reliability Springer- Verlag, Singapore, 2000.

Reference Books:

4. J.D. Musa et. al- Software Reliability Measurment, Prediction and Application, McGraw-Hill, New York 1987.
5. J.D. Musa et. al- Software Reliability Engineering, TMH, New Delhi 2005.

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MSE2023 SOFTWARE ARCHITECTURE AND INTEGRATION

Module 1

Introduction: Definition of Software Architecture, Software design levels engineering discipline for Software, the current state of Software Engineering and Architecture

Module 2

Architecture Styles: Use of Patterns and styles I Software design, Common architectural styles (Pipes and filters, Data abstraction and object orientation, Event based implicit invocation, Layered systems, Repositories, interpreters) with an example case study

Module 3

Shared Information Systems: Detailed study of shared information systems with features like Database integration, Integration of software development environments, Architectural structures of shared information systems.

Module 4

Architectural Design: Guidelines for Architectural design, Design space and rules, Applying design space with an example, study of Quantified design space.

Module 5

Formal models and specifications: Architectural formalism and its applications, Study of formalizing various architectural styles like filters, pipes, etc. Formalizing Architectural design Space.

Module 6

Architectural Description Languages: Requirements of an Architectural Description Language, First-Class Connectors, Adding implicit invocation to traditional programming Languages

Module 7

Architectural Design Tools: UniCon – A Universal Connecting Language, Exploiting styles in Architectural design, Architectural interconnection

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Text Book:

Mary Shaw & David Garlan, “Software Architecture”, Prentice Hall India PrivateLimited.

Reference Book:

Len Bass, Paul Clements, & Rick Kazman, “Software Architecture in Practice”, Second Edition, Pearson Education.

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(*)REAL TIME EMBEDDED SYSTEMS DESIGN

Module 1
Introduction to embedded systems:
Introduction to embedded systems, essential components and consideration, design issues, characteristics of embedded systems, embedded systems on-chip(SOC) and the VLSI circuit applications (5)

Module 2
Processor and hardware:
General purpose processor, ASIP's and ASIC's, semiconductor IC's programmable logic devices of CGD, Processor selection for embedded systems, special purpose processor, timer, counter, watch dog timer peripheral UART.
(6)

Module 3
Memory:
Writability and data permanence, memory devices type of memory and basic form, EEPROM, flash memory, SRAM and DRAM, basic DRAM characteristics, memory selection for embedded systems, allocation of memory to the program segment blokes. (6)

Module 4
Device and interrupt service:
Bus models, time multiplexed bus, strobe and handshake protocols, strobe handshake compromise priority arbiter multilevel bus, and architecture. (7)

Module 5
Communication interface:
Communication wireless communication, infrared-TRDA, radio frequency, error detection, CAN, USB, Blue tooth, IEEE 802-II, shared memory models, message passing, communication, synchronisation, non-determinism, specifying timing and timing constrains. (7)

Module 6
Specification Language:
Characteristics, of conceptual models, hierarchy, structural hierarchy, and behavioural hierarchy, specification requirement for embedded systems, examples of specification language, VHDL and hardware (7)

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Module 7

Representative embedded systems:

Digital thermometer, handhold computer, navigation system, IP phone, software defined-radio, smart card (7)

Text Book:

1. Raj Kamal, Embedded Systems Architecture, Programming and design, TMH-2003.

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MSE2027 SERVICE ORIENTED ARCHITECTURE

Module I
Introduction : Fundamental SOA, Common characteristics of contemporary SOA, Common mis perceptions about SOA, Common tangible benefits of using SOA, Common pitfalls of adopting SOA, Evolution of SOA : An SOA time line (from XML to Web services to SOA), The continuing evolution of SOA, The roots of SOA.

Module II

Web Services and Primitive SOA: The Web services framework , Services (as Web services) , Service descriptions (with WSDL), Messaging (with SOAP) .

Module III
Web Services and Contemporary SOA : Message exchange patterns , Service activity , Coordination , Atomic transactions , Business activities , Orchestration , Choreography .

Module IV
Web Services and Contemporary SOA: Addressing , Reliable messaging , Correlation , Policies , Meta data exchange , Security , Notification and eventing.

Module V
Principle of Service Orientation : Service-orientation and the enterprise , Anatomy of a service-oriented architecture , Common principles of service-orientation , How service-orientation principles inter-relate , Service-orientation and object-orientation , Native Web service support for service-orientation principles .

Module VI
SOA Delivery Strategies : SOA delivery lifecycle phases , The top-down strategy , The bottom-up strategy , The agile strategy .

Module VII
Service Oriented Analysis : Introduction to service-oriented analysis , Benefits of a business-centric SOA , Deriving business services , : Service modeling (a step-by-step process) , Service modeling guidelines , Classifying service model logic , Contrasting service modeling approaches (an example) .

Text Book :
Thomas Erl, *Service-Oriented Architecture: Concepts, Technology, and Design,* 1st Edition**,** Prentice Hall August 04, 2005.

Reference Book:

Josuttis N. M., SOA in Practice, 1st Edition, O'reilly Publication, USA, 2010

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Syllabus MCA Non-CBCS

MCA 1001 PROBLEM SOLVING AND PROGRAM DESIGN WITH C [3 (3-0-0)]

MODULE - I & II

Problem Solving and Programming Concepts: Problem Solving in Everyday Life, Types of Problem, Problem Solving with Computers, Constants and Variables, Data Types, Functions, Operators, Expressions and Equations, Data Storage and Communication with Computer, Organizing the Problem, Computer Software and Software Development Method.

MODULE - III

Overview of C: C Language Elements, Variable Declaration, Data Types, Expressions, Data Files.

Top-Down Design with Functions: Top-Down Design and Structure Charts, Functions without Arguments, Functions with Input Arguments.

MODULE - IV

Selection Structures: Problem Solving with Decisions, Control Structures, Conditions, All kinds of if statements, Switch statement.

Repetition and Loop Statements: Problem Solving with Loops, Repetition in Programs, while Statement, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement and Flag Controlled Loops.

MODULE - V

Modular Programming: Functions with Simple Output Parameters, Multiple Calls to a Function with Input/Output Parameters, Scope of Names, Formal Output Parameters as Actual Arguments.

Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Using Array Elements as Function Arguments, Array Arguments, Multidimensional Arrays.

MODULE - VI

Strings: String Basics, String Comparison, Arrays of Pointer, Character Operations, String-to-Number and Number-to-String Conversions.

Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters, Problem Solving with Recursion.

MODULE - VII

Structure and Union Types: User-Defined Structure types, Structure Type Data as Input and Output Parameters, Functions Whose Result Values are Structured, Problem Solving with Structure Types, Union types.

File Processing and Programming in the Large: Input and Output Files, Binary Files, Using Abstraction to Manage Complexity, Header Files, Implementation Files, Storage Classes, Macros.

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Text Books:

1. M.Sprankle- Problem Solving and Programming Concepts, 7th Edn, Pearson Education, New Delhi-2006
2. J.R.Hanly & E.B. Koffman- Problem Solving and Program Design in C, 4th Edn, Pearson Education, New Delhi-2004.

Reference Books:

1. E.Balagurusamy- Programs in ANSI C, 3rd Edn, TMH, New Delhi-2004
2. B.A.Forouzan & R.F. Gilberg- Computer Science: A structured Programming Approach Using C, 2nd Edn, Brooks/Cole- Thomson Learning, Indian Reprint, 2003.

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MCA 1003 NUMERICAL AND STATISTICAL METHODS [4 (3-1-0)]

Numerical Methods

MODULE- I

Errors in Numerical Calculations: Errors & their computation-absolute, relative & percentage.

Solution of algebraic & transcendental equations: Introduction, Bisection method, Iterative method, False position method, Newton's Raphson method, Lin Bairstows method. Error analysis & convergence study.

MODULE - II

Interpolation with equal & unequal intervals: Introduction, finite differences-forward, backward & central, difference tables, differences of polynomials, Newton's formula for interpolation, Gauss's central difference interpolation formula, Divided difference & their properties- Newton's divided differences formula, Lagrange's interpolation formula, Inverse interpolation.

MODULE - III & IV

Numerical differential & integration: Introduction, derivatives using forward & backward difference formula, Numerical Integration-Trapezoidal rule, Simpson's 1/3 & 3/8 rules Weddle's rule.

Numerical solution of linear system of equations: Direct method-Gauss elimination, Gauss-Jordan, LU decomposition methods. Iterative methods-Gauss-Jacobi & Gauss Seidel methods.

Numerical solution ordinary differential equations: Taylor Series method, Euler's method, Modified Euler's method, Runga-Kutta methods of 2^{nd} &4^{th} order, Predictor-Corrector methods (Milne's method and Adam's methods).

Statistical Methods

MODULE - V

Concepts of Probability: Experiment and Sample Space,Events and Operations with Events, Probability of an Event, Basic Probability Rules, Applications of Probability Rules, Conditional Probability.

Random Variables: How Random Variable Arise, Probability Distribution of a Random Variable, Mean or Expected Value of a Random Variable, Probability Histogram Value of a Random Variable, Variance and Standard Deviation of a Random Variable.

MODULE - VI

Binomial Experiments: Structure of a Binomial Experiment, Binomial Probability Distribution, Use of Binomial Probability Table.

Normal Curve and Normal Distribution: Motivation behind a Normal Curve, Properties of a Normal Curve, Normal Probability Distribution, Areas Under a Normal Curve.

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Applications of the Normal Distribution: Approximating a Binomial Probability, The Normal Theorem and the Central Limit Theorem.

MODULE - VII

Estimation of Population Parameters: Parameter and Statistic, Point and Interval Estimation, Interval Estimation of Three Common Parameters.

Hypothesis Testing for a Single Population: Concept of a Hypothesis, Tests Involving a Population Mean, Tests Involving a Population Proportion, Tests Involving a Population Standard Deviation.

Hypothesis Testing to Compare Two Populations: Comparison of Two Populations, Tests for Two Population Means, Tests for Two Population Means, Tests for Two Population Proportions, Tests for Two Population Variance.

Bivariate Quantitative Data- Correlation and Regression: Concepts of a Bivariate Data Set, Correlation Coefficient, Inferences on a Population Correlation Coefficient, The Regression line, Inferences on the Population Regression Line.

Text Books:

1. S.S.Sastry-Introductory Methods of Numerical Analysis-PHI, Private Ltd., New Delhi.
2. N.Pal & S. Sarkar- Statistics: Concepts and Applications, PHI, New Delhi-2005.

Reference Books:

1 R.V.Hogg et.al- Probability and Statistical Inpane, 7th Edn, Pearson Education, New Delhi-2006.
2. R.L.Burden & J.D.Faires- Numerical Analysis, Thomson Learning-Brooks/Cole, Indian Reprint, 2005.

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MCA 1107 DISCRETE MATHEMATICS [3 (3-0-0)]

Module-I

Relations and digraphs: Product sets and partitions, Relations and Digraphs, Paths in relations and digraphs, equivalence relation, operations on relations, Transitive closure and Warshall's algorithm

Module-II

Functions: Functions for Computer Science, Growth of functions, Permutation functions.

Module-III

Order Relations and Structures: Partially ordered sets, External elements of partially ordered sets, Lattices, Finite Boolean Algebra, Functions on Boolean Algebra, Circuit design

Module-IV

Tree: Trees, Labelled trees, Tree searching, Undirected trees, Minimum Spanning trees

Module-V

Graph: Terminologies, connected graphs, Euler graph, Hamiltonian path and circuit Hamiltonian path and circuits, Transport network, Matching problems,, Graph colouring.

Module-VI

Group: Properties and Operations, Semi group, Products and Quotients of Semigroups, Groups, Products and Quotients of Groups , Other Mathematical structures,

Module-VII

Coding: Codewords and code, Encoding function, Hamming distance, Error detection and correction codes, Pre-fix code

Text book

1. Kolman, Busby, Ross, Rehmann: *Discrete Matheamatical Structures*, 5/e, Pearson Education, 2006.

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MCA 1009 COMPUTER ORGANIZATION AND ARCHITECTURE [3 (3-0-0)]

MODULE - I

Introduction: Organization and Architecture, Structure and Function, Why Study Computer Organization and Architecture?

Computer Evolution and Performance: A Brief History of Computers, Designing for Performance, Pentium and PowerPC Evolution.

MODULE - II

A Top-Level view of Computer Function and Interconnection: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, PCI.

MODULE - III

Cache Memory: Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Pentium 4 and PowerPC Cache Organizations.

Internal Memory: Semiconductor Main Memory, Error Correction, Advanced DRAM Organization.

MODULE - IV

External Memory: Magnetic Disk, RAID, Optical Memory, Magnetic Tape.

Input/Output: External Devices, I/Os, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors.

MODULE - V

Computer Arithmetic: The Arithmetic and Logic Unit, Integer Representation, Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic.

MODULE - VI

Instruction Sets- Characteristics and Functions: Machine Instruction Characteristics, Type of Operands, Pentium and PowerPC Data Types, Types of Operations, Pentium and PowerPC Operation Types.

Instruction Sets- Addressing Modes and Formats: Addressing, Pentium and PowerPC Addressing Modes, Instruction Formats, Pentium and PowerPC Instruction Formats.

MODULE - VII

Processor Structure and Function: Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining, The Pentium Processor, The PowerPC Processor.

Reduced Instruction Set Computers: Instruction Execution Characteristics, The Use of a Large Register File, Compiler-Based Register Optimization, Reduced Instruction Set Architecture, RISC Pipelining, MIPS R4000, SPARC, RISC versus CISC Controversy.

Text Book:

1. William Stallings- Computer Organization & Architecture: Designing for

Performance, 7th Edn, Pearson Education, New Delhi-2006.

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Reference Books:

1. C. Hamacher- Computer Organization, 5th Edn, McGraw Hill, Internaional Education, New Delhi-2002.
2. M.M.Mano- Computer System Architecture, 3rd Edn, PHI/Pearson Education, New Delhi-2006.
3. J.P.Hayes- Computer Architecture and Organization, 3rd Edn, McGraw Hill, Internal Edn, New Delhi-1998.

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MCA 2001 DATA STRUCTURES [3 (3-0-0)]

MODULE - I

Introduction: Pseudocode, The Abstract Data Type, A Model for an Abstract Data, Algorithm Efficiency.

Searching: List Searches, Hashed List Searches, Collision Resolution.

MODULE- II

Linked Lists: Linear List Concepts, Linked List Concepts, Linked List Algorithms, Processing a Linked List, List Applications, Complex Linked List Structures, List Abstract Data Type-Linked List Implementation.

MODULE - III

Stacks: Basic Stack Operations, Stack Linked List Implementation, Stack Applications, Stack Abstract Data Type Implementation, Stack ADT- Array Implementation.

Queues: Queue Operations, Queue Linked List Design, Queuing Theory, Queue Applications, Queue ADT-Linked List Implementation, Queue ADT-Array Implementation.

MODULE - IV & V

Recursion: Factorial – A Case Study, How Recursion Works, Designing Recursive Algorithms, Another Case Study- Fibonacci Numbers, The Towers of Hanoi.

Introduction to Trees: Basic Tree Concepts, Binary Trees, Binary Tree Traversals, Expression Trees, General Trees, Huffman Code.

Search Trees: Binary Search Trees, AVL Trees, AVL Tree Implementation, AVL Abstract Data Type.

MODULE - VI

Heaps: Heap Definition, Heap Structure, Basic Heap Algorithms, Heap Data Structure, Heap Algorithms, Heap Applications.

Multiway Trees: m-Way Search Trees, B-Trees, Simplified B-Trees.

MODULE - VII

Advanced Sorting Concepts: General Sort Concepts, Insertion Sorts, Selection Sorts, Exchange Sorts, External Sorts.

Text Book:

1. R.F.Gilberg & B.A. Forouzan- Data Structures: A Pseudocode Approach with C++,

2nd Edn, Brooks/Cole- Thomson Learning, Indian Reprint, 2005.

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Reference Books:

1. E.Horowitz et.al-Fundamentals of Data Structures in C++, Galgotia Publication, New Delhi, 2006.
2. A.M.Berman- Data Structures vie C++, Oxford Univ. Press, Inc. Indian Reprint, 2002.
3. M.T.Goodrich et.al- Data Structures and Algorithms in C++, John Wiley, Inc. Indian Reprint, 2004.

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MCA 2003 OBJECT ORIENTED DESIGN AND PROGRAMMING [3 (3-0-0)]

MODULE - I

Computing and the Object-Oriented Design Methodology: Basic Computing Terminology, Software, Engineering Software, Object-Oriented Design.

C++ -The Fundamentals: Program Organization, A First Program, A Second Program, Comments, Assigning a Value, Fundamental C++ Objects, Constants, Names, Definitions, Expressions, Output Statements, Computing Average Velocity.

MODULE - II

Modifying Objects: Assignment, Const Definitions, Input Statements, Computing the Number of Molecules in a Hydrocarbon, Compound Assignment, Increment and Decrement, Estimating Yearly Savings of Change, The String Class, EzWindows, Moving Lawns.

Control Constructs: Boolean Algebra, A Boolean Type, Conditional Execution Using the if Statement, Conditional Execution Using the switch Statement, Computing a Requested Expression, Validating a Date, Iteration Using the while Statement, Simple String and Character Processing, Iteration Using the for Statement, Simple Data Visualization, Solving the Lazy Hobo Riddle, Iteration Using the do Construct.

MODULE - III

Functions Usage Basics and Libraries: Function Basics, The Preprocessor, Using Software Libraries, The iostream Library, The iomanip Library, The fstream Library, The math Library, Library ctype, The assert macros.

MODULE - IV

Programmer-Defined Functions: Basics, A Tasty Problem, Some Useful Functions, Integrating a Quadratic Polynomial, The Logic Scope, Displaying a Price-Interval Chart, Recursive Functions.

Advanced Parameter Passing: Reference Parameters, Passing Objects by Reference, Validating Telephone Access Codes, Constant Parameters, Default Parameters, Casting of Function Parameters, Function Overloading, Random Numbers, A Factory Automation Trainer.

MODULE - V

The Class Construct and Object-Oriented Design: Introducing a Parameter-Defined Data Type, The Rectangle Shape Class, Using the Rectangle Shape Class, Constructors, Building a Kaleidoscope, Object-Oriented Analysis and Design.

MODULE - VI

Pointers and Dynamic Memory: Lvalues and Rvalues, Pointer Basics, Constant Pointers and Pointers to Constants, Arrays and Pointers, Character String Processing, Program Command-line Parameters, Pointers to Functions, Dynamic Objects, A Simple ADT for Representing Lists of Integer Values.

MODULE - VII

Inheritance: Object-Oriented Design Using Inheritance, Reuse via Inheritance, A Hierarchy of Shapes, Protected Members and Inheritance, Controlling Inheritance, Multiple Inheritance, A Prettier Kaleidoscope.

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Templates and Polymorphism: Generic actions and Types, Function Templates, Class Templates, A Simple List Class Using a Class Template, Sequential Lists, Polymorphism, Virtual Function Nuances, Abstract Base Classes, Virtual Multiple Inheritance.

Text Book:

1. J.P.Cohoon & J.W.Davidson- C++ Program Design: An Introduction to Programming and Object-Oriented Design, 2nd Edn, TMH Edn, New Delhi-2000.

Reference Book:

1. F.L.Friedman & E.B.Koffman- Problem Solving, Abstraction, and Design Using C++, 4th Edn, Pearson Education, Inc. 2004.

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MCA 2005 DATABASE MANAGEMENT SYSTEM [3 (3-0-0)]

MODULE - I

Introduction: Purpose of Database Systems, Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database languages, Database Architecture, Classification of DBMS, relational database, Database users and Administrators, Advantages of DBMS.

MODULE - II

E-R-Model: Entities and Entity Sets, Relationships and Relationship Sets, Keys, Mapping, Constraints, ER Diagram, Reducing ER Diagram to tables, Generalization and Specialization, Aggregation.

MODULE - III

Relational Model: Concepts, Constraints and Relational database Schemas, Relational Algebra, Relational Calculus, QUEL, QBE, SQL..

MODULE - IV

Database Design: Pitfalls in relational database design, Normalization using functional, Multivalued and join dependencies, DKNF, Atomic values, alternative approaches to database design.

MODULE - V

Security & Integrity : Security & Integrity violations, authorization and views, integrity constants, encryption, Statistical databases.

MODULE - VI

Transaction Processing and Concurrency Control : Transaction Processing, Schedules and Recovery, Locking and Timestamp Ordering for concurrency control.

MODULE - VII

Distributed Databases : Concepts and Types of Distributed databases, data fragmentation, Replication and Allocation.

Text Book:

1. Fundamentals of Database Systems "Ramez Elmasri", Pearson Education

Reference Book:

1. Database Systems Concepts "A. Silberschatz,Korth", McGraw Hill.

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MCA 2007 OPERATING SYSTEM [3 (3-0-0)]

MODULE - I

Overview of Operating Systems: OS and the Computer System, Efficiency, System Performance and User Convenience, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems, Distributed Operating Systems, Modern Operating Systems.

MODULE - II

Processes and Threads: Processes and Programs, Programmer view of Processes, OS view of Processes, Threads, Case studies of Processes and Threads.

MODULE - III

Scheduling: Preliminaries, Non-preemptive Scheduling Policies, Preemptive Scheduling Policies, Scheduling in Practice, Real Time Scheduling, Scheduling in Unix, Scheduling in Linux, Scheduling in Windows, Performance Analysis of Scheduling Policies.

MODULE - IV

Memory Management: Managing the Memory Hierarchy, Static and Dynamic Memory Allocation, Memory Allocation to a Process, Reuse of Memory, Contiguous Memory Allocation, Noncontiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Kernel Memory Allocation, A Review of Relocation, Linking and Program Forms.

MODULE - V

Virtual Memory: Virtual Memory Basics, Demand Paging, Page Replacement Policies, Memory Allocation to a Process, Shared Pages, Memory Mapped Files, Unix Virtual Memory, Linux Virtual Memory, Virtual Memory using Segmentation.

MODULE - VI

File Systems: File System and IOCS, Files and File Operations, Fundamental File Organizations, Directory Structures, File Protection, Interface between File System and IOCS, Allocation of Disk Space, Implementing File Access, File Sharing Semantics, File System Reliability, Virtual File System, Unix File System, Linux File System, Windows File System, Performance of File Systems.

MODULE - VII

Security and Protection: Overview of Security and Protection, Goals of Security and Protection, Security Attacks, Formal and Practical aspects of Security, Encryption, Authentication and Password Security, Access Descriptors and the Access Control Matrix, Protection Structures, Capabilities, Unix Security, Linux Security, Windows Security.

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Text Book:

1. D.M. Dhamdhere- Operating Systems: A Concept-Based Approach, 2nd Edn, TMH, New Delhi-2006.

Reference Books:

1. A. Silberschatz et.al-Operating System Concepts, 6th Edn, John Wiley, Indian Reprint, 2003.
2. C.Cronsley-Operating Systems: A Design-Oriented Approach, TMH, New Delhi, 2002.
3. H.M.Deitel-Operating Systems, 2nd Edn, Pearson Education, 2003.
4. A.S.Tanenbaum-Operating System:Design and Implementation, PHI, New Delhi, 2002.m,.

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MCA 3001 JAVA PROGRAMMING [3 (3-0-0)]

Module-I

Fundamentals of Java Programming: Data in Java Programs, Arithmetic Operators and Expressions, Simple Program Input and Output.

Module-II

Making Decisions with Java: Comparing Numbers in Java, Comparing Strings in Java, Logical (Boolean) Operators and Order of Precedence, Selection Structures in Java.

Module-III

Repeating Program Statements: The **while** Statement, The **for** Statement, The **do…while** Statement, Nested Loops, **break**, and **continue**.

Module-IV

Methods and Classes: Predefined Java Methods, Programmer-Defined Methods.

Arrays: The One-Dimensional Array, Multidimensional Arrays, Other Array Topics.

Module-V

Characters, Strings, and Formatting: Working with Characters, Working with Strings, Formatting Data for Output.

Exceptions and Assertions: Exception Handling, Assertions.

Module-VI

File Input and Output: Inputting Data from a Text File, Outputting Data to a Text file, Performing Input and Output with Binary Files.

Module-VII

Graphical User Interfaces: Creating User Interfaces, Overview of a Java GUI, Developing a Java GUI, Adding Functionality to a GUI , Improving GUI Layout.

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Text Book:

1. Richard A. Johnson, " An Introduction to Java Programming and Object-Oriented Application Development", 1st Edn.,Thomson Learning, New Delhi – 2007

Reference Books:

4. Dietel, Dietel - Java How to Program , 5th Edn, Pearson Education , New Delhi, 2006
5. E. Balagurusamy – JAVA Programming, TMH, New Delhi, 2005
6. James M. Sleek – Programming and Problem Solving with JAVA, Thomson Learning, Indian Edition, 2007.

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MCA 3003 SOFTWARE ENGINEERING [3 (3-0-0)]

Module – I

Introduction to Software Engineering: Evolving Role of Software, Changing Nature of Software, Legacy Software, Software Engineering – A layered Technology.

Module – II

Process Frame work, Process Patterns, Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Unified Process Model, Agile Process Model.

Module – III

Requirement Engineering: A bridge to design and construction, Requirement Engineering Task, Initiating the Requirement Engineering Process, Eliciting Requirements, Developing Use case, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

Module – IV

Design Engineering: Design Process and Design Quality, Design Concepts, Design Models, Pattern Based Software Design.

Module – V

Tasting Strategies and Testing Tactics: Strategic Approach to software Testing, Test Strategies for conventional and Object Oriented Software, Validation Testing System Testing, White Box Testing, Basic Path Testing Control Structure Testing, Black Box Testing, Object Oriented Testing Methods.

Module – VI

Metric for process and Estimation Techniques: Process metrics, Software Measurement, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Estimation for Object Oriented Projects Specialized Estimation Techniques.

Module – VII

Software Quality and Configuration Management: Quality Concepts, Software Quality Assurance, Software Reliability, Software Configuration Management, SCM Repository, SCM Process.

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Text Book:

1. Roger S. Pressiman – "Software Engineering – A Practitioner's Approach", 6th Edn., McGraw Hill.

Reference Books:

1. John Wiley and Sons – " Software Engineering – Principles and Practice –2nd Edn., Haus Van Vliet.
2. Ian Sommerville – "Software Engineering", 7th Edn., Pearson Education.

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MCA 3005 FUNDAMENTALS OF COMPUTER ALGORITHMS [3 (3-0-0)]

MODULE - I

Elementary Algorithmic: Introduction, Problems and instances, The efficiency of algorithms, Average and worst-case analyses, What is an elementary operation, why look for efficiency

Asymptotic Notation : Introduction, A notation for "the order of", Other asymptotic notation, Conditional asymptotic notation, Conditional asymptotic notation, Asymptotic notation with several parameters, Operations on asymptotic notation

MODULE - II

Analysis of Algorithm: Introduction, Analyzing control structures, Using a barometer, Supplementary examples, Average-case analysis, Amortized analysis, Solving recurrences

MODULE - III

Greedy Algorithms: General characteristics of greedy algorithms, Graphs: Minimum spanning trees, Shortest paths, The knapsack problem, scheduling

MODULE - IV

Divide-and-conquer: Introduction: Multiplying large integers, The general template, Binary search, Sorting, Finding the median, Matrix Multiplication, Exponentiation

MODULE - V

Dynamic Programming: Calculation the binomial coefficient, The World Series, Making change, The principle of optimality, The knapsack problem, Shortest paths, Chained matrix multiplication

MODULE - VI

Exploring Graphs : Graphs and games: An introduction, Traversing trees, Depth-first search: Undirected graphs, Depth-first search: directed graphs, Breadth-first search, Backtracking, Branch-and-bound, the minimax principle.

MODULE - VII

Probabilistic Algorithms: Introduction, Probabilistic does not imply uncertain, Expected versus average time, Pseudorandom generation, Numerical probabilistic algorithms, Monte Carlo algorithms, Las Vegas algorithms

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Text Book:

1. G Brassard & P Bratley - Fundamentals of Algorithmics PHI, New Delhi, 2005

Reference Books:

1. E.Horowitz. et.al.- Fundamentals of Computer Algorithms, Galgotia Publication Pvt. Ltd., New Delhi, 2004
2. J.Kleinberg & E. Tardos – Algorithm Design, Pearson Education, New Delhi, 2006
3. T.H. Cormen et.al. – Introduction to Algorithms – PHI, New Delhi, 2005
4. S. Dasgupta et.al. – Algorithm, TMH, New Delhi – 2007
5. S. Sahani – Data Structures, Algorithms and Applications in C++ 2nd Edition, Universities Press (India) Pvt. Ltd., 2005

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MCA 3007 AUTOMATA THEORY [4 (3-1-0)]

Module –I & II

Basic Mathematical Objects and Mathematical Induction: Sets, logic, Functions, Relations, Alphabets, Strings, Languages, Principle of mathematical induction, Recursive definition.

Regular Expressions and Finite Automata: Regular languages and Regular Expressions, Memory required to recognize a language, Finite Automata, capability & limitations of FSM, Deterministic Finite Automata , Non-Deterministic Finite Automata, NFA with e-moves, regular sets & regular expressions, Equivalence of DFA and NDFA, NFA from regular expressions, regular expressions from DFA, Moore versus Mealy m/c, two way finite automata equivalence with one way , Kleen's Theorem, applications of finite automata.

Module -III

Regular and Non-regular languages: Criterion for Regularity, Minimal Finite Automata, Pumping Lemma for Regular Languages, Decision problems, Regular Languages and Computers.

Module-IV

Context Free Grammars : Introduction, definition, Regular Grammar, Derivation trees, Ambiguity, Simplified forms and Normal Forms, Applications.

Module-V

Pushdown Automata : Definition, Moves, Instantaneous Descriptions, Language recognised by PDA, Deterministic PDA, Acceptance by final state & empty stack, Equivalence of PDA , Pumping lemma for CFL, Interaction and Complements of CFL,Decision algorithms.

Module -VI

Turing Machines: Definition and examples, Computing Partial Functions with Turing Machine(TM), Combining TMs, Variations of TMs, Multi-tape TMs, Non-deterministic TM, Universal TM, Church Thesis.

Module -VII

Recursively Enumerable Languages: Recursively Enumerable and Recursive, Enumerating Language, Context Sensitive and Chomosky Hierarchy.

Unsolvable Problems and Computable Functions: Nonrecursive Language and unsolvable Problems, Halting Problem, Rice Theorem, Post Correspondence Problem.

Computational Complexity: Discussion on P, NP, NPC and NP-Hard Problems.

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Text Books :

John Martin -"Introduction to Languages and the Theory of Computation", 3rd edition, TMH.

Reference Books:

1. K.L.P Mishra & N. Chandrasekharan -"Theory of Computer Science", PHI
2. Hopcroft JE. And Ullman JD -"Introduction to Automata Theory, Languages & Computation", Narosa.
3. Lewis H. R. and Papadimitrou C. H -"Elements of the theory of Computation", PHI.

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MCA 4001 COMPILER DESIGN [4 (3-1-0)]

Module -I
Introduction to Compiler:

Compilers, Analysis of the source program, The phases of the compiler, Major data structures in a Compiler, Issues in a Compiler Structure, Bootstrapping and Porting .

Module -II

Scanning : Scanning Process, Regular Expression(R.E.), Finite Automata(F.A.), R.E. to DFA , Implementation of Scanner, Use of Lex to generate a Scanner.

Context Free Grammar and Parsing: Parsing Process, The role of a parser, Context Free Grammar, Parse trees and Abstract Syntax trees, Ambiguity, EBNF, Formal properties of Context Free Languages.

Module -III
Top-down Parsing: Top down Parsing by Recursive Descent, LL(1), First and Follow sets, Recursive Descent Parser for a Tiny language, Error Recovery in Top-down Parser.

Module - IV & V
Bottom-up Parsing : Overview of Bottom-up Parsing, LR(0) items and LR(0) Parsing, SLR(1), General LR(1) and LALR(1) Parsing, YACC , Error Recovery in Bottom-up Parser.

Semantic Analysis: Attributes and Attributes Grammars, Algorithms for Attribute Computation, Symbol Table, Data types and Data type Checking, Semantic Analyzer for Tiny language.

Module -VI

Run-time Environments : Memory organization during program execution, Fully static run-time environment, Stack-based run-time environments, Dynamic memory, Parameter passing mechanism, Run-time environment for Tiny language.

Module-VII

Code Generation: Intermediate code and data structures for code generation, Basic code generation techniques, Code generation of Control statements and Logical expressions, Code generation of Procedure and Function calls, Code generation for a tiny language, A survey of code optimization techniques.

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Text Book:

1. Kenneth C. Louden -"Compiler Construction – Principle and Practice", Thomson 2007.

Reference Book:

1. Aho, Sethi, Ullman -"Compiler Principles, Techniques and Tools", Pearson Education, 2007.

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MCA 4103 DATA COMMUNICATIONS AND COMPUTER NETWORKS [3 (3-0-0)]

MODULE - I

Data Communications and Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for a Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture

MODULE - II

Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity.

Guided and Wireless Transmission: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.

MODULE - III

Signal Encoding Techniques: Digital Data Digital Signals, Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals.

MODULE - IV

Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing.

MODULE - V

Data Link Control: Flow Control, Error Control, High-Level Data Link Control (HDLC).

Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.

MODULE - VI

Circuit Switching and Packet Switching: Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signaling, Softswitch Architecture, Packet-Switching Principles, X.25, Frame Relay.

MODULE -VII

Asynchronous Transfer Model: Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.

Routing in Switched Networks: Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms

Text Book :

1. W. Stallings - Data and Computer Communications, 7th Edn., Pearson Edn./ PHI, New Delhi, 2006

Reference Books :

1. B. A. Forouzan - Data Communications and Networking, 4th Edn. TMH, New Delhi 2006

2. P.C. Gupta – Data Communications and Computer Networks, PHI, New Delhi 2006

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MCA 4007 COMPUTERIZED FINANCIAL ACCOUNTING [3 (3-0-0)]

Module -I

Origin, People Interested in Accounts, Concepts & Conventions System of Accounting, Accounting Standards Book-Keeping, Double Entry, Classification of Business Accounts, "Golden Rules", Journal, Subsidiary Books, Ledger Posting & Balancing, Concept of Trial Balance, Errors and Omission, Commission, Principle and Compensating, Final Accounts with Adjustments, Introduction to Financial Accounting, (Tally 7.2), Creating Company Master, Modification & Deletion.

Module - II

Definition, Aims, Traditional vs. Innovative Management Accounting Practices, Development of Throughput Accounting, An Alternative view of Management Accounting, Lean Accounting(Accounting for Lean), Related Qualifications, Concept of Financial Budgeting, Fund Flow, Cash Flow Statement, C-V-P Analysis, MIS in Report Preparation, SFC and DFD, Working of FM Module of SAP Transaction.

Module - III

Voucher Entry: Receipt Voucher, Payments Voucher, Contra Voucher, Journal Voucher, Physical Stock Voucher, Stores Ledger Book Keeping Through MM Module of SAP Transaction.

Module - IV

Inventory Information: Stock Groups, Unit of Memo, Go Down Items, Warehousing, Displaying and Altering and Stock Keeping.

Module - V

Invoice: Preparation of Invoice, Entry, Inco-Terms, Tax Implication, CENVAT and Concept of CVED, Printing & Display.

Module - VI

Report Generation: Balance Sheet, Profit and Loss Accounts, Stock Summary, Day Book, Accounts Books.

Module - VII

Report Generation: Cash Book, Bank Book, Ledger, Outstanding Register.

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Text Books:

1. S.N. Maheshwari- Advance Accountancy, Vikas Publication
2. Amitabh Mukherjee & Md Hanif- Modern Accountancy, TMH Publication

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MCA 5001 COMPUTER GRAPHICS **[3 (3-0-0)]**

Module -I

Introduction: Image Processing as Picture Analysis, The Advantages of Interactive Graphics, Representative Uses of Computer Graphics, Classification of Applications, Development of Hardware and Software for Computer Graphics, Conceptual Framework for Interactive Graphics.

Basic Raster Graphics Algorithms for Drawing 2D Primitives: Overview, Scan Converting Lines, Scan Converting Circles, Scan Converting Ellipses, Filling Rectangles, Filling Polygons, Filling Ellipse Arcs, Pattern Filling, Thick Primitives, Line Style and Pen Style, Clipping in a Raster World, Clipping Lines, Clipping Circles and Ellipses, Clipping Polygons, Generating Characters, SRGP_copyPixel, Antialising.

Module- II & III

Graphics Hardware: Hardcopy Technologies, Display Technologies, Raster-Scan Display Systems, The Video Controller, Random-Scan Display Processor, Input Devices for Operator Interaction, Image Scanners.

Geometrical Transformations: 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Composition of 2D Transformations, The Window-to-View port Transformation, Efficiency, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Transformations as a Change in Coordinate System.

Viewing in 3D: Projections, Specifying an Arbitrary 3D View, Examples of 3D Viewing, The Mathematics of Planar geometric Projections, Implementing Planar Geometric Projections, Coordinate Systems.

Module -IV

Input Devices, Interaction Techniques, and Interaction Tasks: Interaction Hardware, Basic Interaction Tasks, Composite Interaction Tasks.

Representation Curves and Surfaces : Polygon Meshes, Parametric Cubic Curves, Parametric Bicubic Surfaces, Quadric Surfaces.

Module-V

Achromatic and Colored Light: Achromatic Light, Chromatic Color, Color Models for Raster Graphics, Reproducing Color, Using Color in Computer Graphics.

The Quest for Visual Realism: Why Realism?, Fundamental Difficulties, Rendering Techniques for Line Drawings, Rendering Techniques for Shaded Images, Improved Object Models, Dynamics, Stereosis, Improved Displays, Interacting with Our Other Senses, Aliasing and Antialiasing.

Module -VI

Head of Department

Visible-Surface Determination: Functions of Two Variables, Techniques for Efficient Visible-Surface Algorithms, Algorithms for Visible-Line Determination, The z-Buffer Algorithms, List-Priority Algorithms, Area-Subdivision Algorithms, Algorithms for Octress, Algorithms for Curved Surfaces, Visible-Surface Ray Tracing.

Illumination and Shading: Illumination Models, Shading Models for Polygons, Surface Detail, Shadows, Transparency, Interobject Reflections, Physically Based Illumination Models, Extended Light Sources, Spectral Sampling.

Module-VII

Advanced Raster Graphics Architecture: Simple Raster-Display System, Display-Processor Systems, Standard Graphics Pipeline, Introduction to Multiprocessing, Pipeline Front-End Architectures, Parallel Front-End Architectures, Multiprocessor Rasterization Architectures.

Advanced Geometric and Raster Algorithms: Clipping, Scan-Converting Primitives, Antialiasing, The Special Problems of Text, Filling Algorithms, Making copyPixel Fast, The Shape Data Structure and Shape Algebra.

Text Book:

1. Foley, Van Dam, Feiner, Hughes- Computer Graphics Principles & Practice, 11th edn., Pearson Education, New Delhi, 2004.

Reference Book:

1. D. Hearn & M.P.Baker- Computer Graphics, PHI, New Delhi, 2006

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MCA 5003 SYSTEM SIMULATION AND MODELLING [4 (3-1-0)]

Module –I& II

Introduction to Discrete-Event System Simulation

Introduction to Simulation: When Simulation is the Appropriate Tool, When Simulation is not Appropriate, Advantages and Disadvantages of Simulation, Areas of Application, Systems and System Environment, Components of a System, Discrete and Continuous Systems, Model of a System, Types of Models, Discrete-Event System Simulation.

Simulation Examples: Simulation of Queuing Systems, Simulation of Inventory Systems, Other Examples of Simulation.

Module-III

General Principles: Concepts in Discrete-Event Simulation, List Processing.

Simulation Software: History of Simulation Software, Selection of Simulation Software, An Example of Simulation, Simulation in Java, Simulation in GPSS, Simulation in SSF, Simulation Software, Experimentation and Statistical-Analysis Tools.

Module-IV

Mathematical and Statistical Models

Statistical Models in Simulation: Review of Terminology and Concepts, Useful Statistical Models, Discrete Distributions, Continuous Distributions, Poisson Process, Empirical Distributions.

Module-V

Queuing Models: Characteristics of Queuing Systems, Queuing Notation, Long-Run Measures of Performance of Queuing Systems, Steady-State Behavior of Infinite-Population Markovian Models, Steady-State Behavior of Finite-Population Models(M/M/c/K/K), Networks of Queues.

Module-VI

Random-Number Generation: Properties of Random Numbers, Generation of Psedo-Random Numbers, Techniques for Generating Random Numbers, Tests for Random Numbers.

Random-Variate Generation: Inverse-Transform Technique, Acceptance-Rejection Technique, Special Properties.

Module-VII

Analysis of Simulation Data

Input Modeling: Data Collection, Identifying the Distribution with Data, Parameter Estimation, Goodness-of-fit Tests, Fitting a Nonstationary Poisson Process, selecting Input Models without Data, Multivariate and Time-Series Input Models.

Verification and Validation of Simulation Models: Model Building, Verification, and Validation, Verification of Simulation Models, Calibration and Validation of Models.

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Text Book:

1. J. Banks, J. S. Carson , B.L. Nelson, D.M. Nicol- Discrete-Event System Simulation, 4th Edn, Pearson Education, 2007.

Reference Book:

1.A.M. Law & W.D. Kelton – Simulation Modeling and Analysis, 3rd Edn. TMH, 2003

MCA 5005 OPTIMIZATION THEORY *[3 (3-0-0)]*

Module – I

Operation Research – An overview, Organ and Development of OR, Nature and Features of OR, Modeling in OR, General Solution Methods for OR models, Scientific method in OR, Methodology of OR, Application, Opportunities and Shortcomings of OR.

Module – II

Linear Programming Problem : Introduction, Mathematical Formulation of the Problem, Graphical Solution Method, Some Exceptional Cases, General LPP, Canonical and Standard forms of LPP, Simplex Method: Introduction, Fundamental properties of solutions, the Computational Procedure, Use of Artificial variables, Solution to simulation Linear Equations, Investing a Matrix using Simplex Method.

Module – III

Duality in LPP: Introduction, General Primal – Dual pair, Formulating a Dual Problem, Primal Dual pair in Matrix form, Dhaliting theorems, Dual simplex method, Post optical Analysis, Introduction: Variation in cost vector, Requirement Vector, Coefficient Matrix, Structural Variation.

Module – IV

Integer Programming and Advance LPP techniques: Introduction, Gomory's Method, Courtruction of Gomory's constraints, Fractional Cut Method: All Integer & Mixed Integer, Revised Simplex Method, Bounded Variable, Parametric LPP, Karmakar Algorith.

Module – V

Dynamic Programming & Introduction: Characteristic of Dynamic Programming, Dynamic Programming Algorithm, Solution of LPP by Dynamic Programming.

Module – VI

NLPP: Introduction, Formulality a NLPP, General NLPP, Constrained Optimization with Equality Constraints and Inequality constraints, Saddle Points.

Module – VII

NLPP Methods: Introduction, Graphical solution, Kuhn – Tucker Conditions with Non Negative Constraints, Quadratic Programming, Wolfe's Modified Simplex Method, Separable Convex Programming & Algorithm.

Text Book:

Head of Department

1. Kanti Swarup, P.K. Gupta, Man Mohan – "Opeations Reaearch, Sultan Chand & Sons, New Delhi – 2001

Reference Books:

1. Ronald L. Rardin "Optimization in Operations Research", pearson Education, New Delhi – 2003
2. S.S. Rao, "Optimization Theory & Application", Wiley Eastern Ltd, 1979.

LIST OF ELECTIVES

GROUP I : DATABASE TECHNOLOGY

MCA 7101 DISTRIBUTED DATABASES [3 (3-0-0)]

Module – I
Introduction to Distributed Data Processing: Advantages of DDB's, Problem areas.

Module – II
Distribute Database Management System Architecture: DBMS Standardization, Architectural models for DDBMS Distribute DBMS Architecture.

Module – III
Distributed Database Design: Design Strategies, Distribution design issues, Fragmentation, Allocation.

Module – IV
Semantic Data Control : view management, data security, Integrity control.

Module – V
Query processing and Optimization: Quarry Processing Problem, Characterization of Query Processors, Layers of query Processing, Query decomposition, Query Optimization, Centralized query optimization, Join ordering in fragment queries, Distributed Query Optimization Algorithms.

Module – VI
Transaction Management and Concurrency Control: Introduction, Properties, Serializability Theory, Locking Based Concurrency control Algorithm Time Stamp based concurrency control Algorithms, Dead Lock management.

Module – VII
Recovery and Reliability: Failures and fault tolerance in distributed system, Distributed & local reliability protocol, Sits failures, network partitioning.

Text Book:

1. M. Tamer Ozsee, Patric Valduriez - Principle of Distributed Database Systems 2nd Edn., Pearson Education Asia,2001.

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MCA 7103 DECISION SUPPORT SYSTEMS [3 (3-0-0)]

Module – I

Decision Making Process: An Over view, Introduction, Managerial decision making and Information System, Need for computerized decision support and the supporting technologies, Framework of DSS, Group Support System, Executive information system, Knowledge management Systems.

Module – II

Decision Making, System, Models : Decision Making – Introduction and Definition, System, Models, previews of modeling process, Decision making – The intelligence phase, the design phase and the choice phase.

Evaluation – Multiple Goals, sensitivity analysis, What – if and goal seeking.

Decision Making - The implementation phase, Alternative decision making models.

Module – III

DSS – Configurations, Definitions, Characteristics & Capabilities, Components, The Data management Subsystem, Model Management Subsystem, Knowledge – based management, Subsystem, User interface Subsystem, DSS Classification, DSS H/W, Difference between Management Science and MIS.

Module – IV

Modeling & Analysis - Modeling for MSS, Static & Dynamic Models, Treating Certainty, Uncertainty and Risk, Interface diags, MSS modeling in spreadsheets, Decision analysis (Decision tables and Decision trees), Optimization via mathematied programming, Meusistic Programming, Multidimensional Modeling – OLAP.

Module – V

DSS Development – Introduction, The Traditional System Development life cycle, Alternate Development Methodologies, Prototyping, DSS Technology Levels and Tools, DSS Development Platforms, DSS Development Tool Selection, Team Developed DSS, End – User Developed DSS, DSS System Integration.

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Module – VI

Collaboration Communication, Enterprise DSS Group Decision Making – Communication & Collaboration, Communication Support, Collaboration Support – Computer Supported Co-operative work, Group Support System, GSS Technologies.

Module – VII

Enterprise DSS – Information need concepts & definitions, Evaluation of EIS, Comparing and Integrating EIS and DSS, Data Access, Data Collection, Problem & Quality, DBMS in DSS, Data Warehousing, Data Query, OLAP Multidimensional Analysis and Presentation, Data Visualization and Multidimensionality, Organizational DSS.

Text Book:

1. E. Turloan & E. Aronson- Decision Support System & Intelligent System, 6th Edn., Pearson Education.

Reference Book:

1. **G.M. Marakas- Decision Support Systems, 2nd Edn., Pearson /Prentice Hall of India.**

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MCA 7105 ENTERPRISE RESOURCE PLANNING **[3 (3-0-0)]**

Module-I

Introduction to ERP : Evolution of ERP, What is ERP, Reasons for the growth of the ERP market, Advantages of ERP, Reasons of Failure.

Module-II&III

Enterprise- An Oberview : **Integrated Management information, Business Modeling, Integrated Data Model.**

ERP and Related Technologies : BRP (Business Process Reengineering), MIS (Management Information System), DSS (Decision Support System), EIS (Executive Information system), OLAP, Supply Chain Management.

Module-IV

A Manufacturing Perspective : ERP, CAD/CAM, MRP (Material Requirement Planning), Bill of Material, Closed loop MRP, MRP-II, DRP (Distributed Requirement Planning), Product Data Management, Data Management,

Module-V

Benefits of PDM : ERP Modules, Finance, Plant Maintenance, Quality Management, Material Management.

Benefits of ERP :

Module-VI

ERP Market : SAP, BAAN, Oracle Corporation, People Soft.

ERP Implementation Life Cycle :

Module-VII

Vendors, Consultants & Users's : In – house Implementation – pros & cons, Vendors, Consultants, End-users.

Future Directions in ERP.
ERP Case Studies.

Text Book :

1. Enterprise Resource Planning by Alexis Leon TMH Fourth Reprint 2001.

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MCA 7107 DATA MINING AND WARE HOUSING [3 (3-0-0)]

Module – I

Introduction: Introduction, Data Mining as subject, What motivated Data mining, Why is it important.

Data warehousing: Introduction, What is a Data Warehousing Definition, Multidimensional Data Model, OLAP Operation, warehouse Scheme, Data Warehousing, Architecture, Metadata, OLAP ENGINE, Data warehouse Backend Process.

Module – II

Data Mining: Introduction, What is Data Mining, Data Mining Definition, KDD Vs, Data Mining, DBMS Vs. DM, Other related area, DM Technique, Other Mining Problem, Issue and challenge is in DM, DM Application area, DM Application, Case Sturdy.

Module – III

Mining Association Rule in Large Database: Introduction, what is an Association Rule, Method to discover association Rule, A Priori Algorithm, Partition Algorithm, Pinear- Search algorithm, Dynamic item set Counting Algorithm, FP – Tree Growth Algorithm, Discussion and Different Algorithm, Generalized, Association Rule, Association Rules with Item Constraints.

Module – IV

Clustering Techniques: Introduction , Clustering Paradigram, Partition Algorithm, K- Medoid Algorithm, CLARA, CLARANS, Heirer Chial Clustering, DBSCAN, BIRCH, CURE, Categorical Chastereing Algorithms, STIRR, ROCK, CACTUS.

Module – V

Data Mining Primitives, Language and System Architecture : Data Mining Primitives, what defines a Data Mining task, Task relevant Data, The Kind of Knowledge to Mined, Concept Hicrechings, Interestingness Measwce, presenation and visualization of Discovered Patterns, Data Mining Query Language.

Module – VI

Decision Trees: Introductions, What is decision Tree, Tree Construction Principle, Best split splitting Indices, Splitting criteria, Decision Tree Construction with Presenting, Prunesing Technique, Integration of Pruning Technique and Construction.

Module – VII

Temporal and Spatial Data Mining: Introduction, What is Temporal Data Mining emporal Association Rules, Sequence Mining, The GSP Algorithm, SPIRIT, Spafial Mining, Spatial Clustering, Spatial Trends.

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Text Book: A.K. Pujari, "A Data Mining Technique", University press (India) Limited, 2001

Reference Books:

1. A Hand and M. Kamber, "Data Mining Concept and Technique", Morgan. Kauffmann Publishers, Else river India, New Delhi, 2003.

1. Recherd J, Roiger and Michance W. Creatz, Data Mining: a tutorial Based Primer, Addision Wesley, 2003.
2. M.H. Dienham, Data Mining : Introductory and Advanced Topics, Pentice Hall 2003.

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MCA 7109 MULTIMEDIA DATABASES [3 (3-0-0)]

Module I

Introduction ,Multimedia Information Applications , Issues and Challenges

Module II

Semantic Models for Multimedia Information Systems, Multimedia Semantic Models

Module III & IV

Multimedia database Searching, Image Segmentation ,Video Parsing and Segmentation Approaches ,Iconic-Based Grouping and Browsing Approaches , Knowledge-Based Event Modeling Approaches , Characteristics of Video Data Modeling , Motion Detection and Tracking Approaches ,Object Recognition Approaches ,Content-Based Retrieval

Module V

Multimedia Browsing, Video Browsing, Key Frame Selections

Module VI

Augmented Transition Network Model (ATN), Spatial and Temporal Relations of Semantic Objects, Multimedia Presentations, Multimedia Database Searching, Multimedia Browsing, User Interactions and Loops

Module VII

Object Composition Petri Net Model, Interval Based Conceptual Models

Text Book:

1. Chen S C, Kashyap R L, Ghafoor A; Semantic Models for Multimedia Database Searching and Browsing, Kluwer Academic Publishers,

Reference Book:

1. Muneesawang P ,Guan L-Multimedia Database Retrieval A Human-Centered Approach, Springer Publication, 2006

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Group II : Software Technology

MCA 7201 ADVANCED JAVA PROGRAMMING [3 (3-0-0)]

Module-I &II

Components and Facilities or Rich Graphical User Interfaces: Programming with the JFC, Swing API Components, Jcomponent Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, and Check Boxes, Menus, Toolbars, and Actions, Sliders, Spinners, Progress Bars, and Scrollbars, Lists and Combo Boxes, Text-Entry Components, Color and File Choosers, Tables and Trees, Printing with the 2D API, Java Print Service API.

Module-III

Using Relational Database: Introduction, Best Practices for Programming for Databases, JDBC Drivers for RDBM Systems, SQL to Java Type Mappings, Understanding the Database used in this chapter, Using the **java.sql** API, Coding Transactions, Using the **javax.sql** API, Connection Pooling.

Module-IV

XML: Introduction, XML Structure, XML Example Document with SAX, Parsing an XML Document with DOM, Generating an XML Document with DOM, Validating XML Documents using DTD and XML Schema, Transforming XML using XSLT.

Module-V

Network Programming: Introduction, Working with URLs, Working with Sockets, Remote Method Invocation.

Module-VI

Building Web Applications: Introduction, The Technology of the Web, J2EE Web Application Packaging, Servlets, The Servlet API, The User Experience, Building a Web App with Continuity, Java Server Pages, JSP Tags and API, How the Server Processes JSPs, Java Coding in JSPs, Frameworks for Building Web Applications, Building Robust WebApps.

Module-VII

Enterprise JavaBeans: Introduction, Enterprise Programming, What are EJBs? Session EJBs, EJB Clients, Entity EJBs, Message-Driven Beans, EJB Transactional Characteristics, EJB Security, Best Practices for Designing EJB-Based Applications.

Text Book:

1. Wigglesworth & McMillan – JavaTM Programming Advanced Topics, 3rd Edn., India Edition, Thomson Education, New Delhi, 2007

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MCA 7203 SYSTEMS PROGRAMMING [3 (3-0-0)]

Module –I

Introduction: System Softwares & its Components, Evolution of System Softwares- Operating System, Loaders, Interpreters, Compilers, Linkers, Assemblers.

Module-II

Assemblers: Elements of Assembly Language Programming, Assembly Process, Single Pass Assembler, Design of a 2-Pass assembler for In 8088.

Module –III

Macros & Macro processors: Macros, Different forms of Macros, Macros using AIF, AGO, REPT. Etc, Design of a Macro Processor, Macro Assembler.

Module-IV

Loaders: Basic Loader Functions, Absolute Loader, Compile & go Loader, Relocating Loader, Direct Linking Loader.

Module – V

Linkage Editors: Linking and Relocation, Program Relocability, Linkage Editor and its Application in IBP-PC, Linking for Program Overlays.

Module-VI & VII

Software Tools: Spectrum of Software Tools, Text Editors, Interpreter and Program Generators, Debug Monitors, Programming Environments.

Text Book:

1. D.M. Dhamdhere-System Programming and Operating Systems, 2en Edn., TMH, New Delhi.

Reference Book:

1. J.J. Donovon- System Programming, TMH, New Delhi.

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MCA 7205 PROGRAMMING LANGUAGE DESIGN AND CONCEPTS

[3 (3-0-0)]

Module-I

Introduction:

The Role of Programming Languages: Toward Higher-Level Languages, Programming Paradigms, Languages Implementation: Bridging the Gap.

Language Description: Syntactic Structure: Expression Notations, Abstract Syntax Trees, Lexical Syntax, Context- Free Grammars, Grammars for Expressions.

Module-II& III

Imperative Programming:

Statements: Structured Programming: The Need for Structured Programming, Syntax-Directed Control Flow, Design Considerations: Syntax, Handling Special Cases in Loops, Programming with Invariants, Proof Rules for Partial Correctness, Control Flow in C.

Types: Data Representation: The Role of Types, Basic Types, Arrays: Sequences of Elements, Records: Named Fields, Unions and Variant Records, Sets, Pointers: Efficiency and Dynamic Allocation, Two String Tables, Types and Error Checking.

Procedure Activations: Introduction to Procedures, Parameter- Passing Methods, Scope Rules for Names, Nested Scopes in the Source Text, Activation Records, Lexical Scope: Procedures as in C.

Module-IV& V

Object-Oriented Programming:

Grouping of Data and Operations: Constructs for Program Structuring, Information Hiding, Program Design with Modules, Modules and Defined Types, Class Declarations in C++, Dynamic Allocation in C++, Templates: Parameterized Types, Implementation of Objects in C++.

Object-Oriented Programming: What is an Object?, Object-Oriented Thinking, Inheritance, Object-Oriented Programming in C++, Derived Classes and Information Hiding, Objects in Smalltalk, Smalltalk Objects have a Self.

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Module-VI& VII

Functional Programming:

Elements of Functional Programming: A Little Language of Expressions, Types: Values and Operations, Approaches to Expression Evaluation, Lexical Scope, Type Checking.

Functional Programming in a Typed Language: Exploring a List, Function Declaration by Cases, Functions as First-Class Values, ML: Implicit Types, Data Types, Exception handling in ML.

Functional Programming with Lists: Scheme, Dialect of Lisp, The Structure of Lists, List Manipulation, A Motivating Example: Differentiation, Simplification of Expressions.

Text Book:

1. R.Sethi & K.V. Viswanathan- Programming Languages Concepts & Constructs, 2nd Edn., Pearson Education, 2007.

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MCA 7207 ASSEMBLY LANGUAGE PROGRAMMING [3 (3-0-0)]

Module – I

Introduction to PC H/W and S/W: The Processor, Internal Memory, Segments & Addressing, Registers, Operating System Characteristics, The Boot Process, DOS-BIOS Interface, System Programming Loader, The Stack, Program Addressing, Memory of Register References.

Module – II

Execution of Instructions: The Debug Program, Viewing Memory Locations, Entering a symbolic Assembly Program, Using the INT instruction, Saving a Program from within DEBUG, The PTR Operator.

Module – III

Fundamentals of Assembly Language: (a) Requirements: Assembler & Compilers, Assembly language, Comments, Reserved words, Identifiers, Statements, Direction, Initializing a Program for Execution, Initializing for Protecting Mode, Simplified Segment Directives, Data Definition, Directive for Defining Data, The EQU Directive.

Assembling, Linking, and Executing a Program, Processor Instruction & Addressing, Writing Com Programs, Program Logic & Control.

Module – IV

Screen & Keyboard Operation : Selecting the Cursor, Clearing the screen, DOS Function 02H, 09H, 0AH, Use of Control Characters for Displaying, File Handling, File Handles for keyboard Input, Advance Setting video Mode, Text Mode, Screen Pages, BIOS Interrupt 10H for Text Mode, Blinking, Reverse video & Scrolling, BIOS Interrupt 10H for Graphics, Setting & Displaying Graphics Mode.

Advance Keyboard Processing: DOS Interrupt 21H, 16H, 09H, Keyboard Buffer, Extended Function Keys & Scan codes, Selecting from Menu.

Module – V

Data Manipulation: Repeat String Prefix, Move String, Load String, Store String, Transferring Data, Compare String, Scan String, Scan & Replace, Duplicating a pattern, Right Adjusting on the screen.

Processing Binary Data: Addition & Subtraction, Multiword Arithmetic, Unsigned & Signal Data, Multiplication with Stiffing, Division & Division with Stipling, Reversing the Sign, Numeric Data Processing.

Module – VI

Input / Output: Disk Storage Organization, Disk Processing (Writing & Reading files), DOS operations for Supporting Disk & files, BIOS Disk operations, Printing.

Module – VII

Advance Programming: Writing Macros, Linking to Subprograms, DOS Memory Management.

Text Book:

1. Pelter Abel, "IBM PC Assembly Language & Programming", 4th Edn, PHI.

Reference Book :

1. Brey & Borry, Intel Microprocessor 8080,86,186,286, 386,486, Pentium,5th Edn., PHI.

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MCA 7209 WEB PROGRAMMING [3 (3-0-0)]

Module-I

XML: Part I: Creating Basic XML Document, Parsing an XML Document, Writing Well -Formed Documents, Working with Special characters.

XML: Part II : Organizing Elements with Namespaces, Defining elements with DTDs, Validating XML Documents Against DTDs, Declaring Elements in a DTD, Declaring Attributes in a DTD.

Module-II

Visual Basic .NET: Part I: Understanding the Basic of Visual Studio .NET, Using the Visual Studio .NET Integrated Developer Interface (IDE), Creating the User Interface for a Solution, Using VB .NET Controls, Examining the Structure of a VB .NET Module, Understanding VB .NET Data Types and Variables, Introduction to Event Handlers, Writing Decision-Making Statements, Using Repetition Statements.

Module-III

Visual Basic .NET: Part II: Getting Started, An Overview of ADO .NET, Creating the DataAdapter, Storing Data in DataSet and DataTable Objects, Binding Controls to a DataSet, Navigating Through the Records in a Database Table, Modifying a Database Record.

Module-IV

ASP .NET: Part I: Building Web Forms Using ASP .NET, Exploring ASP .NET Server Controls, Using ASP .NET Server Controls to Create Web Forms,Understanding the Code Behind the Page.

ASP .Net Part II: Working With User Controls, Exposing User Control Properties and Methods, Using ASP .NET Server Controls in User Controls, Using Validation Controls to Improve Web Forms, Uploading Files to a Web Server.

Module-V

CGI/Perl: Part I: Writing Your First CGI Script in Perl, Testing a Perl CGI Script, Debugging a Perl CGI Script, Creating a Link to a CGI Script, Using a Link to Send One Item of Data to a CGI Script, Parsing the Data Sent to a Perl CGI Script, Using a Link to Send Multiple Items of Data to a CGI Script.

Module-VI

CGI/Perl: Part II: Using a CGI Script to Process From Data, Planning a CGI Script, Declaring Scalar Variables in Perl, Using Assignment Statements to Assign Values to Variables, Using Arithmetic Operators in Perl, Accessing the Values Received from an Online Form, Including a Dollar sign in a Number, Using the **printf** function.

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\Module-VII

PHP: Part I: Preparing the Use PHP, Exploring PHP for the First Time, Understanding PHP Basics, Displaying PHP Output, Managing PHP Program Flow.

PHP: Part II: Examining the Relationship Between PHP and MySQL, Planning a PHP Web Application, Creating and Using a Logon Window, Managing System Data, Updating a PHP Web Application.

Text Book:

1. Xue Bai, Michael Ekedahl, Joyce Farrell, DonGosselin, Diane Zak, Shashi Kaparthi, Peter Maclntyre, Bill Morrissey - The Web Warrior Guide to Web Programming, India Edition,Thomson Education

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MCA 7211 SOFTWARE PROJECT MANAGEMENT [3 (3-0-0)]

Module – I

Managing Software Project: Process & Project Management, Project Management and the CMM, Project Management at Infosys, Introduction to CMMI, PCMM.

The Project Planning Infrastructure: The process data base, The process capability Baseline, Process Assets and the Body of Knowledge System.

Module – II

Process Planning: The Infosys Development Process, Requirement Change Management

Effort Estimation & Scheduling: Estimation and Scheduling Concepts, Effort – Estimation, Scheduling.

Module – III

Quality Planning: Quality Concepts, Quantitative quality Management Planning, Defect Prevention Planning.

Risk Management: Concepts of Risks and Risk Management, Risk Assessment, Risk Control, Examples.

Module – IV

Measurement and Tracking Planning: Concepts in measurement, Measurements, Project tracking.

Project Management Plan: Team Management, Customer Communication and Issue Resolution, Structure of the Project Management Plan.

Module – V

Configuration Plan: Concepts in Configuration Management, Configuration Management Process.

Reviews: The Reviews, Review process Data Collection, Monitoring & Control, Introduction of Reviews & the NAH Syndrome.

Module – VI

Project Monitoring & Control: Project tracing, Milestone Analysis, Activity Level Analysis using SPC, Defect Analysis & Prevention Process Monitoring & audit.

Module – VII

Project Closure: Project closure Analysis.

Text Book:

1. Pankaj Jalote – Software Project Management in Practice, Pearson Education, New Delhi, 2002

Reference Books:

1. B.Huges and M.Cotterell – Software Project Management, 3/e, Tata Mcgraw Hill, New Delhi, 2004.
2. Pankaj Jalote – CMM in Practice, Pearson Education, New Delhi, 2002
3. W. Humph Grey – Managing the Software Process, Addition – Wesley, 1989.

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Group III : Cognitive Sciences and Intelligent Systems

MCA 7301 NATURAL LANGUAGE PROCESSING [3 (3-0-0)]

Module-I& II

Introduction to NLP : Definition, issues and strategies, application domain, tools for NLP, Linguistic organisation of NLP, NLP vs PLP.

Word Classes Review of Regular Expressions, CFG and different parsing techniques

Morphology: Inflectional, derivational, parsing and parsing with FST, Combinational Rules

Phonology: Speech sounds, phonetic transcription, phoneme and phonological rules, optimality theory, machine learning of phonological rules, phonological aspects of prosody and speech synthesis.

Module-III & IV

Pronunciation, Spelling and N-grams: Spelling errors, detection and elimination using probabilistic models, pronunciation variation (lexical, allophonic, dialect), decision tree model, counting words in Corpora, simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.

Syntax : POS Tagging: Tagsets, concept of HMM tagger, rule based and stochastic POST, algorithm for HMM tagging, transformation based tagging

Module-V

Sentence level construction & unification: Noun phrase, co-ordination, sub-categorization, concept of feature structure and unification.

Semantics:

Representing Meaning: Unambiguous representation, canonical form, expressiveness, meaning structure of language, basics of FOPC

Semantic Analysis: Syntax driven, attachment & integration, robustness

Module-VI

Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, internal structure of words, metaphor and metonymy and their computational approaches

Word Sense Disambiguation: Selectional restriction based, machine learning based and dictionary based approaches.

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Module-VII

Pragmatics: Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Co-reference, pronoun resolution algorithm, text coherence, discourse structure.

Dialogues: Turns and utterances, grounding, dialogue acts and structures

Natural Language Generation: Introduction to language generation, architecture, dicourse planning (text schemata, rhetorical relations.

Text Book:

1. D. Jurafsky & J. H. Martin – "Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition", Pearson Education

Reference Books:

1. Allen, James – "Natural Language Understanding". Benjamin/Cummings, 2nd Edn.,1995
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal., Natural Language Processing- "A Pananian Perspective", Eastern Economy Edition,PHI, 1995
3. Eugene Cherniak: "Statistical Language Learning", MIT Press, 1993.
4. Manning, Christopher and Heinrich Schutze, "Foundations of Statistical Natural Language Processing". MIT Press, 1995

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MCA 7303 GENETIC ALGORITHMS AND SWARM INTELLIGENCE [3 (3-0-0)]

Module – I

Introduction: Biological Background, Conventional Genetic Algorithms, Theory and Hypothesis, Modifications to Genetic Algorithms, Chromosome representation, Objective and Fitness Function, Selection method, Genetic Operators, Replacement Schemes, A Game of Genetic creative (Example).

Module – II

Intrinsic Characteristics : Parallel Genetic Algorithm, Multiple Objective, Robustness, Multimodel, Constraints Hierarchical Genetic Algorithm, Biological Inspiration, Hierarchical Chromosome Formulation, Genetic operations, Multiple Objective Approach.

Module – III

Application of Genetic Algorithms: Genetic Algorithm in speech Recognition Systems, Genetic Algorithm in Communication Systems.

SWARM INTELIGENCE

Module – IV

Introduction: social insets, modeling collective behavior in social inset – modeling and designing, self-organization in social insets, stinger, Modeling as an interface from Algorithms to Robotics.

Module – V

Ant Foraging Behavior Combinational Optimization and Routing in Communication Networks: Overview**,** Foraging Strategies in ANTS, Natural Optimization, Rapid patterns of Array Ants, Ant colony optimization, The traveling salesman problem, Ant system, Ant colony system, The Quadratic assignment problem.

Module – VI

Division of Labor and Task Allocation: Overview, Division of Labor in social insects, Response threshold, introduction, model with one task, Formal analysis of the model, Deterministic equations, Model with several tasks adoption task allocation.

Module – VII

Self Organization and Templates: Overview, the interplay of self organization and templates, A Reaction Diffusion model of the construction of the Royal Chamber, Wall building in Laptotheras albepennis, Applications, Data Analysis, Graph Partitioning, Nest Building in social insects, Strigmerry and Self organization, Discrete stignersy.

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Text Books:

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz – "Swarm Intelligence From Natural to Artificial Systems", Oxford University Press, 1999.
2. K.F. Man, K.S. Tang, S. Kwong – "Genetic Algorithms : Concepts and Designs, Spinger – verlag, 1999.

Reference Book:

1. David E. Goldberg – "Genetic Algorithms in Search, Optimization and Machine Designing,PearsonEducation,1989.

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MCA 7305 ARTIFICIAL INTELIGENCE [3 (3-0-0)]

Module-I&II

Introduction: Overview Of Artificial Intelligence- Problems Of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature Of Environment, Structure Of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving : Problems, Problem Space & Search: Defining The Problem As State Space Search, Production System, Problem Characteristics, Issues In The Design Of Search Programs.

Module-III

Search Techniques: Solving Problems By Searching, Problem Solving Agents, Searching For Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Search Techniques : Solving Problems By Searching :Problem Solving Agents, Searching For Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search For Constraint Satisfaction Problems.

Module-IV

Adversarial Search : Games, Optimal Decisions & Strategies In Games, The Minimax Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

Knowledge & Reasoning : Knowledge Representation Issues, Representation & Mapping, Approaches To Knowledge Representation, Issues In Knowledge Representation.

Module-V

Using Predicate Logic : Representing Simple Fact In Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, Natural Deduction.

Representing Knowledge Using Rules : Procedural Verses Declarative Knowledge, Logic Programming, Forward Verses Backward Reasoning, Matching, Control Knowledge.

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Module-VI

Probabilistic Reasoning: Representing Knowledge In An Uncertain Domain, The Semantics Of Bayesian Networks, Dempster-Shafer Theory, Fuzzy Sets & Fuzzy Logics.

Planning : Overview, Components Of A Planning System, Goal Stack Planning, Hierarchical Planning, Other Planning Techniques.

Natural Language Processing : Introduction, Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Module-VII

Learning : Forms Of Learning, Inductive Learning, Learning Decision Trees, Explanation Based Learning, Learning Using Relevance Information, Neural Net Learning & Genetic Learning.

Expert Systems : Representing And Using Domain Knowledge, Expert System Shells, Knowledge Acquisition.

Text Book:

1. Ritch & Knight -Artificial Intelligence, TMH

Reference Books:

1. S. Russel and P. Norvig- Artificial Intelligence A Modern Approach, Pearson Education.

2. Patterson -Introduction to Artificial Intelligence & Expert Systems, PHI

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MCA 7307 IMAGE PROCESSING [3 (3-0-0)]

Module – I

What Is Digital Image Processing ,Fundamental Steps in Digital Image Processing ,Components of an Image Processing System , Elements of Visual Perception , Light and the Electromagnetic Spectrum , Image Sensing and Acquisition , Image Sampling and Quantization , Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Module – II

Enhancements in Spatial Domain: Some Basic Gray Level Transformations , Histogram Processing , Enhancement Using Arithmetic/Logic Operations , Basics of Spatial Filtering , Smoothing Spatial Filters , Sharpening Spatial Filters , Combining Spatial Enhancement Methods

Module – III

Enhancements in Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain , Smoothing Frequency-Domain Filters , Sharpening Frequency Domain Filters , Homomorphic Filtering

Module – IV

Image Restoration: A Model of the Image Degradation/Restoration Process , Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering , Periodic Noise Reduction by Frequency Domain Filtering. Linear, Position-Invariant Degradations , Estimating the Degradation Function. Inverse Filtering , Minimum Mean Square Error (Wiener) Filtering , Constrained Least Squares Filtering. Geometric Mean Filter , Geometric Transformations.

Module – V

Image Compression: Fundamentals , Image Compression Models , Elements of Information Theory , Error-Free Compression , Lossy Compression

Module – VI & VII

Morphological Image Processing and Segmentation: Preliminaries , Dilation and Erosion , Opening and Closing , The Hit-or-Miss Transformation. Some Basic Morphological Algorithms , Detection of Discontinuities , Edge Linking and Boundary Detection , Thresholding , Region-Based Segmentation.

Text Book:

1. Gonzalez R., Woods R.; Digital Image Processing, 2nd Edition, Prentice Hall of India, New Delhi

Reference Book:

1. Jain, A. K. ; Fundamentals of Digital Image Processing, Prentice Hall of India, New Delhi

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MCA 7309 SOFT COMPUTING [3 (3-0-0)]

Module – I

Introduction To Artificial Intelligence System, Neural Network, Fuzzy Logic & Genetic Algorithm. Fuzzy Set Theory : Fuzzy Versus Crisp, Crisp Set, Fuzzy Set, Crip Relation, Fuzzy Relations.

Module – II

Fuzzy System: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System, Defuzzification Methods, Applications.

Module – III

Genetic Algorithms, Basic Concepts, Creation Of Offspring, Working Principle, Encoding, Fittness Function, Reproduction.

Module – IV

Genetic Modelling, Inheritance Operations, Cross Over, Inversion And Deletion, Mutation Operator, Bit Wise Operators, Generation Cycle, Convergence Of Genetic Algorithm, Application, Multi Level Optimization, Real Life Problems, Difference And Similarities Between GA And Other Traditional Methods, Advanced In GA.

Module – V

Fundamentals Of Neural Networks, Basic Concepts Of Neural Network, Human Brain, Model Of An Artificial Neuron, Neural Network Architectures, Characteristic Of Neural Networks, Learning Method, Taxomany Of Neural Network Architectures, History Of Neural Network Research, Early Neural Network Architectures, Some Application Domains.

Module – VI

Back Propagation Network Architecture Of Back Propagation Network, Back Propagation Learning, Illustration, Applications, Effect Of Tuning Parameters Of The Back Propagation Neural Network, Selection Of Various Parameters In BPN, Variations Of Standard Back Propagation Algorithm.

Module – VII

Associative Memory And Adaptive Resonance Theory, Autocorrelators, Hetrocorrelators , Multiple Training Encoding Strategy, Exponential BAM, Associative Memory For Real Coded Pattern Pairs, Applications, Introduction To Adaptive Resonance Theory, ARTI, Character Recognition Using ARI1

Text Book:

1. S. Rajasekharan & G. A. Vijayalakshmi – " Neural Network, Fuzzy Logic And Gentic Algorithm Synthesis And Applications", Prentice Hall Of India PLT, Pai – 2004

Reference Book:

3. Jyh – Shing R Jang, C. T. Sun, E Mizutani – Neuro Fuzzy And Soft Computing – A Computational Approach To Learning And Machine Intelligence", Prentice Hall Of India – 1997.

Head of Department

Group IV : Networking and Distributed Systems

MCA 7401 NETWORK SECURITY AND CRYPTOGRAPHY [3 (3-0-0)]

Module-I&II

Attacks on Computers and Computer Security: Introduction, The Need for Security, Security Approaches, Principles of Security, Types of Attacks.

Cryptography: Concepts and Techniques: Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key range and Key Size, Possible Types of Attacks.

Module-III

Symmetric Key Algorithms and AES: Introduction, Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard (AES).

Module-IV

Asymmetric Key Algorithms, Digital Signatures and RSA: Introduction, Brief History of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm, Some Other Algorithms.

Module-V

Digital Certificates and Public Key Infrastructure(PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML, PKI and Security, Creating Digital Certificates Using Java.

Module-VI

Internet Security Protocols: Introduction, Basic Concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hyper Text Transfer Protocol (SHTTP) , Time Stamping Protocol (TSP) , Secure Electronic Transaction (SET), SSL versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol (WAP) Security, Security in GSM, Security in 3G.

Module-VII

User Authentication and Kerberos: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Kerberos, Key Distribution Center (KDC), Security Handshake Pitfalls, Single Sign on (SSO) Approaches.

Network Security, Firewalls and Virtual Private Networks (VPN): Introduction, Brief Introduction to TCP/IP, Firewalls, IP Security, Virtual Private Networks (VPN), Intrusion.

Text Book:

1. A.Kahate- Cryptography and Network Security , 2nd Edn., Tata McGraw Hill Publication, New Delhi, 2007

Reference Books:

1. B.A. Foronzan – Cryptography & Network Security, TMH, New Delhi, 2007
2. S. Stalling – Cryptography and Network Security, Pearson Edn., New Delhi, 2006

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MCA 7403 GRID COMPUTING [3 (3-0-0)]

Module-I

Introduction: Motivation; Definitions of Grid Computing; Evolution of the Grid; Differences with similar efforts (Meta, cluster, heterogeneous, Internet); Examples of usage; Research possibilities / scope in Grid Computing; Thrust areas.

Module-II

High Performance computing : PACX-MPI, MPI-Connect, P-MPI; I-WAY experiment.

Module-III

Earliest Grid Tools / Projects : Condor Part 1, Part 2; Globus Part 1, Part 2; Nimrod.

Module-IV

Grid Basics - Technologies / Challenges: Security - Different models: SSL, Kerberos, SASL, GSI, Others; Information Services: NWS.

Module-V & VI

HPC and Grids : Scheduling HPC applications in Grids: AppLeS, Scheduling Parameter sweep applications, Metascheduling Part1, Part2; Grid RPC mechanisms - Part1, Part2; Rescheduling; Computational Steering, Scientific visualization of Grid applications; Grid Applications - Everywhere and Cactus experiments; Data management: Data distribution, Redistribution, Data cache maintenance.

Module-VII

Recent Efforts / Challenges : Grid economy; Grid simulation - SimGrid, GridSim, MicroGrid; Grid standards and forums - OGSA, GGF and Other topics.

Text Books:

1. [Module: 1]
Ian Foster, Carl Kesselman; The Grid: Blueprint for a New Computing Infrastructure (2nd edition)**;** Morgan Kaufmann Publishers; 2nd edition, 2003.

2. [Module: 2, 3, and 4]
Francine Berman, Geoffrey Fox, Tony Hey; Grid Computing: Making the Global Infrastructure a Reality; John Wiley & Sons, 2003.

3. [Modules: 5, 6, and 7]
Jarek Nabrzyski, Jennifer M. Schopf, Jon Weglarz; Grid Resource Management: State of the Art and Future Trends; Kluwer Academic Publishers, 2003.

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MCA 7405 WIRELESS TECHNOLOGY [3 (3-0-0)]

Module-I

Introduction to Networking : Technology and Change, The Internet, Reference Models, Layering, and Protocols, OSI and Other Models, Network Types, Network Media, Network Topologies, Connectivity Devices, Evolution of Networking.

Introduction to Wireless Communications: Why Wireless?, Types and Range of Wireless Communications, Growth of Wireless Communications, Wireless Technologies, Wireless LANs, Satellite Communications, Wireless Application Protocol, Other Wireless Systems.

Module-II

Technical Foundation of Wireless Technologies: What is Wireless? Antennas, Narrowband and Spread Spectrum Technology, Accessing Channels: Spread Spectrum and Cellular Telephony, Propagation, Frequencies and Spectrum, Signals, Personal Communications System, How an Organization Gets a Piece of Spectrum.

Module-III & IV

Wireless Application Protocol: Background, History, Design and Principles of Operation, WAP Architecture Requirements, WAP Architecture Overview, The WAP Model, WAP Architecture Components, Compliance and Interoperability, WAE Overview, The WWW Model, The WAE Model, WAE Services and Formats, Internationalization, Security and Access Control, WTA Architecture Overview, WTA Framework Components, Telephony-Specific Exchanges, Wireless Telephony Application Interface Specification, Supported Content Formats, Wireless Session Protocol Specification, Wireless Transaction Protocol Specification, Wireless Transport Layer Security Specification, Handshake Protocol Overview, Wireless Data gram Protocol Specification, Wireless Control Message Protocol Specification, The Future.

Module-V & VI

Bluetooth : Purpose and Beginnings, Design and Principles of Operation, Transmitter Characteristics, Spurious Emissions, Baseband Characteristics, Physical Channel, Physical Links, General Format, Transmit/Receive Timing, Channel Control, Bluetooth Security, Link Manager Protocol, Logical Link Control and Adaptation Layer Protocol, General Operation, Data Packet Format, Service Discovery Protocol, Rfcomm, Telephony Control Protocol Specification, Interoperability Requirements for Bluetooth as a WAP Bearer, Alternatives to Bluetooth, The Outlook, Recent Events in the Bluetooth World.

Cellular Telephony: History of Cellular Telephony, Design and Principles of Cellular Operation, Cellular Telephony Operations, Analog Cellular Telephones, Digital Cellular Telephones, The Digital Network, Personal Communications System, Third Generation, Recent Events in the Cellular World.

Module-VII

Public Services: Interoperability in Communications, Aspects for the Law Enforcement Community, Incident Response Plans, Design and Principles of Operation, Specialized Mobile Radio.

Wireless LANs: Introduction, Benefits of WLANs, Design and Principles of Operation, WLAN Configurations, Microcells and Roaming, Types of WLANs, WLAN

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Customer Considerations, Wireless LAN Standard IEEE 802.11, 802.11b, and 802.11a, Planning for a New Network, Selecting a WLAN, Microwave LANs, Recent Events.

Text Book:

1. Gary S. Rogers, John Edwards, "An Introduction to Wireless Technology", 1st Edn., Pearson Education, New Delhi – 2007

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MCA 7407 PARALLEL AND DISTRIBUTED COMPUTING [3 (3-0-0)]

Sec A: Parallel Computing

Module-I

Introduction: Computational Demand of Modern Science, Advent of Practical Processing, Parallel Processing Terminology- Contrasting Pipelining and Data Parallelism, Control Parallelism, Scalability, Control-Parallel Approach, Data-Parallel Approach with I/O.

Module-II

PRAM Algorithm: A Model of Serial Computation, The PARAM Model of Parallel Computation, PARAM Algorithm- Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Colouring, Problem defining Fast Solutions on PRAMS.

Module-III

Elementary Parallel Algorithm: Classifying MIMD Algorithm, Reduction.

Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors.

Module-IV

Solving Linear Systems: Terminology, Back Substitution, ODD-EVEN Reduction, Gaussian Elimination, The JACOBI Algorithm, The Gauss-Seidel Algorithm, Jacobi Overrelaxation and Successive Overrelaxation, Mulyigrid Methods, Conjugate Gradient.

Sec B: Distributed Computing

Module-V

Basic Algorithms in Message-Passing Systems: Formal Models for Message Passing Systems, Broadcast and Convergecast on a Spanning Tree, Flooding and Building a Spanning Tree, Constructing a Depth-First Search Spanning Tree for a Specified Root, Constructing a Depth-First Search Spanning Tree without a Specified Root.

Leader Election in Rings: The Leader Election Problem, Anonymous Rings, Asynchronous Rings, Synchronous Rings.

Module-VI & VII

Mutual Exclusion in Shared Memory: Formal Model for Shared Memory Systems, The Mutual Exclusion Problem, Mutual Exclusion using Powerful Primitives, Mutual Exclusion using Read/Write Registers.

A formal Model for Simulations: Problem Specifications, Communication Systems, Processes, Admissibility, Simulations, Pseudocode Conventions.

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Broadcast and Multicast: Specification of Broadcast Services, Implementing a Broadcast Service, Multicast in Groups, An Application: Replication

Distributed Shared Memory: Linearizability Shared Memory, Sequentially Consistent Shared Memory, Algorithms, Lower Bounds.

Text Books:

1. H.Attiya & J. Welch- Distributed Computing- Fundamentals, Simulations and Advanced Topics,2nd Edn., Wiley India Publication, New Delhi, 2006.

M.J. Quinn-Parallel Computing-Theory and Practice, 2nd Edn., McGraw Hill Inc., New York.

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MCA 7409 MOBILE COMPUTING [3 (3-0-0)]

Module-I

Mobile Computing Architecture: Internet – The ubiquous network; Schematic representation of mobile computing environment; The Three-Tier mobile computing architecture; Design considerations for mobile computing; Mobile computing through Internet; Making existing applications mobile-enabled.

Module-II

Mobile Communications: Introduction; The GSM architecture; Call routing in GSM; Network aspects in GSM; GSM frequency allocation; Authentication and security; GPRS system architecture and routing.

Module-III

Mobility Management: Mobility management; Location Management Principles and Techniques; Location Management Case studies: PCS, Mobile IP.

Module-IV

Data Dissemination and Management: Challenges; Data Dissemination; Mobile Data Caching; Mobile Cache Maintenance Schemes; Mobile Web Caching; Case studies.

Module-V

Mobile Middleware: Introduction; Adaption: The spectrum of adaption, Resource monitoring, Characterizing adaption strategies, Odyssey-An application aware adaption architecture, Sample Odyssey application; Mobile Agents: Agent architectures, Migration strategies, Communication strategies.

Module-VI

Service Discovery Middleware: Middleware services: Universally unique identifiers, Standardization, Textual Descriptions, Interfaces for standardization; Discovery and Advertisement Protocols: Unicast discovery, Multicast discovery and advertisement, Service catalogs; Garbage collection: Leasing, Advertised expirations; Eventing; Security: Jini, Service location protocol, Ninja; Interoperability.

Module-VII

Device Operating System: Introduction to Symbian Operating System; Symbian OS architecture; Applications for Symbian; Special feature:- Event Driven Multitasking using Active objects; Client-Server framework model on Symbian OS.

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Text Books:

1. [Modules: 1, 2, and 7]
Asoke K Talukder and Roopa R. Yavagal; Mobile Computing – Technology, Applications and Service Creation; TMH Publication, New Delhi, 2006

2. [Modules: 3, 4, 5, and 6]
Frank Adelstein et.al.; Fundamentals of Mobile and Pervasive Computing; TMH Publication, New Delhi, 2005

Head of Department

Group V : Applications of Information Technology

MCA 7501 BIOINFORMATICS [3 (3-0-0)]

Module – I

Bioinformatics: An Introduction : Introduction, Bio informatics Application, Major Database in Bio informatics, Molecular Biology and Bio informatics. Control Dogma of Molecular Biology.

Genome Analysis and Gene Mapping: Introduction, Genome Analysis, Genome Mapping, Genetic Mapping and Linkage Analysis, Cloning the Entire Genome, Genome Sequencing.

Module – II

Alignment of Pairs of Sequence: Introduction, Biological Motivation and alignment Problems, Methods of Sequence Alignment, Using Scoring Matrix, Measuring Sequence Detection Efficiency.

Module – III

Alignment of Multiple Sequence and Phylogenetic Analysis: Introduction, Methods of Multifile sequence alignment, Evaluating of Multiple Alignment, Application of Multiple Alignment, Phylogentic Analysis, Method of Phylogentic analysis, Problem of Phylogenetic Analysis.

Module – IV

Tools for similarity search and Sequence Alignment: Introduction, Working with FASTA, Working with BIASTA, Filtering and Gapped BLAST, FASTA and BLAST Algorithm comparison.

Profile and Hidden Markov Models: Introduction, Using Profile, Hidden Marker Models (HMMs)

Module – V

Gene Identification, Predication and Gene Expression: Introduction, Basis of Gene Prediction, Pattern Recognition, Gene Prediction Methods, Gene Prediction Tools, Clustering Gene Expression Profile.

Module – VI

Protein Classification and Structure Visualization: Introduction, Overview of protein structure, Protein Structure Visualization, Structure based Protein classification, Protein Structure database, Protein Structure alignment, Tools for Plotting Protein – Ligand Interaction.

Module – VII

Protein Structure Prediction: Introduction, Protein Identification and Characterization, Primary Structure analysis and Prediction, Secondary Structure analysis and Prediction, Modify, Profile, Pattern and Fingerprint Search, Methods of Sequence based protein Prediction, Methods of 2D Structure Prediction, Protein Function Prediction.

Text Book:

1. S. C. Ratogi, N. Mendiratha, P Rastogi, “Bioinformatics Methods and Applications”, PHI, New Delhi, 2005.

Reference Books:

1. D. E. Krane & M. L. Ragmer - Fundamental of Concept of Bioinformatics, Pearson Education, New Delhi – 2003.
2. V. R. Srinivas – Bioinformatics : A Modern Approach, PHI, New Delhi – 2005
3. A. M. Lesk – Introduction to Bioinformatics, Oxford (Indian Edn) New Delhi – 2004

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MCA 7505 MULTIMEDIA AND ANIMATION [3 (3-0-0)]

Module I

ntroduction: Multimedia Elements and Applications, Multimedia Systems Architecture, Defining Objects for Multimedia Systems, Multimedia Data Interface Standards, Multimedia databases

Module II

Compression and Decompression: Types of Compression, Binary Image Compression Schemes, CCITT Group 3 1-D, 2-D, 3-D, JPEG, Video Image Compression, MPEG, Motion Compensation, Vector Quantization, Audio Compression, Adaptive DPCM

Module III

Data and File formats: Rich Text formats, TIFF, Resource Interchange File Format (RIFF), MIDI File format, RDIB file format, TWAIN

Module IV

Multimedia Input Output Technology: Electronic Pen, Video and Image Display Systems, Print Output Technology, Image Scanners, Video Images and Animation, Full motion video

Module V

Multimedia Application Design: Multimedia Application Classes, Types of Multimedia Systems, Virtual Reality, Application Workflow Design Issues

Module VI

Multimedia Authoring: Multimedia Authoring Systems, Hypermedia Application Design Considerations, Linking and Embedding, CORBA

Module VII

Multimedia Content Development Tools: HTML, XML, Macromedia Flash, Shockwave, Modelling and Animation concepts

Text Books:

1. Andleig P. K.& Thakrar K.- Multimedia Systems Design, Prentice Hall of India, New Delhi , India 2004
2. Parekh R.-Principles of Multimedia, Tata McGraw Hill, New Delhi, India, 2004

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MCA 7507 SUPPLY CHAIN MANAGEMENT [3 (3-0-0)]

Module-I

Supply Chain Management: An Overview

Introduction to Supply Chain Management: Introduction, What is Supply Chain Management?, Why is Supply Chain Management Important?, The Origins of Supply Chain Management, Important Elements of Supply Chain Management, , Future Trends in Supply Chain Management.

Module-II

Purchasing Issues in Supply Chain Management
Purchasing Management: **Introduction, The Role of Purchasing in an Organization,**
The Purchasing process, Sourcing Decisions: The Make-or-Buy Decision, Roles of Supply Base, Supplier Selection, How many Suppliers to Use, Purchasing Organization: Centralized versus Decentralized Purchasing, International Purchasing/Global Sourcing.
Creating and Managing Supplier Relationships: **Introduction, Developing Successful Partnerships, Supplier Evaluation and Certification, Supplier Development, Supplier Awards, Supplier Relationship Management Software.**

Module-III

Strategic Sourcing for Successful Supply Chain Management:-Introduction, Developing Successful Sourcing Strategies, Supply Base Reduction Programs, Evaluating and Selecting Key Suppliers, Strategic Alliance and Supplier Certification Programs, Outsourcing Programs, Early Supplier Involvement, Supplier Management and Alliance Development, Managing and Developing Second-Tier Supplier Relationships, Use of e-procurement Systems, Rewarding Supplier Performance, Benchmarking Successful Sourcing Practices, Using Third-Party Supply Chain Management Services, Assessing and Improving the Firm's Purchasing Function.

Module-IV

Operations Issues in Supply Chain Management

Demand Forecasting and Collaborative Planning, forecasting, and Replenishment: Introduction, Matching Supply and Demand, Forecasting Techniques, Qualitative Methods, Quantitative Methods, Forecast Accuracy, Collaborative Planning, Forecasting, and Replenishment, Software Solutions.

Module-V

Enterprise Resource Planning Systems:- Introduction, The Development of Legacy Materials Requirement Planning Systems, The Development of Enterprise Resource Planning Systems, The Rapid Growth of Enterprise Resource Planning Systems, Implementing Enterprise Resource Planning Systems,

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Advantages and Disadvantages of Enterprise Resource Planning Systems, Enterprise Resource Planning Software Applications, Enterprise Resource Planning Software Providers.

Module-VI

Process Management: Just-in-Time and Total Quality Management issues in Supply Chain Management: Introduction, Just-in-Time and Supply Chain management , the Elements of Just-in-Time, total Quality Management and Supply Chain Management, Total Quality Management and Supply Chain Management.

Distribution Issues in Supply Chain Management
Domestic and International Transportation: Introduction, The Impact of Transportation on Supply Chain Management, The Fundamentals of Transportation, Warehousing, International Transportation Issues, Transportation Management, e-Commerce and Transportation.

Module-VII
Customer Relationship Management :- Introduction, Defining Customer Relationship Management, Customer Relationship Management's Role in Supply Chain Management, Key Tools and Components of Customer Relationship Management, Designing and Implementing a Successful Customer, Relationship Management Program, Some Customer Relationship Management Application Providers, Future Trends in Customer Relationship Management.
Facility Location Decision:- **Introduction, Location Strategies, Critical Location Factors, Facility Location Models, Helpful On-Line Information for Location Analysis, Business Clusters.**
Service Response Logistics :- Introduction, An Overview of Service Operations, Supply Chain Management is Services, The Primary Concerns of Service Response Logistics.

Text Book:

1. J. D. Wisner, G. Keong Leong & K. Tan- Principles of Supply Chain Management, 1st Edn.,Thomson Education, New Delhi, 2007

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MCA 7411 CLOUD COMPUTING

Module I

Introduction: Essentials, Benefits and need for Cloud Computing - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics Cloud Adoption.

Module II

Cloud Models: Cloud Characteristics - Measured Service - Cloud Models - Security in a Public Cloud Public versus Private Clouds - Cloud Infrastructure Self Service

Cloud as a Service: Gamut of Cloud Solutions - Principal Technologies - Cloud Strategy Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined

Module III and IV

Cloud Solutions: Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) – Cloud sourcing.

Cloud Offerings: Information Storage, Retrieval, Archive and Protection - Cloud Analytics Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud.

Cloud Management: Resiliency – Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Metering.

Module V

Cloud Virtualization Technology: Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements.

Cloud Virtualization: Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Center.

Module VI

Cloud and SOA: SOA Journey to Infrastructure - SOA and Cloud - SOA Defined - SOA and IaaS - SOA-based Cloud Infrastructure Steps - SOA Business and IT Services.

Module VII

Cloud Infrastructure Benchmarking: OLTP Benchmark - Business Intelligence Benchmark - e-Business Benchmark - ISV Benchmarks - Cloud Performance Data Collection and Performance Monitoring Commands - Benchmark Tools.

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Text Book:

1. K. Saurabh– Cloud Computing, 2nd Edn, Wiley India, 2014.

Reference Books:

1. T. Velte, A. Velte and R. Elsenpeter-Cloud Computing: A Practical Approach, McGraw Hill, India.
2. R. Buyya, J. Broberg-Cloud Computing: Principles and Paradigms, Wiley.
3. K. *Hwang*, G. Fox and J. Dongarra-*Distributed and Cloud Computing*, From Parallel Processing to the Internet of Things, Morgan Kaufmann, 2012.

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Syllabus BE CSE CBCS

COURSE INFORMATION SHEET

Course code: BE101
Course title: Biological Science for Engineers
Pre-requisite(s): NIL
Co- requisite(s): NIL
Credits: 2 L:2 T:0 P:0
Class schedule per week: 02
Class: B. Tech
Semester / Level: III-IV /First
Branch: All
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Recognize and understand the basic cell biology, biomolecules, related metabolic pathways and applicable bioenergetics.
2.	Relate common biological phenomenon at molecular level.
3.	Describe the chemical nature of enzymes and mechanism of action for their function in biochemical reactions.
4.	Correlate the molecular methods of biological signal generation and propagation in living system.
5.	Comprehend the steps involved in common application of biotechnology such as applicable for creation of transgenics, stem cells, plant metabolites production, PCR, ELISA.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate an understanding of fundamental biochemical principles, such as the structure/function of biomolecules involved in living system.
CO2	Interpret the bio mechanism involved in signal generation and transmission.
CO3	Correlate the basic methods involved in common biotechnological application.
CO4	Apply and effectively communicate scientific reasoning and data involved in common biotechnological applications.

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BE101 Biological Science for Engineers

Credit:2

Module-1:
Basic Cell Biology: Origin of life, Cell theory, Cell Structure and function, Biomolecules, Cell cycle and cell division, Biological Organization. **[5L]**

Module-2:
Bioenergetics and Metabolism: Gibbs free energy and thermodynamics, aerobic and anaerobic respiration, Glycolysis, Krebs cycle and electron transport chain, Beta oxidation, Photosynthesis. **[6L]**

Module-3:
Enzymes and its Application: Classification of enzymes, Structure and mechanism of enzyme action and uses of enzymes, factors affecting enzyme activity, Immobilization of enzymes and their application. **[5L]**

Module-4:
Biological Signal Generation and Propagation: Nerve cell structure and signal propagation. Mechanism of vision and hearing, cell signaling, Circadian rhythm. **[6L]**

Module-5:
Engineering Biological Systems and its Applications:
Central dogma of molecular biology, Methods in genetic engineering and application, PCR, ELISA and its application, stem cell and tissue engineering. Artificial Intelligence in Biology, Plant factory. **[6L]**

Books Recommended
Recommended Text Book
1. Purves et al, (1998) Life: *The Science of Biology*, 4th Ed.
2. R. Dulbecco, The Design of Life.
3. Lehninger A, Principals of Biochemistry , 5th Ed

Reference Book

1. Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman.
2. K. Wilson & K.H. Goulding, (2006) *A biologist's guide to Principles and Techniques of Practical Biochemistry*.

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

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Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End Sem Examination Marks	50
Assignment / Quiz (s)	10+10
Teacher's Assesment	5

Assessment Components	CO1	CO2	CO3	CO4
Mid Sem Examination Marks	√	√	√	√
End Sem Examination Marks	√	√	√	√
Quiz I	√	√	√	
Quiz II	√	√	√	

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	1	2	1	2	1	1	2	2	1
CO2	3	2	2	1	1	2	2	2	1	1	1	2	3	2	2
CO3	3	3	3	2	2	1	3	2	1	2	1	2	2	3	2
CO4	2	2	2	2	3	2	3	2	2	1	1	1	1	2	2

If satisfying< 34%=1, 34-66% =2, > 66% = 3

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD 1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, 2, 3, 4	CD1, CD2, CD3, CD8
CD 2	Tutorials/Assignments	CO1, 2, 3, 4	CD1, CD2, CD3, CD8
CD 3	Seminars		
CD 4	Mini projects/Projects		
CD 5	Laboratory experiments/teaching aids		
CD 6	Industrial/guest lectures		
CD 7	Industrial visits/in-plant training		
CD 8	Self- learning such as use of NPTEL materials and internets		
CD 9	Simulation		

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT201
Course title: **Basics of Intelligent Computing**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II/2
Branch: All

Course Objectives
This course enables the students:

A.	To know the basic functions of different AI branches.
B.	To understand the functionalities of IoT .
C.	To know the application of fuzzy logic.
D.	To understand the basic functionalities of a cloud based system.
E.	To find the basic functions of soft computing.

Course Outcomes:
After the completion of this course, students will be able to:

1.	Identify the difference between different branches of AI.
2.	Analyze a fuzzy based system.
3.	Design Neural Networks to solve problems.
4.	Analyze a problem in terms of ANN point of view.
5.	Identify the components of a cloud-based system.

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SYLLABUS

Module I

Introduction

Definition of Computing, Conventional Computing vs. Intelligent Computing, Necessity of Intelligent Computing, Current trends in Intelligent Computing

AI Concepts

Introduction to AI, AI problems and Solution approaches, Fundamentals of problem solving using Search and Heuristics, Overview of Knowledge-base creation, and Intelligent Agents, Classification of AI.

(8 L)

Module II

Introduction to Soft Computing

Hard Computing vs. Soft Computing, Paradigms of Soft Computing, Real Life applications of Soft Computing

Fuzzy Logic

Classical Sets Vs Fuzzy Sets, Membership Functions, Fuzzy operations, Fuzzy Relations, Fuzzy Composition (Max-Min, Max-Product), Defuzzification, Fuzzy Inference System

Genetic Algorithm

Principle of Optimization, Traditional vs Evolutionary optimization, Genetic Algorithm: Working Cycle of GA, Encoding, Crossover, Mutation.(8 L)

Module III

Introduction to Artificial Neural Networks:

Biological Neuron to Artificial Neuron, Mc-Culloh Pitts Perceptron Model, Layer of Neurons, Activation Function, Artificial Learning, Types of Learning, Introduction to Back Propagation Networks, Applications of Neural Network. (8L)

Module IV

Introduction to Cloud computing

Conventional Computing, Historical developments, Defining a Cloud, Cloud Computing reference model, Overview of Virtualization: Introduction, Types of cloud, Cloud Platforms: Amazon Web Services, Microsoft Azure, Cloud Applications (8L)

ModuleV

Introduction to IOT

The IoT Paradigm, Concept of Things, IoT Hardware, IoT Protocols, IoT Architecture, enabling technologies of IoT, IoT Designing and its levels. (8L)

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Text books:

1. Rich Elaine, Knight Kevin, Nair S. B. Artificial Intelligence, 3rd Edition, Tata Mc. Graw Hill.
2. Padhy N. P., Simon S. P. Soft Computing: With MATLAB Programming, Oxford University Press, 2015.
3. Buyya Raj Kumar, Vecchiola Christian &Selvi S.Thamarai , Mastering Cloud Computing, McGraw Hill Publication, New Delhi, 2013.
4. Madisetti Vijay and BahgaArshdeep, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.

Reference Books:

Raj Pethuru and Raman AnupamaC.,The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.
Konar Amit, Computational Intelligence: Principles, Techniques and Applications, Springer.
Shivanandam and Deepa, Principles of Soft Computing, 2nd Edition, John Wiley and Sons, 2011.

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	2	2	1	1	1	2	3	1	1
CO2	3	3	3	2	1	2	2	2	2	1	1	2	2	3	2
CO3	3	3	3	2	2	1	2	2	2	2	1	3	2	3	2
CO4	3	3	3	3	2	2	2	3	2	2	1	3	3	2	3
CO5	2	2	1	1	2	1	2	3	1	1	1	2	2	2	1

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: MA205
Course title: Discrete Mathematics
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:1 P:0 C: 4
Class schedule per week: 3 Lectures, 1 tutorial
Class: I. M.Sc. /B. Tech
Semester / Level: 2
Branch:
Name of Teacher:

Course Objectives: This course enables the students to

1.	exposed to a wide variety of mathematical concepts that are used in the Computer Science discipline, which may include concepts drawn from the areas of Number Theory, Graph Theory and Combinatorics.
2.	come across a number of theorems and proofs. Theorems will be stated and proved formally using various techniques.
3.	gain the various graphs algorithms along with its analysis
4.	apply graph theory based tools in solving practical problems.

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Course Outcomes: After the completion of this course, students will be able to

CO 1.	to model and analyze computational processes using analytic and combinatorial methods
CO 2.	solve the problems of graph theory using graph algorithms
CO 3.	apply computer programs (e.g. SAGE) to study graphs.
CO 4.	apply counting techniques to solve combinatorial problems and identify, formulate, and solve computational problems in various fields.
CO 5.	apply graph theory in the areas of computer science, operation research, biology, chemistry, physics, sociology, and engineering

SYLLABUS

MA205 **Discrete Mathematics**

Module I

Mathematical logic and Mathematical Reasoning, Compound Statements, Propositional Equivalences, Predicates and Quantifiers, Methods of Proof, Mathematical Induction, Well-ordering principal, Recursive Definition and Algorithms. [9L]

Module II

Recurrence Relations, Classification of Recurrence Relations and their solutions by Characteristic Root method, Generating function and their various aspects, Utility of Generating function in solving Recurrence Relations.

[9L]

Module III

Set, Operations on Set, Computer representation of Set, Relations, Properties/Classification of Relations, Closure operations on Relations, Matrix representation of Relations, Digraphs. Functions and their Representation, Classification of Functions, Warshall's algorithm, Discrete Numeric Functions, Growth of Functions, Big O, Big Q, Hash Function, Growth Functions.

[9L]

Module IV

Binary Operations, Groups, Product and Quotients of Groups, Semi group, Products and Quotients of Semi groups, Permutation Group, Composition of Permutation, Inverse Permutation, Cyclic Permutation, Transposition, Even and Odd Permutation, Coding of Binary Information and Error Correction, Decoding and Error Correction.

[9L]

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Module V

Introduction to Graph, Graph Terminologies and their Representation, Connected & Disconnected graphs, Isomorphic Graph, Euler & Hamilton graphs. Introduction to Trees, Versatility of Trees, Tree traversal. Spanning Trees, Minimum Spanning Tree.

[9L]

Text Books:

1. **Mott, Joe L., Abraham Kandel, and Theodore P. Baker** Discrete Mathematics for ComputerScientists& Mathematicians, PHI, 2nd edition 2002.
2. **Swapan Kumar Chakraborty and BikashKanti Sarkar**: Discrete Mathematics, Oxford Univ.Publication, 2010.
3. **Kolman, Bernard, Robert C. Busby, and Sharon Ross.** Discrete mathematical structures,Prentice-Hall, Inc., 2003**.**

Reference Books:

1. **BikashKanti Sarkar and Swapan Kumar Chakraborty,** *Combinatorics and Graph Theory*, PHI,2016.
2. **Seymour Lipschuz and Mark Lipson**,*Discrete Mathematics*, Shaum's outlines, 2003.
3. **Liu, Chung Laung,** *Elements of Discretemathematis*, Mcgraw Hill, 2nd edition, 2001.
4. Bondy and Murty, Grapg Theory with Applications, American Elsevier,1979.
5. Robin J. Wilson, Introduction to Graph Theory, Pearson, 2010.

6. Course delivery methods	
Lecture by use of boards/lcd projectors/ohp projectors	√
Tutorials/assignments	√
Seminars	
Mini projects/projects	√
Laboratory experiments/teaching aids	
Industrial/guest lectures	
Industrial visits/in-plant training	
Self- learning such as use of nptel materials and internets	√
Simulation	

Course outcome (co) attainment assessment tools & evaluation procedure

Direct assessment

Assessment tool	**% contribution during co assessment**
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10

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Assignment	5

Assessment components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Mid semester examination	√	√	√		
End semester examination	√	√	√	√	√
Quiz (s)	√	√	√		
Assignment	√	√	√	√	

Indirect assessment –

1. Student feedback on course outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	2	2	1	2	1	1	1	1	1	1	2	3	3	1
CO2	2	3	3	1	1	2	1	1	1	1	1	2	2	2	2
CO3	2	3	3	3	2	1	1	2	1	2	1	1	2	2	1
CO4	3	3	2	1	1	1	1	1	2	2	1	2	3	2	1
CO5	3	2	2	1	3	1	2	2	1	2	2	2	3	3	2

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: EC203
Course title: Digital System Design
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: **L: 3** **T:0** **P:0** **C:3**
Class schedule per week: 3x1
Class: B. Tech
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives

This course enables the students to:

A.	Understand the basics of the digital electronics.
B.	Apply the knowledge of digital electronics to construct various digital circuits.
C.	Analyse the characteristics and explain the outputs of digital circuits.
D.	Evaluate and asses the application of the digital circuits.
E.	Design digital machine for simple computing and control.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Explain the concept of digital electronics.
CO2	Apply the knowledge to produce digital electronics circuits.
CO3	Analyse and categorize digital circuits.
CO4	Justify the uses of different digital circuits.
CO5	Schematize and demonstrate simple computing machines.

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SYLLABUS

Module – 1:

Basics of Digital Electronics: Number representation, Binary number system, Number base conversion, Octal, Hexadecimal and BCD codes, binary Arithmetic, Logic gates, Introduction to VHDL and Verilog, VHDL Models, Logic Families: TTL, ECL, and CMOS Logic Circuits, Logic levels, voltages and currents, fan-in, fan-out, speed, power dissipation. Comparison of logic families.

Module – 2:

Simplification of Boolean functions: Boolean Algebra, Basic theorems and Properties, De Morgan's theorem, Canonical & Standard forms, Simplification of Boolean function using Karnaugh map, POS& SOP simplification, Prime implicant, NAND and NOR implementation,.

Module – 3:

Design of Combinational Circuits: Analysis and design procedure, Parity Generators and Checkers, Adders, Subtractors, Look ahead carry, Adder, 4-bit BCD adder/subtractor, Magnitude comparator, Decoders, Encoders, Multiplexers, De-multiplexers, , Design of 1 bit ALU for basic logic and arithmetic operations.

Module – 4:

Design of Sequential Circuits and Memories: Basic Latch, Flip-Flops (SR, D, JK, T and Master-Slave), Triggering of Flip Flops, Synchronous and asynchronous counters, Registers, Shift Registers, Memories and Programmable Logic design, Types of memories, Memory Expansion and its decoding, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

Module – 5:

Design of simple computing machines: SAP-I concepts with stress on timing diagrams, Microinstructions, Fetch and Execution cycle variable machine cycle, Hardware control Matrix, Macroinstructions, Microprogramming , Bus concepts, Multiplexed Minimum system. Pipelining concepts.

Books recommended:

Textbooks:

1. "Digital Design", Morris Mano and Michael D. Ciletti ,5th edition PHI
2. "Digital System Design using VHDL", Charles H Roth, Thomson Learning

Reference books:

1. Digital computer Electronics AP Malvino, 3rd Edition Mc Graw Hill

Gaps in the syllabus (to meet Industry/Profession requirements): Hands-on-practical on microprocessor trainer Kit

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POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Cours**Course Delivery Methods**

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets

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CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	3	1	2	1	1	2	1	2	2	2	1
CO2	3	3	3	2	3	2	3	2	2	2	1	2	3	2	1
CO3	2	2	3	2	2	2	2	2	2	2	1	2	2	2	1
CO4	2	3	3	3	3	3	3	3	2	2	1	3	3	2	2
CO5	2	2	2	3	3	2	3	3	2	2	2	2	1	1	3

< 34% = 1, 34-66% = 2, > 66% = 3

Mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: CS201
Course title: **Data Structures**
Pre-requisite(s): Programming for Problem Solving
Co- requisite(s): Data Structure Lab
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: II/2
Branch: CSE/IT

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Course Objectives

This course enables the students:

A.	To be familiar with basic techniques of algorithm analysis.
B.	To understand basic concepts about arrays, stacks, queues, linked lists, trees and graphs.
C.	To understand concepts of searching and sorting techniques.
D.	To implement various linear & non-linear data structures; and searching & sorting algorithms.
E.	To assess how the choice of data structures impacts the performance of a program**.**

Course Outcomes

After the completion of this course, students will be able to:

1.	Define various linear and non-linear data structures like stack, queue, linked list, tree and graph.
2.	Explain operations like insertion, deletion, traversal, searching, sorting etc. on various data structures.
3.	Design various data structures and their operations.
4.	Analyze the performance of data structure based operations including searching and sorting.
5.	Justify the choice of appropriate data structure as applied to specified problem definition.

SYLLABUS

Module I

Basic Concepts

Definition and basics of: Data Structure, ADT, Algorithms, Time and Space Complexity, Asymptotic Notations (O, θ, Ω), Time complexity computation of non-recursive algorithms (like Matrix addition, Selection sort – using step count), Array – basic operations, concept of multi-dimensional array, Polynomial operations using Array, Sparse Matrix.

(8L)

Module II

Stack and Queue

Stack ADT: basic operations, Queue ADT: basic operations, Circular Queue, Evaluation of Expressions, Another application or Mazing Problem.

(8L)

Module III

Linked List

Singly Linked List: concept, representation and operations, Circular Linked List, Polynomial and Sparse Matrix operations using LL, Doubly Linked List: basic concept.

(8L)

Module IV

Tree and Graph

Basic concepts and terminologies, Binary Search Tree and Heap, Disjoint Set, Graph: concept and terminologies, Concept of BFS, DFS, Spanning Tree, Connected Components.

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(8L)

Module V

Searching and Sorting

Sequential Search and Binary Search, Insertion Sort, Heap Sort, Radix Sort,External Sorting: k-way merging approach.

(8L)

Text book:

1. SahniHorwitz,, Freed Anderson, Fundamentals of Data Structures in C, 2nd Edition (or latest) , University Press.(T1)

Reference books:

1. TharejaReema, Data Structures Using C, 2nd Edition, Oxford University Press.(R1)
2. Tanenbaum, Langsam, Augenstein, Data Structures using C, Pearson. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment tool	**% contribution during co assessment**
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	3	3	3	1	2	1	1	1	1	1	1	2	2	2	1
CO4	3	3	2	1	2	1	1	1	1	1	1	2	2	3	1
CO5	2	2	3	2	2	1	1	2	1	1	1	2	3	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: EE102
Course title: EE102 ELECTRICAL ENGINEERING LABORATORY
Pre-requisite(s): Physics, Fundamentals of Mathematics and Electrical Engineering.

Credits:	L	T	P
	0	0	3

Class schedule per week: 3

Course Overview: Concepts of measuring instruments, AC RLC series parallel circuit operation, resonance, KVL and KCL, circuit theorems, 3-phase star and delta connections, measurement of low and high resistance of D.C. machine, measurement of power by three voltmeter, three-ammeter methods, measurement of power of 3-phase induction motor by two-wattmeter method.

Course Objectives

This course enables the students :

A.	To describe students practical knowledge of active and passive elements and operation of measuring instruments
B.	To demonstrate electrical circuit fundamentals and their equivalent circuit models for both 1-φ and 3- φ circuits and use circuit theorems
C.	To establish voltage & current relationships with the help of phasors and correlate them to experimental results
D.	1. To conclude performance of 1 – Φ AC series circuits by resonance phenomena 2. To evaluate different power measurement for both 1-φ and 3- φ circuits

Course Outcomes

After the completion of this course, students will be able to:

1.	classify active and passive elements, explain working and use of electrical components, different types of measuring instruments;
2.	illustrate fundamentals of operation of DC circuits, 1-φ and 3- φ circuits and also correlate the principles of DC, AC 1-φ and 3- φ circuits to rotating machines like Induction motor and D.C machine.;
3.	measure voltage, current, power, for DC and AC circuits and also represent them in phasor notations;
4.	analyse response of a circuit and calculate unknown circuit parameters;
5.	recommend and justify power factor improvement method in order to save electrical energy.

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SYLLABUS

LIST OF EXPERIMENTS :

1. **Name: Measurement of low & high resistance of DC shunt motor**
   Aim: (i) To measure low resistance of armature winding of DC shunt motor
   (ii) To measure high resistance of shunt field winding of DC shunt motor

2. **Name: AC series circuit**
   Aim: (i) To obtain current & voltage distribution in AC RLC series circuit and to draw phasor diagram
   (ii) To obtain power & power factor of single phase load using 3- Voltmeter method and to draw phasor diagram

3. **Name: AC parallel circuit**
   Aim: (i) To obtain current & voltage distribution in AC RLC parallel circuit and to draw phasor diagram
   (ii) To obtain power & power factor of single phase load using 3- Ammeter method and to draw phasor diagram

4. **Name: Resonance in AC RLC series circuit**
   Aim : (i) To obtain the condition of resonance in AC RLC series circuit
   (ii) To draw phasor diagram

5. **Name: 3 phase Star connection**
   Aim : (i) To establish the relation between line & phase quantity in 3 phase star connection
   (ii) To draw the phasor diagram

6. **Name: 3 phase Delta connection**
   Aim : (i) To establish the relation between line & phase quantity in 3 phase delta connection
   (ii) To draw phasor diagram

7. **Name: 3 phase power measurement**
   Aim : (i) To measure the power input to a 3 phase induction motor using 2 wattmeter method
   (ii) To draw phasor diagram

8. **Name: Self & mutual inductance**
   Aim : To determine self & mutual inductance of coils

9. **Name: Verification of Superposition, Thevenin's and Reciprocity theorem**
   Aim : (i) To verify Superposition theorem for a given circuit
   (ii) To verify Thevenin's theorem for a given circuit

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10. Name: Verification of Norton's, Tellegen's and Maximum Power transfer theorem

Aim : (i) To verify Norton's theorem for a given circuit

(ii) To verify Maximum Power transfer theorem for a given circuit

Gaps in the syllabus (to meet Industry/Profession requirements)

1. Application of principles of magnetic circuits to electrical machines like transformers, generators and motors
2. Visualize Phase sequence

POs met through Gaps in the Syllabus :a, b, c, g

Topics beyond syllabus/Advanced topics/Design

1. Assignment : Simulation of electrical circuits with dependent/independent sources by various techniques (Mesh current/Node Voltage/Thevenin's theorem/Norton's theorem/Maximum power transfer theorem etc.) using MATLAB/PSIM/C++ softwares
2. Active/reactive power calculation for 3 – Φ circuits

POs met through Topics beyond syllabus/Advanced topics/Design: e,f, i, j, k

Mapping of lab experiment with Course Outcomes

Experiment	Course Outcomes				
	1	**2**	**3**	**4**	**5**
1	3	3	3	2	
2	3	3	3	3	2
3	3	3	3	3	2
4	3	3	3	3	2
5	3	3	3	1	
6	3	3	3	1	
7	3	3	3	2	2
8	3	3	3	3	
9	3	3	3	2	
10	3	3	3	2	

3=High, 2=Medium, 1=Low

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors
CD2	Tutorials/Assignments
CD3	Mini projects/Projects
CD4	Laboratory experiments/teaching aids
CD5	Self- learning such as use of NPTEL materials and internets
CD6	Simulation

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Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
(1) Progressive Evaluation (60)	
Day to Day performance & Lab files	30
Quiz (s)	10
Viva	20
(2) End Semester (40)	
Examination Experiment performance	30
Quiz	10
Grand Total	100

Assessment Compoents	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation Marks					
End Semester Marks					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes onto Course Objectives

Course Outcome #	Course Objectives			
	A	B	C	D
1	3	3	3	3
2	3	3	3	3
3	3	3	3	3
4	3	3	3	3
5	2	3	3	3

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	1	1	1	2	2	1	2	1	1	1	1	1
CO2	3	3	3	1	2	2	2	2	1	2	1	1	2	1	1
CO3	3	3	3	2	2	2	2	2	1	2	1	1	3	2	1
CO4	3	3	3	2	2	2	2	2	2	2	1	1	3	2	1
CO5	3	3	3	3	3	2	3	3	3	3	2	2	3	3	2

Mapping of Course Outcomes onto Program Educational Objectives

Course Outcome #	Program Educational Objectives			
	1	2	3	4
1	3	3	2	2
2	3	3	3	
3	3	3	3	2
4	3	3	3	
5	3	3	2	2

Mapping Between COs and Course Delivery (CD) methods

Course Outcome	Course Delivery Method
CO1	CD1,CD2,CD4, CD5
CO2	CD1,CD4,CD5
CO3	CD1,CD3,CD4,CD5,CD6
CO4	CD1,CD2,CD4, CD5
CO5	CD4, CD5

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COURSE INFORMATION SHEET

Course code: EC204
Course title: Digital System design Lab
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L:0 T:0 P:3 C:1.5
Class schedule per week: 03
Class: B. Tech
Semester / Level: III/ 02
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Understand the basics of logic gates, input, output, power supply and gates IC's.
2.	Apply the knowledge of digital electronics to construct combinational and sequential circuits.
3.	Analyse controlled digital circuits with different Boolean function.
4.	Evaluate combinational/sequential circuits and memories.
5.	Translate real world problems into digital logic formulations using VHDL.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Describe the knowledge of basic logic gates and their design using universal gates.
CO2	Demonstrate the working of combinational and sequential circuits.
CO3	Integrate and experiment with controlled digital circuits.
CO4	Appraise combinational/sequential circuits and memories.
CO5	Schematize, simulate and implement combinational and sequential circuits to solve real world problems using VHDL systems.

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SYLLABUS

List of experiments:

1. Design and implement a controlled CMOS Inverter.
2. To study and verify the truth table of NAND and EX-OR gate using IC 7400.
3. Design and implement SEVEN segment display unit.
4. Design and verify half adder and full Adder circuits using gates and IC 7483.
5. Design and implement a 3:8 Decoder.
6. Design and implement 8:3 priority encoder.
7. Design a 4 bit magnitude comparator using combinational circuits.
8. Design and implement 8:1 multiplexer and 1:4 demultiplexer.
9. Design ALU with functions of ADD, SUB, INVERT, OR, AND. XOR, INC, DEC and CMP.
10. Design and verify decade Counter.
11. Design a ROM (8X4) using decoder, gates and diodes.
12. Design of pre settable up/down counter.

Implement all the above experiments using VHDL platform and verify.

Books recommended:

Textbooks:

1. "Digital Design", Morris Mano and Michael D. Ciletti ,5th edition PHI
2. "Digital System Design using VHDL", Charles H Roth, Thomson Learning

Reference books:

2. Digital computer Electronics AP Malvino, 3rd Edition Mc Graw Hill

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	1	1	1	2	2	1	2	1	1	1	1	1
CO2	3	3	3	1	2	2	2	2	1	2	1	1	2	1	1
CO3	3	3	3	2	2	2	2	2	1	2	1	1	3	2	1
CO4	3	3	3	2	2	2	2	2	2	2	1	1	3	2	1
CO5	3	3	3	3	3	2	3	3	3	3	2	2	3	3	2

< 34% = 1, 34-66% = 2, > 66% = 3

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Mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD3, CD6, CD7
CO2	CD1, CD3, CD6, CD7
CO3	CD1, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: CS202
Course title: **Data Structures Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: All

Course Objectives

This course enables the students:

A.	To assess how the choice of data structures and algorithm design methods impact the performance of programs.
B.	To choose the appropriate data structure and algorithm design method for a specified application.
C.	To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.
D.	Analyse and compare the different algorithms

Course Outcomes

After the completion of this course, students will be able to:

1.	Be able to design and analyze the time and space efficiency of the data structure
2.	Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and Quick sort
3.	Have practical knowledge on the applications of data structures
4.	Be capable to identity the appropriate data structure for given problem

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SYLLABUS

1. Program to Find the Number of Elements in an Array
2. Develop and Implement a menu driven program in C for the following Array operations
    a. Creating Array of N Integer elements.
    b. Display of Array elements with suitable headings.
    c. Inserting an element (ELEM) at a given valid position (POS).
    d. Deleting an element at a given valid position (POS).
    e. Exit
3. Programs for Stack, Queues and Circular Queues using Arrays
4. Program to convert an Infix Expression into Postfix and Postfix Evaluation
5. Program to implement stack using arrays
6. Program to implement stack using linked list
7. Program to implement multiple stack in a single array
8. Program to convert infix notation to postfix notation using stacks
9. Program to implement queue using arrays
10. Program to implement queue using pointers
11. Program to reverse elements in a queue
12. Program to implement circular queue using arrays
13. Program to create add remove & display element from single linked list
14. Program to create add remove & display element from double linked list
15. Program to count number of nodes in linear linked list
16. Program to create add remove & display element from circular linked list
17. Programs to implement stack & queues using linked representation
18. Program to concatenate two linear linked lists
19. Program to accept a singly linked list of integers & sort the list in ascending order.
20. Program to reverse linked list
21. Program to represent polynomial using linked list
22. Program to add two polynomials using linked list
23. Program for the creation of binary tree, provide insertion & deletion in c
24. Program for pre-order, post-order & in-order traversals of a binary tree using non reccursive.
25. Program to count no, of leaves of binary tree
26. Program for implementation of B-tree (insertion & deletion)
27. Program for implementation of multi-way tree in c
28. Program for implementation of AVL tree
29. Program to implement bubble sort program using arrays
30. Program to implement merge sort using arrays
31. Program to implement selection sort program using arrays
32. Program to implement insertion sort program using arrays
33. Program to implement topological sort using arrays
34. Program to implement heap sort using arrays
35. Program to implement heap sort using pointers
36. Program to implement bubble sort program using pointers
37. Program to implement linear search using pointers
38. Program to implement binary search using pointers
39. Program to implement linear search using arrays
40. Program to implement binary search using arrays

Head of Department

Text books:

1. Baluja G S, "Data Structure through C", Ganpat Rai Publication, New Delhi, 2015.
2. Pai G A V, "Data Structures and Algorithms: Concepts, Techniques and Applications", 2nd Edn, Tata McGraw-Hill, 2008.
3. Horowitz E., Sahni S., Susan A., "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2010.

Reference books:

1. Tremblay J. P., Sorenson P. G, "An Introduction to Data Structures with Applications", 2nd Edn, McGraw-Hill, Inc. New York, NY, USA.
2. Lipschutz Seymour, "Data Structures", 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
3. Drozdek Adam, "Data Structures and Algorithms in C++", Thomson Learning, New Delhi – 2007.
4. Feller J., Fitzgerald B., "Understanding Open Source Software Development", Pearson Education Ltd. New Delhi

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

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Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	1	2	2	1	2	1	1	2	3	2
CO2	3	3	3	3	2	1	2	2	2	1	1	2	2	3	2
CO3	3	3	3	3	2	1	2	2	1	2	1	2	3	3	2
CO4	3	3	3	3	2	2	2	2	2	2	2	2	3	2	2
CO5	3	2	2	1	2	3	1	1	1	2	2	2	3	3	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: MA 203
Course title: Numerical Methods
Pre-requisite(s): NIL
Co- requisite(s): ---NIL
Credits: L: 2 T: 0 P: 0 C: 2
Class schedule per week: 2 Lectures
Class: B Tech
Semester / Level: 2
Branch: ALL
Name of Teacher:
Course Objectives: This course enables the students to

1.	derive appropriate numerical methods to solve algebraic and transcendental equations
2.	derive appropriate numerical methods to solve linear system of equations
3.	approximate a function using various interpolation techniques
4.	to find the numerical solution of initial value problems and boundary value problems

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Course Outcomes: After the completion of this course, students will be able to

CO 1	solve algebraic and transcendental equation using an appropriate numerical method arising in various engineering problems
CO 2	solve linear system of equations using an appropriate numerical method arising in computer programming, chemical engineering problems etc.
CO 3.	Approximate a function using an appropriate numerical method in various research problems
CO 4	evaluate derivative at a value using an appropriate numerical method in various research problems
CO 5	solve differential equation numerically

Syllabus

MA 203 Numerical Methods 2-0-0-2

Module I: Errors and Nonlinear Equations

Error Analysis: Definition and sources of errors, propagation of errors, floating-point arithmetic
Solution of Nonlinear equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson method and its variants, General Iterative method. [05L]

Module II: System of Linear Equations

Gauss-Elimination, Gauss-Jordan, LU-Decomposition, Gauss-Jacobi and Gauss- Siedel methods to solve linear system of equations and Power method to find least and largest eigenvalues.

[05L]

Module III: Interpolation

Lagrange's interpolation, Newton's divided differences interpolation formulas, inverse interpolation, interpolating polynomial using finite differences. [05L]

Module IV: Differentiation and Integration

Differentiation using interpolation formulas, Integration using Newton-Cotes formulas: Trapezoidal rule, Simpson's rule [05L]

Module V: Solution of Ordinary Differential Equations

Euler's method, modified Euler's method, Runge - Kutta Methods of second and fourth order to solve initial value problems. [05L]

Text Books:

1. Jain M.K, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age Publications, 2004.

Head of Department

2. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI.
3. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. S.C. Chapra and R. P. Canale, Numerical Methods for Engineers, McGraw Hill, 1985.
2. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, Seventh Edition, 2003.
3. R. W. Hamming: Numerical Methods for Scientists and Engineers, Second Edition, Dover

Course delivery methods	
Lecture by use of boards/lcd projectors/ohp projectors	√
Tutorials/assignments	√
Seminars	
Mini projects/projects	√
Laboratory experiments/teaching aids	
Industrial/guest lectures	
Industrial visits/in-plant training	
Self- learning such as use of nptel materials and internets	√
Simulation	

Course outcome (co) attainment assessment tools & evaluation procedure

Direct assessment

Assessment tool	% contribution during co assessment
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

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Assessment components	CO1	CO2	CO3	CO4	CO5
Mid semester examination	√	√	√		
End semester examination	√	√	√	√	√
Quiz (s)	√	√	√		
Assignment	√	√	√	√	

Indirect assessment –

1. Student feedback on course outcome

Mapping of course outcomes onto program outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	1	2	1	2	1	1	3	2	1
CO2	3	3	3	2	2	1	1	2	1	2	1	2	3	3	1
CO3	3	3	2	3	2	2	2	2	2	2	1	1	2	2	1
CO4	2	2	3	3	2	2	2	2	3	3	2	2	2	2	1
CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1

If satisfying< 34%=1, 34-66% =2, > 66% = 3.

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: CE101
Course title: **Environmental Science**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 2 T: 0 P: 0
Class schedule per week: 2
Class: B. Tech
Semester / Level: I
Branch: All

Course Objectives
This course enables the students:

1	To develop basic knowledge of ecological principles and their applications in environment.
2	To identify the structure and composition of the spheres of the earth, the only planet sustaining life.
3	To analyse, how the environment is getting contaminated and probable control mechanisms for them.
4	To generate awareness and become a sensitive citizen towards the changing environment.

Course Outcomes
After the completion of this course, students will be:

1	Able to explain the structure and function of ecosystems and their importance in the holistic environment.
2	Able to identify the sources, causes, impacts and control of air pollution.
3	Able to distinguish the various types of water pollution happening in the environment and understand about their effects and potential control mechanisms.
4	Able to judge the importance of soil, causes of contamination and need of solid waste management.
5	Able to predict the sources of radiation hazards and pros and cons of noise pollution.

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Syllabus

Module 1. Ecosystem and Environment

Concepts of Ecology and Environmental science, ecosystem: structure, function and services, Biogeochemical cycles, energy and nutrient flow, ecosystem management, fate of environmental pollutants, environmental status and reports on climate change.

(8L)

Module 2: Air Pollution

Structure and composition of unpolluted atmosphere, classification of air pollution sources, types of air pollutants, effects of air pollution, monitoring of air pollution, control methods and equipment for air pollution control, vehicular emissions and control, indoor air pollution, air pollution episodes and case studies.

(8L)

Module 3: Water Pollution

Water Resource; Water Pollution: types and Sources of Pollutants; effects of water pollution; Water quality monitoring, various water quality indices, water and waste water treatment: primary, secondary and tertiary treatment, advanced treatments (nitrate and phosphate removal); Sludge treatment and disposal.

(8L)

Module 4: Soil Pollution and Solid Waste Management

Lithosphere – composition, soil properties, soil pollution, ecological & health effects, Municipal solid waste management – classification of solid wastes, MSW characteristics, collection, storage, transport and disposal methods, sanitary landfills, technologies for processing of MSW: incineration, composing, pyrolysis.

(8L)

Module 5: Noise pollution & Radioactive pollution

Noise pollution: introduction, sources: Point, line and area sources; outdoor and indoor noise propagation, Effects of noise on health, criteria noise standards and limit values, Noise measurement techniques and analysis, prevention of noise pollution; Radioactive pollution: introduction, sources, classification, health and safety aspects, Hazards associated with nuclear reactors and disposal of spent fuel rods-safe guards from exposure to radiations, international regulation, Management of radioactive wastes.

(8L)

Text books:

1. A, K. De. (3rd Ed). 2008. Environmental Chemistry. New Age Publications India Ltd.
2. R. Rajagopalan.2016.Environmental Studies: From Crisis to Future by, 3rd edition, Oxford University Press.
3. Eugene P. Odum. 1971. Fundamentals of Ecology (3rd ed.) -. WB Sunders Company, Philadelphia.

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4. C. N. Sawyer, P. L. McCarty and G. F. Parkin. 2002. Chemistry for Environmental Engineering and Science. John Henry Press.
5. S.C. Santra. 2011. Environmental Science. New Central Book Agency.

Reference books:

1. D.W.Conell. Basic Concepts of Environmental Chemistry, CRC Press.
2. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International
3. G.M. Masters& Wendell Ela. 1991. Introduction to Environmental Engineering and Science, PHI Publishers.

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors √
Tutorials/Assignments √
Seminars √
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End Sem Examination Marks	50
Quiz (s) (1 & 2)	10+10
Teacher's assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid sem exam	√	√	√	√	√
End Sem Examination Marks	√	√	√	√	√
Assignment	√	√	√	√	√

Indirect Assessment –

1.Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	1	3	3	2	2	2	1	1	2	1	1
CO2	2	3	2	3	2	3	3	2	2	2	1	1	2	2	1
CO3	2	3	2	3	2	3	3	2	2	2	1	1	2	2	1
CO4	2	3	2	3	2	3	3	2	2	2	1	2	2	2	1
CO5	2	3	3	3	2	3	3	2	2	2	1	2	2	2	1

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Mapping Between Cos and Course Delivery (CD) methods				
CD	Course Delivery methods		Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1, CD2
CD2	Tutorials/Assignments		CO2	CD1, CD2
CD3	Seminars		CO3	CD1, CD2
CD4	Mini projects/Projects		CO4	CD1, CD2
CD5	Laboratory experiments/teaching aids		CO5	CD1, CD2
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

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COURSE INFORMATION SHEET

Course code: CS203
Course title: **Computer Organization Architecture**
Pre-requisite(s): Digital Logic
Co- requisite(s):
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic architecture and organization of systems along with their performances.
2.	To Familiar with Digital Logic circuits, Data representation and Instruction Set Architecture.
3.	To build a complete data path for various instructions.
4.	To understand the pipeline concepts and Hazards.
5.	To familiar with Memory and I/O Organization.

Course Outcomes

After the completion of this course, students will be to:

1.	Explain the merits and pitfalls in computer performance measurements and analyze the impact of instruction set architecture on cost-performance of computer design
2.	Explain Digital Logic Circuits ,Data Representation, Register and Processor level Design and Instruction Set architecture
3.	Solve problems related to computer arithmetic and Determine which hardware blocks and control lines are used for specific instructions
4.	Design a pipeline for consistent execution of instructions with minimum hazards
5.	Explain memory organization, I/O organization and its impact on computer cost /performance.

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Syllabus

Module I

Basic Structures of Computers

Introduction to Digital Logic, Basic Structure of Computers: Computer Types, Functional Units, Input Unit, Memory Unit, Arithmetic and Logic Unit, Output Unit, Control Unit, Basic Operational Concepts: Fixed and floating point Representation and Arithmetic Operations, Performance, Historical Perspective.

(5L)

Module II

Instruction Set Architecture

Memory Locations and Addresses: Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Subroutines, Additional Instructions, Dealing with 32-Bit Immediate Values.

(5L)

Module III

Basic Processing Unit & Pipelining

Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors.

Pipelining: Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Pipeline Performance Evaluation.

(10L)

Module IV

Memory Organization

Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage.

(10L)

Module V

Input Output & Parallel Processing

Basic Input Output

Accessing I/O Devices, Interrupts

Input Output Organization

Bus Structure, Bus Operation, Arbitration, Interface, Interconnection Standards.

Parallel Processing

Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling.

(10L)

Text Book:

Patterson David A., Hennessy John L., Computer Organization and Design: The Hardware / Software Interface, 5th Edition, Elsevier.(T1)

Reference Books:

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Hamachar Carl et. al , Computer Organization and Embedded Systems, 6th Edition, McGraw Hill. (R1)
Mano M. Morris, Computer System Architecture, Revised 3rd Edition, Pearson.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	1	1	1	2	1	2	1	2	1	2	2	3	3	3
CO2	3	1	1	1	2	1	2	1	2	1	2	2	3	3	3
CO3	3	2	2	2	3	1	2	1	2	1	2	2	3	3	3
CO4	3	2	2	2	3	1	2	1	2	2	3	3	3	3	3
CO5	3	2	3	3	3	1	2	1	3	1	3	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS204
Course title: **Object Oriented Programming and Design Patterns**
Pre-requisite(s): Data Structure
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II/2
Branch: CSE/IT

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Course Objectives

This course enables the students:

1.	The course shall allow students to understand the basic tenets of OOP.
2.	The course will exemplify the basic syntax and constructs of JAVA.
3.	The course will help students understand the application OOP principles in various use cases.
4.	The course will explain basic JAVA GUI components and their working.
5.	The course aims to expose students to newer JAVA constructs like NIO, Lambdas etc.

Course Outcomes

After the completion of this course, students will be:

1.	Identify the difference between procedural and OO programming.
2.	Construct programs using various OOP principles.
3.	Design UI using JAVA GUI components.
4.	Operate on files and strings in real life scenarios.
5.	Analyze thread performance and inter thread communication issues

SYLLABUS

Module I

Introduction to Classes, Objects and Java

Introduction to Object Technology, Java, Understanding the Java development environment, Programming in Java, Memory concepts, Doing basic Arithmetic, Comparing entities, Classes, Objects, Methods, Strings, Primitive vs reference types.

(8L)

Module II

Control Statements, Methods and Arrays

Basic selection statements, Iterative constructs, Relative and Logical operators, break, continue, Methods, static methods, parameter passing, argument promotion and casting, scopes, method overloading. Arrays and ArrayList in Java, Enhanced for statement, Passing arrays to methods, Multidimensional arrays, Using command line arguments.

(8L)

Module III

Object Oriented Concepts: Polymorphism & Inheritance

Controlling access to class members, the use of this keyword, getters and setters, Composition, enum, the use of static and final, Garbage collection. Superclass and subclass, protected members, constructors in subclass, the Object class, Introduction to polymorphism, Abstract classes and methods, Assignment between subclass and superclass variables, Creating and using interfaces.

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(8L)

Module IV

Exception Handling & GUI Design

When to use exception handling, Java exception hierarchy, finally block, Stack unwinding, Chained exceptions, Declaring new exception types, Assertions, try with resources. Simple I/O with GUI, Basic GUI Components, GUI Event handling, Adapter classes, Layout managers, Using panels.

(8L)

Module V

Strings, characters & Files

Working with the String and StringBuilder class, Character class, Tokenizing strings, Regular Expressions, Files and Streams, Using NIO classes, Sequential file handling, Object serialization, JFileChooser, Introduction to threading, Introduction to Generics and lambda expressions.

(8L)

Text book:

Deitel P., Deitel H., Java How to Program, 10th Edition, Pearson Publications, 2016.(T1)

Reference book:

Wu C. T., Object Oriented Programming in Java, 5th Edition, McGrawHill Publications, 2010.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

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Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment tool	**% contribution during co assessment**
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO2	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO3	2	1	3	3	3	3	2	1	1	1	1	2	3	2	3
CO4	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3
CO5	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS206
Course title: **Design and Analysis of Algorithm**
Pre-requisite(s): Data Structure
Co- requisite(s): Algorithms Lab
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II/2
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	To analyze the performance of recursive and nor-recursive algorithms.
2.	To understand various algorithm design techniques.
3.	To use of different paradigms of problem solving.
4.	To find efficient ways to solve a given problem.
5.	To compare various algorithms of a given problem.

Course Outcomes

After the completion of this course, students will be able to:

1.	Define the concepts and mathematical foundation for analysis of algorithms.
2.	Explain different standard algorithm design techniques, namely, divide & conquer, greedy, dynamic programming, backtracking and branch & bound.
3.	Demonstrate standard algorithms for fundamental problems in Computer Science.
4.	Design algorithms for a given problem using standard algorithm design techniques.
5.	Analyze and compare the efficiency of various algorithms of a given problem.

SYLLABUS

Module I

Algorithms and Complexity

Introduction, Algorithm Complexity and various cases using Insertion Sort, Asymptotic Notations, Time complexity of Recursive Algorithm, Solving Recurrences using Iterative, Recursion Tree and Master Theorem. (8L)

Module II

Divide and Conquer

Discussion of basic approach using Binary Search, Merge Sort , Quick Sort , Selection in Expected linear time, Maximum Subarray , Matrix Multiplication , Introduction of Transform and Conquer and AVL Tree . (8L)

Module III

Dynamic Programming

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Introduction and Approach, Rod Cutting, LCS, Optimal BST, Transitive closure and All-pair Shortest Path, Travelling Salesperson Problem.
(8L)

Module IV
Greedy and other Design Approaches
Introduction to greedy using fractional knapsack, Huffman Code, Minimum Spanning Tree – Prim and Kruskal, Single Source Shortest Path Dijkstra's and Bellman-Ford, Introduction to Backtracking using N-Queens problem, Introduction to Branch and Bound using Assignment Problem or TSP.
(8L)

Module V
NP Completeness and Other Advanced Topics
Non-deterministic algorithms – searching and sorting, Class P and NP, Decision and Optimization problem, Reduction and NPC and NPH, NP Completeness proof for: SAT, Max-Clique, Vertex Cover, Introduction to Randomized Algorithms, Introduction to Approximation Algorithms. (8L)

Text Book:

1. Cormen Thomas H. et al., Introduction to Algorithms. 3rd Edition, PHI Learning, latest edition.(T1)

Reference Books:

1 Horowitz E., Sahani, Fundamentals of Computer Algorithms, Galgotia Publication Pvt. Ltd. (R1)
2 Dave and Dave, Design and Analysis of Algorithms, 2nd Edition, Pearson. (R2)
3 Goodrich, Tamassia. Algorithm Design. Wiley. (R3)

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects

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CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects

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CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO2	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO3	2	2	3	2	1	1	1	1	1	2	2	2	3	3	3
CO4	3	3	3	3	2	1	1	1	1	2	2	3	3	3	3
CO5	3	3	3	3	2	1	1	1	1	2	2	3	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS211
Course title: **Operating System**
Pre-requisite(s): Data Structure, Computer System Architecture, Basic Course on Computer Programming
Co- requisite(s): None
Credits: L:3 T:0 P:0

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Class schedule per week: 3
Class: BTech
Semester / Level: V
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Present the main components of OS and their working
2.	Introduce the concepts of process and thread and their scheduling policies
3.	Handling synchronization of concurrent processes and deadlocks
4.	Analyze the different techniques for managing memory, I/O, disk and files
5.	Design the components of operating system

Course Outcomes

After the completion of the course student will be able to:

1.	Describe the main components of OS and their working
2.	Explain the concepts of process and thread and their scheduling policies
3.	Solve synchronization and deadlock issues
4.	Compare the different techniques for managing memory, I/O, disk and files
5.	Design components of operating system

Syllabus

Module I **[8L]**

Operating system Overview

Operating system Objective and Functions, Evolution of Operating System, Major Advances in OS Components, Characteristics of Modern Operating Systems

Process Description and Control

Process Concept, Process States, Process Description, Process Control, Threads, Types of Threads, Multicore and Multithreading

Module II **[8L]**

Scheduling

Type of scheduling, Uniprocessor Scheduling, Multiprocessor Scheduling

Module III **[8L]**

Concurrency

Mutual Exclusion and Synchronization

Principle of Concurrency, Mutual Exclusion, Hardware Support, Semaphores, Monitors, Message Passing, Readers/Writers Problem

Deadlock and Starvation

Principle of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher Problem

Module IV **[8L]**

Memory Management

Memory Management Requirements, Memory Partitioning, Paging, Segmentation

Virtual Memory

Hardware and Control Structures, Operating System Policies for Virtual Memory

Module V **[8L]**

I/O Management and Disk Scheduling

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I/O device, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling, RAID, Disk Cache

File Management

Overview, File Organization and Access, File Directories, File Sharing, Record Blocking, File Allocation and Free Space Management

Text Book:

1. StallingsW., Operating systems - Internals and Design Principles, , 8th Edition, Pearson, 2014.

Reference Books:

1. SilberchatzAbraham, Galvin Peter B.,Gagne Greg, Operating System Principles, 9th Edition, Wiley Student Edition, 2013.
2. Tanenbaum Andrew S., Modern Operating Systems, 4th Edition, Pearson, 2014.
3. Dhamdhere D. M. ,Operating Systems A concept - based Approach, 3rd Edition, McGrawHill Education, 2017.
4. Stuart B. L., Principles of Operating Systems, 1st Edition, 2008, Cengage learning, India Edition.
5. Godbole A. S., Operating Systems, 3rd Edition, McGrawHill Education, 2017.

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars

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CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	1	1	2	1	1	1	1	2	2	2	1
CO2	2	2	2	2	1	1	2	1	1	1	1	2	2	2	1
CO3	2	2	3	2	2	2	2	2	1	2	1	3	3	2	2
CO4	3	3	3	3	2	2	2	2	2	2	2	3	3	3	3
CO5	3	2	2	2	2	3	1	1	1	1	1	1	3	3	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: MA204
Course title: **Numerical Methods Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 2 C:1
Class schedule per week: 2
Class: B. Tech
Semester / Level: III/II
Branch: All

Course Objectives
This course enables the students to understand

1.	derive appropriate numerical methods to solve algebraic, transcendental equations and linear system of equations
2.	approximate a function using various interpolation techniques, to find the numerical solution of initial value problems
3.	ncepts in probability theory, the properties of probability distributions
4.	estimation of mean, variance and proportion, the concepts of statistical hypothesis

Course Outcomes
After the completion of this course, students will be able to

1.	solve algebraic, transcendental equation and linear system of equations using an appropriate numerical method arising in various engineering problems
2.	evaluate derivative at a value using an appropriate numerical method in various research problems, solve differential equation numerically
3.	learn basic probability axioms, rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
4.	find the point and interval estimates, analyse data statistically and interpretation of the results

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Syllabus
List of Assignments

1. Find a simple root of $f(x)=0$ using bisection method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
2. Find a simple root of $f(x)=0$ using Regula-Falsi method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
3. Find a simple root of $f(x)=0$ using Newton Raphson method. Read any initial approximation x_0, maximum number of iterations n and error tolerance eps.
4. Solution of a system of $n\times n$ linear equations using Gauss elimination method with partial pivoting. The program is for 10×10 system or higher order system.
5. Matrix inversion and solution of $n\times n$ system of equations using Gauss-Jordan method. If the system of equations is larger than 15×15 change the dimensions of the float statement.
6. Program to solve a system of equation using Gauss-Seidel iteration method. Order of the matrix is n, maximum number of iterations $niter$, error tolerance is eps and the initial approximation to the solution vector is x_0. If the system of equations is larger than 10×10 change the dimension in float.
7. Program to find the largest Eigen value in magnitude and the corresponding Eigen vector of a square matrix A of order n using power method.
8. Program for Lagrange interpolation.
9. Program for Newton divided difference interpolation.
10. Program for Newton's forward and backward interpolation.
11. Program for Gauss's central difference interpolation (both backward and forward).
12. Program to evaluate the integral of $f(x)$ between the limits a to b using Trapezoidal rule of integration based on n subintervals or $n+1$ nodal points. The values of a,b and n are to be read. The program is tested for $f(x)=1/(1+x)$.
13. Program to evaluate the integral of $f(x)$ between the limits a to b using Simpson's rule of integration based on $2n$ subintervals or $2n+1$ nodal points. The values of a,b and n are to be read and the integrand is written as a function subprogram. The program is tested for $f(x)=1/(1+x)$.
14. Program to solve an IVP, $dy/dx=f(x), y(x_0)=y_0$ using Euler method. The initial value x_0, y_0 the final value x_f and the step size h are to be read. The program is tested for $f(x,y)=-2xy^2$.
15. Program to solve an IVP, $dy/dx=f(x), y(x_0)=y_0$ using the classical Runge-Kutta fourth order method with step size h, $h/2$ and also computes the estimate of the truncation error. Input parameters are: initial point, initial value, number of intervals and the step length h.

Solutions

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with h, $h/2$ and the estimate of the truncation error are available as output. The right hand side The program is tested for $f(x,y) = -2xy^2$.

Text Books:

1. S.S.Sastry-Introductory Methods of Numerical Analysis-PHI, Private Ltd., New Delhi.
2. N.Pal& S. Sarkar- Statistics: Concepts and Applications, PHI, New Delhi-2005.

Reference Books:

1 R.V.Hogg et.al- Probability and Statistical Inpane, 7th Edn, Pearson Education, New Delhi-2006.

2. R.L.Burden&J.D.Faires- Numerical Analysis, Thomson Learning-Brooks/Cole, Indian Reprint, 2005.

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
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CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	(60)
Attendance Marks	12
Lab file Marks	12

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Viva Marks	24
Day-to-day performance Marks	12
End SEM Evaluation	(40)
Lab quiz Marks	20
Lab performance Marks	20

Assessment Components	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation	√	√	√	√	√
End SEM Evaluation	√	√	√	√	√

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	2	1	1					1	2	2	3	2
CO2	2	2	3	2	1	1				2	1	2	2	3	2
CO3	2	2	3	2	1	1			1	2	2	2	2	3	2
CO4	3	3	3	2	1	1	2	2	1	2	2	3	3	3	3
CO5	3	3	3	2	1	1	2	2	1	2	2	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT202
Course title: **Basic IT Workshop**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 2
Class schedule per week: 2
Class: B. Tech
Semester / Level: IV/II
Branch: All

Course Objectives

This course enables the students:

1.	Understand and use the basic Matlab functions and understand its environment and variables
2.	Know about handling operations and advanced features like menus and toolbars

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3.	Implement programs with the use of arrays, strings and graphical data representations
4.	Understand Python, Data Types, Operators, Arrays
5.	Implement Functions and loops, object oriented programming using Python

Course Outcomes

After the completion of this course, students will be able:

1.	Apply features of Matlab and algorithms to solve problems
2.	Develop application programs with the help of various tool boxes available in Matlab.
3.	Apply data analysis through graphical data representations
4.	Implement programs with the use of arrays, strings in Matlab
5.	Implement Functions and loops, using Python

Syllabus

Module I

Introduction to MATLAB and Basics Part I:

Introduction, Advantage, Disadvantage of MATLAB, MATLAB Environment, Variables and Array, Built-in Functions of MATLAB, Subarrays, Multidimensional Arrays, Data Files.

Module II

MATLAB Basic Part II:

Scalar and Array Operations, Hierarchy of Operations, Introduction to Plotting, Polar Plots, Subplots, MATLAB profiler. String Functions, Complex Data, Three-Dimensional Plot

Module III

MATLAB Advanced Features:

Sparse Arrays, Cell Arrays,Structure Arrays, I/O Functions, Object Handles, Position and Units, Graphical User Interface: Dialog Boxes, Menus, Toolbars.

Module IV

Introduction to Python Basics

Basics, I Python, Data Types, Operators, Arrays, Plotting

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Module V

Python Programming Part 2:

Functions and loops, object oriented programming, Numerical Formalism

Sample list of Assignments:

Sample Assignments on Python

Data Types, Input- Outputs, Variables

1. Write a program in Python to swap two variables.

2. Write a program in Python to check the input character is an alphabet or not.

Loop

3. Write a program in python to shuffle a deck of card using the module random and draw 5 cards.

4. Write a program in python to find the factors of a number.

Array and Lists

5. Write a program in python to transpose a given matrix M = [[1, 2], [4, 5], [3, 6]].

6. Write a program in python to print the median of a set of numbers in a file.

Function

6. Write a function in Python to find the resolution of a JPEG image.

7. Write a program in python and use in-built functions to convert a decimal number to binary, octal and hexadecimal number.

8. Write a program in python to sort words in alphabetical order.

Plot

9. Use Matplotlib to draw histogram to represent average age of population given as Age [21, 54, 66, 44, 32,42, 54, 62, 93, 45, 32, 70]

10. Create a 3-D plot in Python for the function $\sqrt{y^2 - x^2}$ over the interval $-3 \leq x \leq 3$ and $-3 \leq x \leq 3$.

Sample Assignments on MATLAB

Assignment Statements:

1. Given two sides a= 3.2 and b=4.6 of a triangle and angle theta= 60^0 between these two sides. Find the length of the third side and the area of the triangle.

2. Write a MATLAB statement to calculate the sum of the series:

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$S= 1- x^2/2! + x^4/4! – x^6/6! + x^8/8!$ for x= 1.5

Arrays

3. The array A is given below. Extend the 2-D array to 3-D array by including another 2-D array as second element in the third dimension.

$$A = 123; 543; 136;$$

4. Let a matrix A of size (3x4) is defined as, = 12356791011 4812 . Reshape the matrix A into matrix B of the size (6x2).

5. Let a column vector z be given as z = [2; 3; 4; 5].

(i) Form a diagonal matrix A, using the elements of z as he main diagonal elements of A.

(ii) Form the matrix B, using the elements of vector z as elements of upper diagonal of B.

(iii) Form the matrix C, using the elements of vector z as elements of first lower diagonal of C.

Polynomials

6. Integrate the polynomial $y = 4x^3 + 12x^2 + 16x + 1$. Take the constant of integration as 3.

7. Find the polynomial of degree 2 to fit the following data:

x	0	1	2	4
y	1	6	20	100

Input-Output statement and files

8. Write a program in MATLAB to illustrate the use of ‘pause’ command.

9. Write a program in MATLAB to illustrate the use of fwrite function for writing binary data of different formats to a file named ‘check.txt’.

Plots

10. Plot the curve given by the equation y = sin(x) where x varies from 0 to 2π. Also label the x-axis and y-axis and provide a suitable title for the plot

11. Plot a bar graph for the data given as x = [1 2 3 4 5 6] and y = [10 15 25 30 27 19]

12. Given $x = t^2$ and y = 4t for $-4 < t < 4$. Using MATLAB obtain a 3-D plot showing the matrix in (x, y) space as a factors of time.

Control structures

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13. Write a program in MATLAB to find the count of even values in the given n numbers.

Functions

14. Write a function in MATLAB to calculate the roots of the quadratic equation $ax^2 + bx + c = 0$, where a, b, c are constants.

Text Books:

1. MATLAB® Programming for Engineers:Stephen J. Chapman, Thomson Corporation, 4th Edition
2. Introduction to Python for Engineers and Scientists, Sandeep Nagar, Apress, 2018

Reference Books

1. Learn Python The Hard Way, Zed A. Shaw, Addison-Wesley, Third Edition

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping between course outcomes and course delivery method

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	3	2	3	1					1	2	2	2	2
CO2	2	1	3	2	3	1				2	1	2	2	2	3
CO3	2	2	3	2	3	1			2	2	2	2	2	2	3
CO4	2	3	3	2	3	1	2	2	2	2	2	3	3	2	3
CO5	2	3	3	2	3	1	2	2	2	2	2	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

COURSE INFORMATION SHEET

Course code: CS205
Course title: **OOPDP Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV/II
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	To introduce the student with fundamentals and features of Object Oriented programming.
2.	To be able to write a Java program to solve a well specified problem
3.	To be able to describe, recognize, apply and implement selected design patterns in Java
4.	To be familiar with common errors in Java and its associated libraries
5.	To understand a Java program written by someone else and be able to debug and test the same.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Work in any object oriented environment and program using those features.
CO2	Student will have hands on experience with all basic concepts of Java programming
CO3	Analyse the design pattern of the given problem and further solve with less complexity.
CO4	Use his/her programming skills to resolve the issues coming while programming for bigger problems.
CO5	Work in industry environment with good enough knowledge about Java and OOPs.

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Syllabus

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To understand and Implement basic java program concepts using Scanner class.

Q1. Take input from user a character variable in a program and if the value is alphabet then print "Alphabet" if it's a number then print "Digit" and for other characters print "Special Character"

Q2. Write a program to add all the values in a given number and check if the sum is prime number or not. Ex: 1234->10, not prime.

2. **Lab Assignment No: 2**

Objective: To Understand and Implement the concept of arrays in java

Q1. Write a program to find the largest 2 numbers and the smallest 2 numbers in the array initialized by the user.

Q2. Write a program to print the element of an array that has occurred the highest number of times Eg) Array -> 10,20,10,30,40,100,99 O/P:10

3. **Lab Assignment No: 3**

Objective: To Understand and Implement the concept of 2-D arrays in java.

Q1.Write a program to reverse the elements of a given 2*2 array. Four integer numbers needs to be passed as Command Line arguments

Eg: C:\>java Sample 1 2 3 4

O/P Expected :

The given array is : 1 2

3 4

The reverse of the array is : 4 3

2 1

Q2. Write a program to find greatest number in a 3*3 array. The program is supposed to receive 9 integer numbers as command line arguments.

4. **Lab Assignment No: 4**

Objective: To Understand and Implement the concept of classes and Constructors

Q1. Create a class Box that uses a parameterized constructor to initialize the dimensions of a box.(dimensions are width, height, depth of double type). The class should have a method that calculates and returns the volume of the box . Obtain an object and print the corresponding volume in main() function.

Q2. Write a program in Java with class Rectangle with the data fields width, length, area and color. The length, width and area are of double type and color is of string type. The methods are set_length() , set_width() , set_color(), and find_area(). Create two object ofRectangle and compare their area and color. If area and color same for the objects then display "Matching Rectangles" otherwise display "Non Matching Rectangle".

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5. Lab Assignment No: 5

Objective: To Understand and Implement the concept of Inheritance

Q1.Create a class named 'Animal' which includes methods like eat() and sleep(). Create a child class of Animal named 'Bird' and override the parent class methods. Add a new method named fly(). Create an instance of Animal class and invoke the eat and sleep methods using this object.Create an instance of Bird class and invoke the eat, sleep and fly methods using this object.

Q2. A HighSchool application has two classes: the Person superclass and the Student subclass. Using inheritance, in this lab you will create two new classes, Teacher and CollegeStudent. A Teacher will be like Person but will have additional properties such as salary (the amount the teacher earns) and subject (e.g. "Computer Science", "Chemistry", "English", "Other"). The CollegeStudent class will extend the Student class by adding a year (current level in college) and major (e.g. "Electrical Engineering", "Communications", "Undeclared").

6. Lab Assignment No: 6

Objective: To Understand and Implement the concept of Overloading and Overriding

Q1.Create a class Account with two overloaded constructors. First constructor is used for initializing, name of account holder, account number and initial amount in account. Second constructor is used for initializing name of account holder, account number, address, type of account and current balance. Account class is having methods Deposit(), WithDraw(), and GetBalance().Make necessary assumption for data members and return types of the methods. Create objects of Account class and use them.

Q2. Create a base class Fruit which has name ,taste and size as its attributes. A method called eat() is created which describes the name of the fruit and its taste. Inherit the same in 2 other class Apple and Orange and override the eat() method to represent each fruit taste.

7. Lab Assignment No: 7

Objective: To Understand and Implement String class in Java

Q1. Reverse the string but not the words. Eg. I/P: Birla institute of technology

O/P: technology of institute birla.

Q2. Find out and print the maximum possible palindrome in a given string. Eg:

I/P: nononsene O/P: nonon

Q3.Given a string and a non-empty word string, return a string made of each char just before and just after every appearance of the word in the string. Ignore cases where there is no char before or after the word, and a char may be included twice if it is between two words.

If inputs are "abcXY123XYijk" and "XY", output should be "c13i".

If inputs are "XY123XY" and "XY", output should be "13".

8. Lab Assignment No: 8

Objective: To Understand and Implement the concept of Abstract classes and Interfaces

Q1. Create an abstract class Compartment to represent a rail coach. Provide an abstract function notice in this class. Derive FirstClass, Ladies, General, Luggage classes from the compartment class. Override the notice function in each of them to print notice suitable to the type of the compartment. Create a class TestCompartment. Write main function to do the following: Declare an array of Compartment of size 10.

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Create a compartment of a type as decided by a randomly generated integer in the range 1 to 4. Check the polymorphic behavior of the notice method.

Q2.Write a program in java which implement interface Student which has two methods Display_Grade and Attendance for PG_Students and UG_Students (PG_Students and UG_Students are two different classes for Post Graduate and Under Graduate Students respectively).

9. Lab Assignment No: 9

Objective: To Understand and Implement Exception handling in java

Q1. Write a program in Java to display name and roll number of students. Initialize respective array variables for 10 students. Handle ArrayIndexOutOfBoundsException, so that any such problem does not cause illegal termination of program.

Q2. Write a program to accept name and age of a person from the command prompt(passed as arguments when you execute the class) and ensure that the age entered is >=18 and < 60. Display proper error messages. The program must exit gracefully after displaying the error message in case the arguments passed are not proper. (Hint : Create a user defined exception class for handling errors.)

10. Lab Assignment No: 10

Objective: To Understand and Implement File Handling and multithreading in java

Q1. Write a program to count the number of times a character appears in the Fileand also copy from one file to another. (Case insensitive... 'a' and 'A' are considered to be the same)

Q2. 1. Create class of SalesPersons as a thread that will display fives sales persons name. 2. Create a class as Days as other Thread that has array of seven days.

3. Call the instance of SalesPersons in Days and start both the threads 4. suspendSalesPersons on Sunday and resume on wednesday Note: use suspend, resume methods from thread

Q3. Create two threads, one thread to display all even numbers between 1 & 20, another to display odd numbers between 1 & 20. Note: Display all even numbers followed by odd numbers Hint: use join

11. Lab Assignment No: 11

Objective: To Understand and Implement Applets, AWT and Swings

Q1. Program to create a calculator with the help of AWT packages in Java.

Q2. Program to create a unit converter using Swings in Java.

Q3. APPLETS

a) Working with Frames and various controls.

b) Working with Dialogs and Menus.

c) Working with Panel and Layout.

d) Incorporating Graphics.

e) Working with colors and fonts.

Books recommended:

TEXT BOOKS

1. Krishna P. R., Object Oriented Programming through JAVA, 1st Edition, Universities Press, 2008.
2. Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.

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3. Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi.

REFERENCE BOOKS

1. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi.
2. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi.

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

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Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
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CD5	Industrial visits/in-plant training
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CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO2	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO3	2	1	3	3	3	3	2	1	1	1	1	2	3	2	3
CO4	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3
CO5	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CS212
Course title: Operating System Lab
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Gain practical experience with designing and implementing concepts of operating systems such as system calls.
2.	Implement and develop CPU scheduling.
3.	Implement and understand process management, memory management.
4.	To provide a foundation in use of file systems and deadlock handling using C language in Linux environment.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand and implement basic services and functionalities of the operating system using system calls. .
CO2	Use modern operating system calls and synchronization libraries in software/ hardware interfaces.
CO3	Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.
CO4	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
CO5	Implement memory management schemes and page replacement schemes.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To Understand and Implement Directory Structure

Q1. WAP to create a File directory system.

2. **Lab Assignment No: 2**

Objective: To Understand and Implement Scheduling processes

Q1. WAP to schedule various processes

3. **Lab Assignment No: 3**

Objective: To Understand and Implement FCFS

Q1. WAP to implement FCFS CPU Scheduling

4. **Lab Assignment No: 4**

Objective: To Understand and Implement SJF

Q1. WAP to implement SJF CPU scheduling.

5. **Lab Assignment No: 5**

Objective: To Understand and Implement SRTF

Q1.WAP to implement SRTF CPU scheduling.

6. **Lab Assignment No: 6**

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Objective: To Understand and Implement Scheduling algorithms

Q1. WAP to implement Round Robin Scheduling

7. **Lab Assignment No: 7**

Objective: To Understand and Implement Scheduling algorithms

Q1 WAP to implement SRTF scheduling .

8. **Lab Assignment No: 8**

Objective: To Understand and Implement context switching

Q1. WAP to implement Round Robin Scheduling with context switching.

9. **Lab Assignment No: 9**

Objective: To Understand and Implement context switching.

Q1.WAP to implement SRTF with context switching.

10. **Lab Assignment No: 10**

Objective: To Understand and Implement Page Replacement Techniques

Q1. WAP to implement FCFS page replacement algorithm.

Q2. WAP to implement Optimal page replacement algorithm.

Books recommended:

TEXT BOOKS

OPERATING SYSTEM CONCEPTS(2012): ABRAHAM SILBERSCHATZ Yale University PETER BAER GALVIN Pluribus Networks GREG GAGNE Westminster College. **(T1)**

Operating Systems (2003) by Deitel, Deitel, and Choffnes. (**T2**)

REFERENCE BOOKS

OPERATING SYSTEM CONCEPTS(2012): ABRAHAM SILBERSCHATZ Yale University PETER BAER GALVIN Pluribus Networks GREG GAGNE Westminster College.**(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

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POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
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CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	**% Distribution**
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	**% Distribution**
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4
Progressive Evaluation	3	3	3	3
End SEM Evaluation	3	3	3	3

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	1	1	2	1	1	1	1	2	2	2	1
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CO3	2	2	3	2	2	2	2	2	1	2	1	3	3	2	2
CO4	3	3	3	3	2	2	2	2	2	2	2	3	3	3	3

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1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Head of Department

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Course Outcomes	Course Delivery Method
CO1	CD1,CD4
CO2	CD1, CD2,CD5
CO3	CD1, CD2
CO4	CD1, CD3,CD5
CO5	CD1,CD2

COURSE INFORMATION SHEET

Course code: CS207
Course title: **Design of Algorithm Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives
After the completion of this course, students will be able to:

1.	Able to implement various design strategies of algorithms
2.	Able to examine the efficiency of algorithm by changing the places of important steps.
3.	Able to compare approximate and exact solutions.
4.	Able to investigate effect randomness on correctness and efficiency of algorithms.
5.	Able to design approximate, random and parallel solution of different problems.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Able to know the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations.
CO2	Able to determine the practical implications of asymptotic notations.
CO3	Able to Implement, analyze, and compare algorithms.
CO4	Able to Know the difference between the dynamic programming concept and a greedy approach.
CO5	Able to know and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.

Syllabus

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Programs on Polynomial vs logarithmic running times

   Lab Assignment No: 2

Programs on Divide-and-conquer algorithms

2. **Lab Assignment No: 3**

Programs on Greedy and dynamic-programming algorithms

3. **Lab Assignment No: 4**

   Programs on Binary trees

4. **Lab Assignment No: 5**

Programs on Heaps and priority queues

5. **Lab Assignment No: 7**

Programs on Binary search trees

6. **Lab Assignment No: 8**

Programs on Hash tables

7. **Lab Assignment No: 9**

   Programs on Graph traversal

8. **Lab Assignment No: 10**

Programs on Shortest paths in graphs.

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Books recommended:

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001. **(T1)**
2. SanjoyDasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, Tata McGraw-Hill, 2008. **(T2)**
3. Jon Kleinberg and ÉvaTardos, Algorithm Design, Pearson, 2005. **(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A
Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

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CD9	Simulation

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
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Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO2	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO3	2	2	3	2	1	1	1	1	1	2	2	2	3	3	3
CO4	3	3	3	3	2	1	1	1	1	2	2	3	3	3	3
CO5	3	3	3	3	2	1	1	1	1	2	2	3	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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COURSE INFORMATION SHEET

Course code: IT301
Course title: **Data Communication & Computer Network(DCCN)**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Study the components of the data communication model and communications architecture.
2.	Understand the differences and similarities between the OSI model and the TCP model.
3.	Understand the fundamentals of the theory of signalling.
4.	Understand the basic principles of signal encoding techniques, error-detection, and error-correction techniques.
5.	Understand the characteristics of analog signaling and digital signaling and the strengths and weaknesses of each method.

Course Outcomes
After the completion of this course, students will be able to:

1.	Identify the elements of a communication network.
2.	Illustrate different data communications and networking standards.
3.	Design and implement a simple LAN and a WAN that meet a specific set of criteria.
4.	Identify the new trends and technologies, their potential applications.
5.	Examine the social impact of the networking technology particularly on issues related to security and privacy.

Syllabus
Module I
Data Communications and Networking Overview
A Communications Model, Data Communications, Data Communication Networking, The Need for Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture, Data TransmissionConcepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity. (8L)
Module II
Transmission Media and Signal Encoding Techniques: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.Digital Data Digital Signals,

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Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals. (8L)

Module III

Digital Data Communication Techniques and Data Link Control: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing, Flow Control, Error Control, High-Level Data Link Control (HDLC). (8L)

Module IV

Multiplexing, Circuit Switching and Packet Switching Multiplexing

Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing, Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signaling, Soft switch Architecture, Packet-Switching Principles, X.25, and Frame Relay. (8L)

Module V

Asynchronous Transfer Model

Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.

Routing in Switched Networks

Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms. (8L)

Text Book:

Stallings W., Data and Computer Communications, 10thEdn., Pearson Education, PHI, New Delhi, 2014.(T1)

Reference Book:

Forouzan B. A., Data Communications and Networking, 5thEdn. TMH, New Delhi, 2017.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	1			2	2	3	3	3	3
CO2	3	2	2	2	2	1	1		2	2	2	3	3	3	3
CO3	3	3	2	2	2	2	1		2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS301
Course title: **Database Management System (DBMS)**
Pre-requisite(s): Data Structures.
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	Understand the fundamental concepts, historical perspectives, current trends, structures, operations and functions of different components of databases.
2.	Recognize the importance of database analysis and design in the implementation of any database application.
3.	Describe the role of transaction processing in a database system.
4.	Understand various concurrency control mechanisms for a database system.
5.	Describe the roles of recovery and security in a database system.

Course Outcomes

After the completion of this course, students will be able to:

1.	Analyze data organization requirements and their inter relationships.
2.	Illustrate the features of data models and their application for storing data.
3.	Design queries to maintain and retrieve useful information from the databases created.
4.	Analyze the physical database design with respect to their expected performance using normalization and query processing.
5.	Examine the best practices according to concepts of indexing, transaction control and concurrency maintenance

Syllabus

Module I

Database Design and Entity - Relational Model

Purpose of Database System; View of Data, Database Languages, Transaction Management, Database architecture, Database Users and Administrator, Types of database System, Overview of design process, E-R model, Constraints, E–R Diagram, E-R Diagram issues, Weak Entity Sets, Extended E – R Features, Reduction to E–R Schemas. (8L)

Module II

Relational Model

Structure of Relational Database, Codd's Rules, Fundamental Relational Algebra Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations, Data definition, Basic structure of SQL queries, Set Operations, Aggregate Functions, Null Values, Nested Sub Queries, complex queries, views, modification of database, Joined relations, SQL data types & schemas, Integrity constraints, authorization, Embedded SQL, Triggers. (8L)

Module III

Relational Database Design

Functional dependency, Decomposition, Normalization, First normal form, Second normal form, Third normal form, BCNF, Multivalued dependencies and Fourth normal form, Join dependencies and Fifth normal form, DKNF. (8L)

Module IV

Indexing & Hashing

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Ordered Indices, B+ Tree index files, B-Tree index files, Multiple key access Static hashing, Dynamic Hashing, Comparison of ordered indexing and hashing, Index definition in SQL.

Query Processing

Measure of Query Cost, Selection Operation, Evaluation of Expressions. (8L)

Module V

Transaction & Concurrency Control

Transaction Concepts & ACID Properties, Transaction States, Implementation of Atomicity & Durability, Concurrent Executions, Serializability& Its Testing, Recoverability, Lock-Based protocols, Validation based protocol, Multiple Granularity, Multiversion Schemes, Deadlock Handling. (8L)

Text Book:

Silberschatz A. et.al, Database System Concepts, 6th Edition, Tata Mc-Graw Hill, New Delhi, 2011. (T1)

Reference Books:

Elmasri R., Fundamentals of Database Systems, 7thEdition, Pearson Education, New Delhi, 2016. (R1)

Ullman Jeffrey D et.al., A First course in Database Systems, 3rd Edition, Pearson Education, New Delhi- 2014.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO2	3	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO3	3	1	3	3	3	3	2	1	1	2	1	2	3	2	3
CO4	3	1	3	3	3	3	2	1	1	2	2	3	3	2	3
CO5	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS310
Course title: **Formal language and Automata Theory**
Pre-requisite(s): Discrete Mathematics
Co- requisite(s): NIL
Credits: L:3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Define a system and recognize the behavior of a system.
2.	Design finite state machines and the equivalent regular expressions.
3.	Construct pushdown automata and the equivalent context free grammars
4.	Design Turing machines and Post machines
5.	Learn about the issues in finite representations for languages and machines, as well as gain a more formal understanding of algorithms and procedures.

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Course Outcomes

After the completion of this course, students will be able to:

1.	Relate formal languages and mathematical models of computation
2.	Analyze different types of languages and the corresponding machines
3.	Analyze the Pushdown machine and its role in compiler construction
4.	Find the capability of real computers and learn examples of unsolvable problems.
5.	Analyze classes of P, NP, NP-C and NP-Hard problems

Syllabus

Module I

Introduction to Automata: (mathematical model of digital devices, including real computer), State Transition Graph, Finite Automaton (FA) and its types, Deterministic Finite Automaton (DFA), Non-deterministic Finite Automaton (NDFA), Complement, Union, Intersection of FA's , Conversion Strategy from NDFA to DFA , Minimization of FA, Finite Automaton with Output, Applications of FA.
(10L)

Module II

Regular Expressions(RE): Introduction , R.E.'s and basic operations, Algebraic laws on Regular Expression, Finite and Infinite Languages, Equivalence of finite Automaton and regular expressions, Constructing NDFA from Regular Expression , Pumping Lemma for Regular Language, Closure properties of Regular Languages, Non-regular languages, Applications of Regular Expression.
(6L)

Module III

Grammar: Introduction, Formal Definition of Grammar, The Chomsky Hierarchy of Grammar, Designing Regular grammar from DFA, Context Free Grammar, Closure properties of Context Free Languages, , CFG and Normal form: Chomsky Normal Form, Greibach Normal Form, Non-Context Free Language, Applications of CFGs. (8L)

Module IV

Push Down Automation (PDA): Introduction, Definition of PDA, Types of Pushdown Automata (DPDA and NPDA), Converting CFG to PDA, Derivation (Parsing), Parsing Techniques, Ambiguous and Unambiguous Grammar, Demerits of Ambiguous Grammar. (8L)

Module V

Turing Machine(TM): Single Tape TM, Variations of TM, Halting Problem, Turing Machine and Languages, Enumerable Languages, Decidable, Recognizable and Undecidable languages, Solvable and Unsolvable problems, Post Correspondence Problems(PCP), Classes of Problems: P, NP, NP-C and NP-Hard.
(8L)

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Text Book:

Hopcroft J.E., Motwani R. and Ullman J.D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2008. (T1)

Reference Books:

Mishra K.L.P. andChandrasekaran N. , Theory of Computer Science: Automata, Languages and Computation, 3rd Edition, PHI.(R1)

Martin John C., Introduction to Languages and the Theory of Computation, 3rd Edition, TataMcGraw Hill Publishing Company, New Delhi, 2007. (R2)

Lewis Harry R. and Papadimitriou Christos H., Elements of the theory of Computation, 2nd Edition, Prentice-Hall of India Pvt. Ltd. (R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	3	1	2	1	1	2	1	1	1	3	3	2
2	3	3	1	3	1	2	2	1	1	1	2	1	2	2	1
3	3	3	3	3	3	1	1	1	2	2	1	2	2	3	1
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	1
5	2	2	1	2	3	1	1	1	1	3	2	3	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT305
Course title: **Software Engineering**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Students are effective team members, aware of cultural diversity, who conduct themselves ethically and professionally
2.	Students use effective communication skills and technical skills to assure production of quality software, on time and within budget.
3.	Students build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks.
4.	Able to increase level of self-reliance, technical expertise, and leadership.

Course Outcomes
After the completion of this course, students will be:

1.	Explain the software engineering principles and techniques
2.	Apply Software Project Management Practices
3.	Apply the knowledge gained for their project work as well as to develop software following software engineering standards
4.	Develop self-reliance, technical expertise, and leadership.

Syllabus
Module I
Introduction
Some Definitions, FAQs about software engineering, the evolving role of software, Software process models, Waterfall model, the prototyping model, spiral model, RAD and Incremental model, Management activities, Project planning and Project Scheduling.
(8L)
Module II
Software Requirements
Functional and non-functional requirements, User requirements, System requirements, the software requirements document. IEEE standard of SRS, Quality of good SRS.

Requirement Engineering Process: Feasibility study, Requirements elicitation and analysis, Requirements validation, Requirement management.

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(8L)

Module III

Design Engineering

Design Process and Design Quality, Design Concepts, Design Models, Object oriented Design, UML: Class diagram, Sequence diagram, Collaboration diagram.
(8L)

Module IV

Verification and Validation

Verification and Validation Planning, S/W inspection, static analysis.

Software Testing

Testing functions, Test care design, White Box testing, Black box testing, Unit testing, Integration Testing, System testing, Reliability.
(8L)

Module V

Process metrics, Software Measurement, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Quality assurance and standards, Quality planning, Quality control, **S**/W Maintenance in detail.
(8L)

Text Book:

Sommerville, Software Engineering, 7th Edition, Pearson Education Publication. (T1)

Reference Books:

Pressman R. S.,Software Engineering: A Practiioners Approach, 5th Edition., TMA, New Delhi.(R1)
Mall Rajib, Fundamental of Software Engineering, 4th Edition, PHI Learning Private Limited.(R2)
Peters J. F. &Pedrycz W., Software Engineering, John Wiley & Sons, Inc. 2000.(R3)
Behforooz A. & Hudson F.J., Software Engineering Fundamentals, Oxford Univ. Press, New York, 2000.(R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
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1	3	3	3	1	1	2	1	2	3	3	1	1	1	3	2
2	2	3	1	2	2	2	2	2	2	3	2	1	1	2	3
3	2	3	3	3	3	1	1	1	2	3	1	2	2	3	3
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	2
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT320
Course title**: User Interface Design**
Pre-requisite(s): CS204 OOPDP
Co- requisite(s):NIL
Credits: L: 3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Head of Department

Phone : (EPBX) 0651 – 2275444/2275896, 2276002/2276006 FAX : 0651 – 2275401/2275351 Website : www.bitmesra.ac.in

Course Objectives

This course enables the students

1.	To impart the basic concepts of User Interface Design.
2.	To develop understanding about human computer interaction methods that utilize more general, widespread and easier-to-learn capabilities.
3.	The cognitive and perceptual constraints that affect interface design
4.	Techniques for evaluating the usability of an interface
5	How to communicate the results of a design process, both in oral and written form

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Identify the key terms related to user interfaces and user interface design and implementation
2.	Identify and describe various types of computer users and computer use contexts
3.	Identify and describe various types of user interfaces
4.	Describe and explain the user interface design process
5	Identify and describe common abstract user interface components, such as radio buttons and group boxes

Syllabus

Module I

Introduction: Importance of user interface – definition, importance of good design, brief history – Graphical User Interface – Web User Interface – Theories, Principles and Guidelines of User interface design.

(7L)

Module II

Design Process: Obstacles in development path deigning for people-Understanding Human Interaction with computers, Importance of Human Characteristics, Human consideration, Human Interaction speeds – Understanding Business function. (8L)

Module II

Screen Designing: Design goals - screen meaning and purpose, organizing screen elements ordering of screen data and content – screen navigation and flow – visually pleasing composition – amount of information – focus and emphasis – presenting information simply and meaningfully – information retrieval on web – Statistical graphics – Technological considerations in Interface Design. (8L)

Module IV

Menus and navigation schemes: structures of menus-functions of menus- contents of menus - formatting of menus – phrasing the menu- selecting menu choices-navigating menus-kinds of graphical menus- Selection of windows-Window characteristics-components of windows-window presentation styles-types of windows-window management-organising window functions-window operations-Selection of device based and screen based controls - text and messages – icons and images – Multimedia – colours- uses, problems, choosing colours.

(8L)

Head of Department

Module V

Distributed and Collaborative Interaction: Device consistency-distribution of the user interface-event distribution-graphical package layer-programmable API-Model semantics distribution-data layer distribution-asynchronous collaboration-Software tools-specification methods- interface building tools –evaluation and critiquing tools-Interaction devices keyboard and function keys - pointing devices- speech recognition, digitization and generation – image and video displays – printers.
(9L)

Text books:

Wilbert O. Galitz,"The Essential Guide to User Interface Design", 3rd Edition, Wiley Dreamtech,Delhi, 2007.(T1)

Shneiderman Ben, "Designing the User Interface", 5th Edition, Pearson Education Asia, Delhi, 2014.(T2)

Reference books:

Olsen Dan R., "Human Computer Interaction",Cengage, New Delhi,2009.(R1)

Carroll John M.,"Human Computer Interaction", Pearson Education Asia, Delhi, 2002.(R2)

Cooper Alan, "The Essentials of User Interface Design ", Wiley Dreamtech, Delhi, 2002.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	2	3	1	1	2	1	2	1	2	3	2	3
CO2	2	3	3	3	2	3	2	2	2	3	2	3	3	2	3
CO3	3	3	3	3	3	3	1	2	2	3	2	3	3	3	3
CO4	3	3	3	3	3	1	1	1	2	2	2	3	3	2	3
CO5	3	3	3	2	3	2	2	1	2	2	1	2	3	3	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT321
Course title: **Bio Inspired Computing**
Pre-requisite(s): CS201 Data Structure
Co- requisite(s):
Credits: L: 3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the basic structure of cellular system.
2.	To understand the basic structure of Biological nervous systems.
3.	To know the basic structure of Biological immune system.
4.	To understand the artificial evolution of competing systems.

Course Outcomes
After the completion of this course, students will be able to:

1.	Implement and apply evolutionary algorithms
2.	Explain cellular automata and artificial life
3.	Implement and apply neural systems
4.	Explain developmental and artificial immune systems
5.	Explain behavioral systems

Syllabus
Module I
EVOLUTIONARY AND CELLULAR SYSTEMS
Foundations of evolutionary theory – Genotype – artificial evolution – genetic representations – initial population – fitness functions – selection and reproduction – genetic operators – evolutionary measures – evolutionary algorithms – evolutionary electronics – evolutionary algorithm case study Cellular systems – cellular automata – modeling with cellular systems – other cellular systems – computation with cellular systems – artificial life – analysis and synthesis of cellular systems.

(8L)

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Module II

NEURAL SYSTEMS

Biological nervous systems – artificial neural networks – neuron models – architecture – signal encoding – synaptic plasticity – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – case study. (8L)

Module III

DEVELOPMENTAL AND IMMUNE SYSTEMS

Rewriting systems – synthesis of developmental systems – evolutionary rewriting systems – evolutionary developmental programs Biological immune systems – lessons for artificial immune systems – algorithms and applications – shape space – negative selection algorithm – clonal selection algorithm – examples. (8L)

Module IV

BEHAVIORAL SYSTEMS

Behavior is cognitive science – behavior in AI – behavior based robotics – biological inspiration for robots – robots as biological models – robot learning – evolution of behavioral systems – learning in behavioral systems – co-evolution of body and control – towards self reproduction – simulation and reality. (8L)

Module V

COLLECTIVE SYSTEMS

Biological self-organization – Particle Swarm Optimization (PSO) – ant colony optimization (ACO) – swarm robotics – co-evolutionary dynamics – artificial evolution of competing systems – artificial evolution of cooperation – case study. (8L)

Text Books:

Floreano ,D. and Mattiussi ,C., "Bio-Inspired Artificial Intelligence", MIT Press, 2008.(T1)

Neumann ,F. and Witt ,C., "Bioinspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010.(T2)

Elben, A. E. and Smith ,J. E., "Introduction to Evolutionary Computing", Springer, 2010.(T3)

Goldberg, D. E., "Genetic algorithms in search, optimization, and machine learning", Addison- Wesley, 1989.(T4)

Haykin ,Simon O., "Neural Networks and Learning Machines", Third Edition, Prentice Hall,2008.(T5)

Reference Books

Dorigo ,M. and Stutzle ,T., "Ant Colony Optimization", A Bradford Book, 2004.(R1)

Ebelhart ,R. C. et al., "Swarm Intelligence", Morgan Kaufmann, 2001.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

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Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	3	2	1	1	2	1	2	3	3	2
CO2	3	3	2	3	3	3	2	1	1	1	1	2	3	2	2
CO3	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2
CO4	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3
CO5	3	3	3	3	3	3	3	1	1	2	1	2	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS320
Course title: **Optimization Technique**
Pre-requisite(s)::CS206Design and Analysis of Algorithm
Co- requisite(s):Nil
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the basic idea of Network Optimization Models.
2.	To introduce the basic concept of Dynamic Programming.
3.	To understand the idea of Nonlinear Programming.
4.	To know about the basic concepts of Heuristic Programming.
5.	Provide the students to practice on Linear Programming for Problem solving.

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Course Outcomes

After the completion of this course, students will be able to :

1.	Prepare the operational models for the real-world applications using Linear Programming
2.	Apply the techniques to solve the Network Optimization models
3.	Analyse the computational feasibility of the solutions using the Deterministic and Probabilistic Dynamic Programming
4.	Model problems using Non-Linear Programming and evaluate the suitability of the available techniques for the problem at hand
5	Apply the meta-heuristic algorithms for real world optimization

Syllabus

Module I

Introduction to Linear Programming,Solving Linear Programming Problems –Graphical Method,The Simplex Method,The Revised Simplex Method, Duality Theory , Dual Simplex Method, Sensitivity Analysis.
(8L)

Module II

Integer Programming,Gomory's Cutting Plane Method, The Branch-and-Bound Technique for Binary and Mixed-Integer programming.Network Optimization Models, The Network Simplex Method.
(8L)

Module III

Dynamic Programming: Characteristics of Dynamic Programming Problem,Deterministic Dynamic Programming, Probabilistic Dynamic Programming. (8L)

Module IV

Nonlinear Programming: Graphical Illustration of Nonlinear Programming Problems, Types of Nonlinear Programming Problems, Unconstrained Optimization, The Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization, Quadratic Programming, Separable Programming, Convex Programming.
(8L)

Module V

Queueing Theory : Basic Structure of Queueing Models, Examples of Real Queueing Systems, Role of Exponential Distribution, The Birth-and-Death Process,Different Queuing Models.

Heuristic Programming and Metaheuristics: The Nature of Meta-Heuristics, Search, Simulated Annealing, Genetic Algorithms. (8L)

Text Book:

Hiller ,S. & Lieberman ,G.J.,"Operations Research", 9/e , TMH, New Delhi–2012.(T1)

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Reference Books:

Taha ,H.A.,"Operations Research", 9/e , Pearson Education , New Delhi-2013.(R1)
Pai,P.P.,"Operations Research", 1/e, Oxford University Press 2012.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training

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CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	3	2	1	1	2	2	1	2	3	2	3
CO2	3	3	3	3	3	2	1	1	2	2	1	2	3	3	3
CO3	3	3	2	3	3	3	1	1	2	2	1	2	3	2	3
CO4	3	3	3	3	3	2	1	1	2	2	1	2	3	3	3
CO5	3	3	3	3	3	2	1	1	3	3	1	2	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT321
Course title**: Soft Computing**
Pre-requisite(s): MA205Discrete Mathematics
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

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Course Objectives

This course enables the students:

1.	To understand the concept of fuzzy logic and controllers
2.	To understand the various architectures of ANN and its learning methods
3.	To learn about basic concepts of genetic algorithm and its operators
4.	To understand the Artificial Neural Networks
5.	To understand the Genetic Algorithms

Course Outcomes

After the completion of this course, students will be able to:

1.	Solve numerical on Fuzzy sets and Fuzzy Reasoning.
2.	Develop Fuzzy Inference System (FIS).
3.	Solve problems on Genetic Algorithms
4.	Explain concepts of neural networks
5.	Develop neural networks models for various applications.

Syllabus

Module I

Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, Fuzzy types and levels, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement, Fuzzy Number,Fuzzy measure. (8L)

Module II

Fuzzy Logic: Fuzzy Rules and Fuzzy Reasoning:Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Defuzzification,FuzzyReasoning.Fuzzy Inference System: Introduction, Mamdani Fuzzy Models, Other Variants, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models. (8L)

Module III

Fundamentals of Genetic Algorithms: Basic Concepts, Creation of Offsprings, Encoding, Fitness Functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.
(8L)

Module IV

Introduction to Artificial Neural Networks: What is a Neural Network? Human Brain, Models of Neuron, Neural Network viewed as Directed Graphs, Feedback, Network Architecture, Knowledge Representation, Learning processes:(Error correction, Memory-Based, Hebbian ,Competitive,Boltzman ,Supervised,Unsupervised),Memory,Adaptation. (8L)

Module V

Perceptrons, Adaline, Back Propagation Algorithm, Methods of Speeding, Convolution Networks, Radical Basis Function Networks, Covers Theorem, Interpolation Learning, The Hopfield Network. (8L)

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Text Books:

Jang J.S.R., Sun C.T. and Mizutani E., "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi 2004.(T1)
Rajasekaran S. & Vijayalakshmi G.A. Pai, PHI, New Delhi 2003.(T2)
Ross T. J., "Fuzzy Logic with Engineering Applications." TMH, New York, 1997.(T3)
HaykinsSimon ,"Neural Networks :A Comprehensive Foundation, Pearson Education,2002.(T4)

Reference Books:

Ray K.S. ,"Soft Computing and Its application", Vol 1, Apple Academic Press, 2015. (R1)
Lee K.H. ,"First Course on Fuzzy Theory and App.", Adv in Soft Computing Spinger, 2005.(R2)
Zimmermann H.Z. ,"Fuzzy Set Theory and its App " , 4th Edition, Spinger Science, 2001.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	1	1	2	2	1	2	2	3	2
CO2	3	3	3	3	3	3	3	1	3	3	1	2	3	3	3
CO3	3	3	3	3	2	2	1	1	2	2	1	2	3	3	2
CO4	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2
CO5	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS322
Course title: **Simulation and Modelling**
Pre-requisite(s): CS201 Data Structure
Co- requisite(s):
Credits: L: 3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To Characterise engineering systems in terms of their essential elements, purpose, parameters, constraints, performance requirements, sub-systems, interconnections and environmental context.
2.	To understand Engineering problem modelling and solving through the relationship between theoretical and mathematical
3.	To provide Mathematical modelling real world situations related to engineering systems development.
4.	To able Generate random numbers and random varieties using different techniques.
5.	To provide the knowledge of queuing theory to solve real life problem

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Define basic concepts in modeling and simulation (M&S)
2.	Classify various simulation models and give practical examples for each category
3.	Analyze the behavior of a dynamic system and create an analogous model for a dynamic system.
4.	Analyze and test random number variates and apply them to develop simulation models
5.	Develop a real-life model using queuing system

Syllabus

Module I

The concepts of a system, System Environment, Stochastic Activities, continuous and discrete systems, System Modeling, Types of models.System Studies: Subsystem, A Corporate Model, Environment segment, Production Segment, Management Segment, full Corporate Model, Types of System study, System Analysis, System Design, System Postulation. (7L)

Module II

The technique of simulation, the Monte Carlo method, comparison of simulation and analytical methods, experimental nature of simulation, types of system simulation, numerical computation technique for continuous & discrete models, distributed lag models, cobweb models. Continuous

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system models, differential equations, analog computers & methods, hybrid computers, CSSLs, CSMP-III, Feedback Systems, Simulation of an Autopilot. (8L)

Module III

Exponential Growth & decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamics diagrams, Simple system dynamics diagrams, multi–segment models, representation of time delays. (8L)

Module IV

Evaluation of continuous probability functions, continuous uniformly distributed random numbers, a uniform random number numbers, generating discrete distributions, non-uniform continuously distributed random numbers, the rejection method. Random numbers Generators: Techniques for generating random numbers. Test for random numbers. Random vitiate Generation: Inverse transform technique, exponential distribution, uniform distribution. (8L)

Module V

Queuing disciplines, measures of queues. Discrete events, representation of time, generation of arrival patterns, simulation of a telephone system, delayed calls, Simulation programming tasks, measuring utilization and occupancy. (9L)

Text books:

Gordon Geoffrey, System Simulation, 2nd Edition, Pearson Education, 2007. (T1)
Banks J., Carson J. S. , Nelson B.L., Nicol D.M., Discrete-Event System Simulation, 4thEdn, Pearson Education, 2007. (T2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	2	2	1	1	1	2	1	2	2	2	2
CO2	3	3	3	2	3	2	2	1	1	2	1	2	3	2	2
CO3	3	3	3	3	3	2	2	1	1	2	1	2	3	3	2
CO4	3	3	3	3	3	2	2	1	1	2	1	2	3	3	3
CO5	3	3	3	2	3	2	2	1	1	2	1	2	3	3	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS323
Course title: **Simulation and Modelling Lab**
Pre-requisite(s): CS322 Simulation Modelling
Co- requisite(s):NIL
Credits: L: 0 T:0 P:3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To Characterise engineering systems in terms of their essential elements, purpose, parameters, constraints, performance requirements, sub-systems, interconnections and environmental context.
2.	To understand Engineering problem modelling and solving through the relationship between theoretical and mathematical
3.	To provide Mathematical modelling real world situations related to engineering systems development.
4.	To able Generate random numbers and random varieties using different techniques.
5.	To provide the knowledge of queuing theory to solve real life problem

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Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Define basic concepts in modeling and simulation (M&S)
2.	Classify various simulation models and give practical examples for each category
3.	Analyze the behavior of a dynamic system and create an analogous model for a dynamic system.
4.	Analyze and test random number variates and apply them to develop simulation models
5.	Develop a real life model using queuing system

Syllabus

1. Computer Generation of Random Numbers.
2. Chi-square goodness-of-fit test.
3. One-sample Kolmogorov-Smirnov test
4. Test for Standard Normal Distribution
5. Testing Random Number Generators.
6. Monte-Carlo Simulation.
7. Simulation of Single Server Queuing System.
8. Simulation of Two-Server Queuing System.
9. Simulate and control a conveyor belt system
10. Two-sample Kolmogorov-Smirnov test.

Text books:

Gordon Geoffrey, System Simulation, 2nd Edition, Pearson Education, 2007. (T1)
Banks J., Carson J. S. , Nelson B.L., Nicol D.M., Discrete-Event System Simulation, 4thEdn, Pearson Education, 2007. (T2)

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Head of Department

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Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	2	2	1	1	1	2	1	2	2	2	2
CO2	3	3	3	2	3	2	2	1	1	2	1	2	3	2	2
CO3	3	3	3	3	3	2	2	1	1	2	1	2	3	3	2
CO4	3	3	3	3	3	2	2	1	1	2	1	2	3	3	3
CO5	3	3	3	2	3	2	2	1	1	2	1	2	3	3	3

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COURSE INFORMATION SHEET

Course code:IT322
Course title: **Cloud Computing**
Pre-requisites: IT201 Basics of Intelligent Computing
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Understand the elements of distributed computing and core aspects of cloud Computing.
2.	Understand the concepts and aspects of virtualization and application of virtualization technologies in cloud computing environment
3.	Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS and gain comprehensive knowledge of different types of clouds.
4.	Be familiar with application development and deployment using services of different cloud computing technologies provider: Google app Engine, Amazon Web Services (AWS) and Microsoft Azure.
5.	Understanding the key security, compliance, and confidentiality challenges in cloud computing.

Head of Department

Course Outcomes:

After the completion of this course, students will be able to:

1.	Recall the various aspects of cloud computing and distributed computing
2.	Understand the specifics of virtualization and cloud computing architectures.
3.	Develop and deploy cloud application using services of different cloud computing technologies provider: Google app Engine, Amazon Web Services (AWS) and Microsoft Azure.
4.	Evaluate the security and operational aspects in cloud system design, identify and deploy appropriate design choices when solving real-world cloud computing problems.
5.	Provide recommendations on cloud computing solutions for a Green enterprise.

Syllabus

Module I

Introduction: Essentials, Benefits and need for Cloud Computing - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics Cloud Adoption. (8L)

Module II

Principles of Parallel and Distributed Computing: Eras of computing, Parallel vs. Distributed computing, Elements of parallel computing, Elements of distributed computing, Technologies for distributed computing.

(8L)

Module III

Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples.

Storage virtualization:Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Centre.

(8L)

Module IV

Cloud computing architecture: Introduction, Cloud reference model, Types of clouds, Economics of the cloud, Open challenges.

(8L)

Module V

Cloud platforms in industry and Cloud applications : Amazon web services, Google app engine, Microsoft azure, Observations, Scientific applications, Scientific, Business and Consumer applications.

(8L)

Head of Department

Text Book:

Buyya Raj Kumar, Vecchiola Christian &Thamarai S. Selvi, "Mastering Cloud Computing", McGraw Hill Publication, New Delhi, 2013.(T1)

Reference Books:

Velte T., Velte A. and Elsenpeter R., "Cloud Computing: A Practical Approach", McGraw Hill, India.(R1)

Buyya R., Broberg J., "Cloud Computing: Principles and Paradigms", Wiley.(R2)

Hwang K., Fox G. and Dongarra J., "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann, 2012.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Head of Department

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	3	2	2	1	2	2	2	3	3	3
CO2	3	3	3	3	3	3	2	2	1	2	2	2	3	2	3
CO3	3	3	3	2	3	3	2	2	1	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO5	3	3	3	3	3	3	2	2	2	2	2	2	2	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT323
Course title: **Software Project Management**
Pre-requisite(s): IT305 Software Engineering
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the fundamental principles of Software Project management
2.	Be familiar with the different methods and techniques used for project management.
3.	Have a good knowledge of responsibilities of project manager and how to handle these.
4.	To understand about different techniques for software management.
5.	Work in groups to analyze a project

Head of Department

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Create project plan for software projects effectively.
2.	Implement software project plans and handle real-world project management challenges.
3.	Develop skills for project scheduling, tracking and controlling software project.
4.	Analyze a project and implement a solution
5.	Handle activities necessary to successfully complete and close the software Projects.

Syllabus

Module I

Managing Software Project: Process & Project Management, Project Management and the CMM, Project Management at Infosys, Introduction to CMMI, PCMM.

The Project Planning Infrastructure: The process data base, The process capability Baseline, Process Assets and the Body of Knowledge System.

Process Planning: The Infosys Develelopment Process, Requirement Change Management. (8L)

Module II

Effort Estimation & Scheduling: Estimation and Scheduling Concepts, Effort – Estimation, Scheduling.

Quality Planning: Quality Concepts, Quantitative quality Management Planning, Defect Prevention Planning. (7L

Module III

Risk Management: Concepts of Risks and Risk Management, Risk Assessment, Risk Control, Examples.

Measurement and Tracking Planning: Concepts in measurement, Measurements, Project tracking.

(7L)

Module IV

Project Management Plan: Team Management, Customer Communication and Issue Resolution, Structure of the Project Management Plan.

Configuration Management: Concepts in Configuration Management, Configuration Management Process

Reviews: The Reviews, Review process Data Collection, Monitoring & Control, Introduction of Reviews &the NAH Syndrome.

(7L) **Module II**

Project Monitoring & Control: Project tracing, Milestone Analysis, Activity Level Analysis using SPC, Defect Analysis & Prevention Process Monitoring & audit.

Project Closure: Project closure Analysis.

(7L)

Head of Department

Text book:

Jalote Pankaj," Software Project Management in Practice", Pearson Education, New Delhi, 2002.(T1)

Reference books:

Huges B. And CotterellM.,"Software Project Management", 3rd Edition, Tata Mcgraw Hill, New Delhi, 2004.(R1)

Jalote Pankaj, "CMM in Practice", Pearson Education, New Delhi, 2002.(R2)

Grey W. Humph," Managing the Software Process", Addition – Wesley, 1989.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	3	2	2	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	2	2	3
CO3	2	2	2	2	3	2	2	3	3	3	3	2	2	3	3
CO4	2	3	2	2	3	2	2	3	3	3	3	3	2	2	3
CO5	2	2	3	2	3	2	2	3	3	3	3	3	2	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS324
Course title: **SYSTEM PROGRAMMING**
Pre-requisite(s): Nil
Co- requisite(s):NIL
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Describe the utility of different system programs & system tools.
2.	Familiarize with the tradeoffs between run-time and compile-time processing (Linking & Loading techniques).
3.	To learn the concepts and techniques behind the designing of various system software.
4.	To organize the functionalities & components of system software & tools into different layers for efficient code generation.

Course Outcomes

After the completion of this course, students will be:

1.	Able to understand the evolution of various system software.
2.	Able to understand the various data structures that helps in the proper functioning of the system programs.
3.	Able to understand the basic design of various system software.
4.	Able to understand the designing of text editors, debuggers etc.
5.	Able to design Assemblers

Head of Department

Syllabus

Module I

Introduction: System Software & its Components, Evolution of System Softwares- Operating System, Loaders, Interpreters, Compilers, Linkers, Assemblers.

Assemblers: Elements of Assembly Language Programming, Assembly Process, Single Pass Assembler, Design of a 2-Pass assembler for In 8088. (8L)

Module II

Macros & Macro processors: Macros, Different forms of Macros, Macros using AIF, AGO, REPT. Etc, Design of a Macro Processor, Macro Assembler.
(8L)

Module III

Loaders: Basic Loader Functions, Absolute Loader, Compile & go Loader, Relocating Loader, Direct Linking Loader.
(8L)

Module IV

Linkage Editors: Linking and Relocation, Program Reliability, Linkage Editor and its Application in IBM-PC, Linking for Program Overlays.
(8L)

Module V

Software Tools: Spectrum of Software Tools, Text Editors, Interpreter and Program Generators, Debug Monitors, Programming Environments.
(8L)

Text Book:

Dhamdhere D.M., "System Programming and Operating Systems", 2nd Edition., TMH, New Delhi.(T1)

Reference Book:

Donovon J.J., " System Programming", TMH, New Delhi.(R1)
Beck Leland L., "System Software – An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2000. (R2)
Chattopadhyay Santanu, "System Software", Prentice-Hall India, 2007. (R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	3	3	1	1	2	2	1	3	3	2	1
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	2	3
CO4	3	2	3	2	3	3	1	2	2	3	3	1	3	3	3
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	1	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS325
Course title: **Database Modeling**
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objective
This course enables the students:

1.	Learn and practice data modeling using the entity-relationship and developing database designs.
2.	Understand the use of Structured Query Language (SQL) and learn SQL syntax.
3.	Understanding the basic principles of modeling of database using UML and apply normalization techniques to normalize the database system.

Head of Department

4.	Learn Multidimensional schemas suitable for data warehousing. And learn the Difference between OLTP (Online Transaction Processing) and OLAP (Online Analytical Processing).
5.	To demonstrate the principles behind the logical database design and Data Warehouse Modeling.

Course Outcomes

After the completion of this course, students will be to:

1.	Explain the features of database management systems and Relational database and design the ER-models to represent simple database application scenarios.
2.	ApplytheSQL-the standard language to relational tables, populate relational database and formulate SQL queries on data.
3.	Applying UML, it collects the requirements and prepare their scenarios and design. And understand the functional dependencies and design of the database.
4.	Design a data mart or data warehouse for any organization. And Develop a skill to write queries using DMQL.
5.	Analyze the existing design of a database and data warehouse and apply concepts of normalization to design an optimal database.

Syllabus

Module I

Database Design and Entity- Relational Model

Introduction to Data and Database Management, The Database Life Cycle, Conceptual Data Modeling, Fundamental ER Constructs, Mapping Cardinalities and Constraints, Relational Data model (Relational Algebra, Tuple and Domain Relational Calculus), Network Model, Hierarchical Model, Alternative Conceptual Data Modeling Notations, Advanced ER Construct, Summary.

(8L)

Module II

Requirement Analysis and Conceptual Data Modeling

Introduction, Requirements Analysis, Conceptual Data Modeling, View Integration, Entity Clustering for ER Models, Transforming Rules and SQL Constructs, Transformation Steps, Summary.

(8L)

Module III

The Unified Modeling Language (UML) and Normalization

Class Diagrams, Activity Diagrams, Rules of Thumb for UML Usage, Functional Dependencies, Fundamentals of Normalization, Design of Normalized Tables, Normalization of Candidate Tables Derived from ER Diagrams, 1NF, 2NF, 3NF, BCNF, Fourth and Fifth Normal Forms. Determining the Minimum set of 3NF Tables, Summary.

(8L)

Module IV

Business Intelligence

Overview of Data Warehousing, Logical Design, The Exponential Explosion of views, Decision Support system. Overview of Online Analytical Processing (OLAP), View Size Estimation, Selection of Materialized Views, View Maintenance, Query

Head of Department

Optimization, Forecasting, Overview of Data mining and Text Mining, Summary.
(8L)

Module V

Logical Database Design

Requirements Specification, Logical Design, CASE Tools for Logical Database Design, generating a Database from a Design, Database Support, Collaborative Support, Distributed Development, Application Life Cycle tooling Integration, Design Compliance Checking, Reporting, Modeling a Data Warehouse, Semi-Structured Data, XML, Summary.
(8L)

Textbooks:

Teorey ,T. J., Lightstone,S., and Nadeau ,T.,"Database Modeling and Design: Logical Design", Fourth Edition, Morgan Kaufmann Publishers, 2006.(T1)

Reference books:

Elmasri,R., and Navathe ,S.B.,"Fundamentals of Database Systems,"Sixth Edition,Pearson,2015.(R1)

Silberschatz ,A., Korth ,H. F., and Sudarshan ,S.,"Database System Concepts," Sixth Edition,Mc Graw Hill Education,2010.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	3	3	1	1	2	2	1	3	3	3	3
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	3	3
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	3	3
CO4	3	2	3	2	3	3	1	2	2	3	3	1	3	3	3
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	1	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

Head of Department

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COURSE INFORMATION SHEET

Course code: CS326
Course title: **Database Modeling Lab**
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objective

This course enables the students:

1.	Learn and practice data modeling using the entity-relationship and developing database designs.
2.	Understand the use of Structured Query Language (SQL) and learn SQL syntax.
3.	Understanding the basic principles of modeling of database using UML and apply normalization techniques to normalize the database system.
4.	Learn Multidimensional schemas suitable for data warehousing. And learn the Difference between OLTP (Online Transaction Processing) and OLAP (Online Analytical Processing).
5.	To demonstrate the principles behind the logical database design and Data Warehouse Modeling.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Describe the fundamental elements of relational database management systems.
CO2	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
CO3	Design ER-models to represent simple database application scenarios
CO4	Convert the ER-model to relational tables, populate relational database and formulate SQL.
CO5	Improve the database design by normalization.

Head of Department

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SYLLABUS

List of Programs as Assignments:

Lab Assignment No: 1

Objective: Implementation of DDL commands of SQL with suitable examples

- Create table
- Alter table
- Drop Table

Lab Assignment No: 2

Objective: Implementation of DML commands of SQL with suitable examples

- Insert
- Update
- Delete

Lab Assignment No: 3

Objective: Implementation of different types of function with suitable examples

- Number function
- Aggregate Function
- Character Function
- Conversion Function
- Date Function

Lab Assignment No: 4

Objective: Study & Implementation of PL/SQL.

Lab Assignment No: 5

Objective Implementation of different types of operators in SQL

- Arithmetic Operators
- Logical Operators
- Comparison Operator
- Special Operator
- Set Operation

Lab Assignment No: 6

Objective: Implementation of different types of Joins

- Inner Join
- Outer Join
- Natural Join etc..

Lab Assignment No: 7

Objective: Study & Implementation of SQL Triggers.

Lab Assignment No: 8

Objective:

- Creating Database /Table Space
- Managing Users: Create User, Delete User
- Managing roles:-Grant, Revoke.

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Lab Assignment No: 9

Objective: Study and Implementation of

- Group By & having clause
- Order by clause
- Indexing

Lab Assignment No: 10

Objective: Study & Implementation of

- Sub queries
- Views

Lab Assignment No: 11

Objective: Study & Implementation of different types of constraints.

Books recommended:

TEXT BOOKS

1. A.Silberschatz et.al - Database System Concepts, 5thEdn, Tata Mc-Graw Hill, New Delhi – 2000.

REFERENCE BOOKS

1. Date C.J. - An Introduction to Database System, Pearson Education, New Delhi, 2005.
2. R.Elmasri, Fundamentals of Database Systems, Pearson Education, New Delhi, 2005.

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars

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CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	3	3	1	1	2	2	1	3	3	3	3
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	3	3
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	3	3
CO4	3	2	3	2	3	3	1	2	2	3	3	1	3	3	3
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	1	2

COURSE INFORMATION SHEET

Course code: IT324
Course title: **Software Testing**
Pre-requisite(s): IT305 Software Engineering
Co- requisite(s):
Credits: L: 3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Objectives

1.	To understand the fundamental concepts of software testing
2.	To understand about product risks and risk based testing
3.	To learn the details about test planning, test case writing and defect management
4.	To identify various types of system and testing methodologies
5.	To describe about test metrics, test reports and qualitative and quantitative analysis

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Outcomes

After the completion of this course, students will be able to:

1.	Comprehend the quality concepts that serve as the foundation for software testing
2.	Understand about the various risks related to product
3.	Conduct test planning, test case writing and defect management
4.	Enforce various techniques related to system and testing
5.	Elucidate about test metrics, test reports and qualitative and quantitative analysis

Syllabus

Module I

Introduction to Software Quality - Fundamentals of quality, financial aspect of quality, Total Quality Management, basic premises of quality management, quality approaches, quality and productivity relationship, variation in quality expectations, software quality management, processes related to software quality, quality management system structure.

(8L)

Module II

Fundamentals of Software Testing - Basic concepts of software testing, Comparison between TQM testing and Big Bang approaches, testing methodologies such as Black Box testing, White Box testing and Gray Box testing, test processes including test policy defining process, test strategy and test plan, overview of configuration management, SDLC work products, product risk management, potential risks of replacement of manual operation with automated systems, risk management processes, risk control mechanisms, software verification and validation during SDLC, V-Test model, defect management and life cycle.

(8L)

Module III

Testing Techniques and Tools- Levels of testing during SDLC, integration testing techniques, acceptance test plan and criteria, acceptance test process, acceptance testing methods such as alpha, beta and gamma testing, testing of specialised systems such as UI testing, compatibility testing, internationalisation testing, security testing, performance testing, recovery testing and installation testing, special testing such as OO testing, mobile testing, e-Commerce and e-Business testing, control testing, client testing, client server testing, web application testing and agile testing, testing tools and their procurement, advantages and disadvantages of tool usage in SDLC.

(8L)

Module IV

Testing Process - Test policy, test strategy, test planning, test scenario definition, test case definition, test data definition, test estimation techniques, variation in standards used at organisation level, national level, customer level and international level, roles and responsibilities of test team members, test metrics, test reports, quantitative and qualitative data collection and uses of qualitative and quantitative tools required for data analysis and decision making during and post testing. (8L)

Head of Department

Module V

Test Process Improvement - Introduction to test process improvement,Alteration in perception about testing, issues related to testing process, importance of test process improvement, test process maturity, test process improvement model, stages of test process improvement model, graphical representation of improvements.
(8L)

Text book:

Limaye M. G., "Software Testing: Principles, Techniques and Tools", Tata McGraw-Hill Education Pvt Ltd, 2009.(T1)

Reference books:

Chauhan Naresh, "Software Testing: Principles and Practices", Oxford University Press, 2012.(R1)

Sommerville, "Software Engineering', 8th Edition, Pearson Education Ltd, 2009.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√

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Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	2	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	2	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT325
Course title: **Software Testing Lab**
Pre-requisite(s): IT324 Software Testing
Co- requisite(s):
Credits: L: 0 T:0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Familiarize the students with the fundamental concepts of Software Engineering
2.	Impart state-of-the-art knowledge on SRSand UML
3.	Explore case studies to demonstrate practical applications of different concepts
4.	Provide a platform where they can solve real life problems

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Comprehend the quality concepts that serve as the foundation for software testing
CO2	Understand about the various risks related to product
CO3	Conduct test planning, test case writing and defect management
CO4	Enforce various techniques related to system and testing
CO5	Elucidate about test metrics, test reports and qualitative and quantitative analysis

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To Understand and Implement Identification of Requirements from Problem Statements

Q1. To consider the problem statement for a project to be developed and list out the ambiguities, inconsistencies and incompleteness of the problem statement.

Q2. To identify different functionaries to be obtained from a system and characteristics that a system should have, but not possessed by the system itself

2. **Lab Assignment No: 2**

Objective: To Understand and Implement Estimation ofProject Metrics

Q1. To estimate the minimum size of the team one would require to develop a project through application of intermediate COCOMO.

Q2. To use Halstead's metrics to estimate the effort required to recreate a program in JAVA from C.

3. **Lab Assignment No: 3**

Objective: To Understand and Implement Modeling UML Use Case Diagrams and Capturing Use Case Scenarios

Q1. To draw a use case diagram for the given case study.

Q2. To identify the primary and secondary actors for the system and generalization of use cases and «include» stereotypes to prevent redundancy in the coding phase.

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4. Lab Assignment No: 4

Objective: To Understand and Implement E-R Modeling from the Problem Statements

Q1. To identify the possible entity sets, their attributes, and relationships for the given case study.

Q2. To draw an ER diagram for the given case study.

5. Lab Assignment No: 5

Objective: To Understand and Implement Identification of Domain Classes from the Problem Statements

Q1. To identify potential classes and their attributes for the given case study.

Q2. To utilize expert knowledge on the subject matter to identify other relevant classes.

6. Lab Assignment No: 6

Objective: To Understand and Implement Identification of Components from the Problem Statements

Q1. To identify potential components for the given case study.

Q2. To draw component diagram for the given case study

7. Lab Assignment No: 7

Objective: To Understand and Implement State Chart and Activity Modeling

Q1. To draw a statechart diagram to graphically represent the given case study.

Q2. To draw an activity diagram to graphically represent the workflow of the given case study.

8. Lab Assignment No: 8

Objective: To Understand and Implement Modeling UML Class Diagrams and Sequence diagrams

Q1. To draw class diagram for the given case study.

Q2. To draw sequence diagram for the given case study.

9. Lab Assignment No: 9

Objective: To Understand and Implement Modeling Data Flow Diagrams

Q1. To draw data flow diagram (Level 0, 1 and 2) for the given case study.

10. Lab Assignment No: 10

Objective: To Understand and Implement Estimation of Test Coverage Metrics and Structural Complexity

Q1. To identify the basic blocks for a given program

Q2. To draw a CFG using the basic blocks

Q3. To determine McCabe's complexity from a CFG.

11. Lab Assignment No: 11

Objective: To Understand and Implement Designing Test Suites

Q1. To design a test suite for the given case study.

Q2. To verify implementation of functional requirements by writing test cases.

Q3. To analyze results of testing to ascertain the current state of the project.

Head of Department

12. Lab Assignment No: 12

Objective: To Understand and Implement Forward and Reverse Engineering

Q1. To obtain programs from UML diagrams.

Q2. To obtain UML diagrams from programs.

Books recommended:

TEXT BOOKS

1. Software Engineering, Ian Sommerville, Pearson, 10th Edition, 2016.**(T1)**
2. Software Engineering: A Practioner's Approach, Roger S. Pressman, McGraw Hills, 7th Edition, 2009.**(T2)**

REFERENCE BOOKS

1. Fundamentals of Software Engineering, Rajib Mall, Prentice-Hall of India, 3rd Edition, 2009.**(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO2, 5 & 6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	2	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS270
Course title: **Fundamentals of Computer Science**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Head of Department

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Course Objective

This course enables the students:

1.	Use a variety of hardware and software on campus and do simple file editing.
2.	Discuss computer organization in simple terms, including major future directions.
3.	Describe how a computer actually performs instructions.
4.	Discuss the data organization concepts that apply to physical storage, data structures, files, and databases.
5.	Discuss the features of a programming language and the nature of the language translation process.

Course Outcomes:

After the completion of this course, students will be:

1.	Distinguish between program writing and algorithm development and apply various problem solving techniques.
2.	Describe the functions of an operating system and discuss the problems inherent in providing multiprogramming.
3.	Distinguish between good and bad programming design methods.
4.	Describe data organization concepts.
5.	Discuss methods of measuring algorithm performance and the limits of computability.

Syllabus:

Module I

History of Computing.Computer Generations, Significant Events of recent computing history, Using the terminal, Editing text files, System commands, Using electronic mail Data representation. Binary numbers, Integers - 2's complement, sign-magnitude, Fractions - binary, hexadecimal, Exponents - binary, hexadecimal, excess notation, Characters - ASCII, EBCDIC. (8L)

Module II

Computer Architecture,CPU organization - registers, op codes, execution cycle, Memory organization - addresses, base &bound.Device operations - interrupts, parity, commands, physical actions. Modern architectures - pipelining, vector and array processors,Future architectures - data driven, demand driven and inference machines.
(8L)

Module III

Algorithm Development ,Top-down approach,Common tasks - searching, sorting, merging Techniques - repetition, recursion, divide-and-conquer Programming Languages. Language levels, Data types, Operators, Control statements and conditions, Input and output Specifications, Paradigms - procedural, functional, specification, declaration, object-oriented.
(8L)

Head of Department

Module IV

Software Engineering Modularization Documentation Design methodologies Software life cycle Systems Software (3 hrs)OperatingsystemsCompilers, interpreters and assemblers, Linkers and loaders.
(8L)

Module V

Data Organization,Data Structures: Consecutive storage - arrays, stacks, queues, trees Files - access and organization, Data base approaches - relational, network, distributed. Algorithm Analysis, Measuring time and space, Effects of data structures, Computability.
(8L)

Text Books:

Brookshear, J.G., Computer Science, An Overview, Benjamin/Cummings, 1994. (T1)

Reference Books:

Rajaraman V., Computer Fundamentals, 6th edition, Adabala N, PHI.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	1	1	1	1	1	1	1	1	2	3	1	1
CO2	2	2	2	1	2	1	1	1	2	2	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO4	2	3	3	2	2	1	1	1	2	2	2	2	2	2	1
CO5	3	3	3	3	2	1	1	2	2	2	3	3	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS271
Course title: **Fundamentals of Computer Science Lab**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L:0 T:0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objective
This course enables the students:

1.	Use a variety of hardware and software on campus and do simple file editing.
2.	Discuss computer organization in simple terms, including major future directions.
3.	Describe how a computer actually performs instructions.
4.	Discuss the data organization concepts that apply to physical storage, data structures, files, and databases.
5.	Discuss the features of a programming language and the nature of the language translation process.

Course Outcomes:
After the completion of this course, students will be:

	Distinguish between program writing and algorithm development and apply various problem solving techniques.
2.	Analyze and discuss the problems and their solutions through programming
3.	Distinguish between good and bad programming design methods.
4.	Write algorithms to solve problems.
5.	Discuss methods of measuring algorithm performance and the limits of computability.

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Syllabus

1. To find the sum of individual digits of a given number

2. To print the Fibonacci series for 1 to n value

3. To print a prime numbers up to 1 to n

4. To calculate the sum. Sum=1-x2/2!+ x4/4!- x6/6!+ x8/8!- x10/10!

5. Programs that use recursive function to find the factorial of a given integer.

6. Program that use non recursive function to find the factorial of a given integer.

7. To find the GCD of two given integers by using the recursive function

8. Two integer operands and one operator form user, performs the operationand then prints the result.(Consider the operators +,-,*, /, % and use Switch Statement)

9. To find both the largest and smallest number in a list of integers.

10. To perform the addition of two matrices

11. Functions to insert a sub string into given main string from a given position.

12. To generate Pascal‘s triangle

13. To convert the given binary number to 2‘s complement

14. To read the two complex numbers and perform the addition and multiplicationof these two numbers.

15. Program which copies one file to another

Text Books/ reference Book:

Rajaraman V., Computer Fundamentals, 6th edition, Adabala N, PHI.(R1)

E. Balaguruswamy, Programming in ANSI C, &th Edition, TMH.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Head of Department

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	2	1	1	1	1	2	3	2	2
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CO3	3	3	3	3	3	2	1	1	1	1	2	2	3	3	3
CO4	2	2	2	1	1	1	1	1	1	1	1	2	2	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CA201
Course title: **Object Oriented Programming using Java**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T: 0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: II
Branch: CSE/IT

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Course Objectives

This course enables the students:

A.	Learn about Object oriented programming concepts
B.	Learn how to use the JDK
C.	Improve their programming skills in core Java
D.	Use the Java packages, applets for software development

Course Outcomes

After the completion of this course, students will be able to:

1.	Use the knowledge of object oriented programming through Java
2.	Successfully use the JDK of various versions for programming
3.	Apply the knowledge gained for project work as well as Advanced Java
4.	Apply latest know-how related to the new developments in the field of Java
5.	develop GUI applications.

Syllabus

MODULE I

Procedure-Oriented Programming, Object-Oriented programming, Benefits of OOP, Applications of OOP, Basics, Evolution of Java, Structure of JAVA Program, Simple Java Program, Tokens, Comments, Identifiers, Operators, Literals, Control Structures. Java Environment Setup, Compiling a Java Program, Java Virtual Machine, Philosophy of Java and Benefits. (6L)

MODULE II

Data types and program statements: Primitive and reference data types, variables and constants, enumerated constants, labelled statement, expression and null statements, compound statement, control statement – decision and loops, jump statement, declaration statement, try-throw-catch-finally statement, declaring and creating arrays, accessing array elements, assigning values to array elements, multidimensional arrays. (9L)

MODULE III

Functions, Data Abstraction and classes: Declaration, definition and call, main method arguments, reference variables, method overloading, parameter passing by value for primitive types, object references and arrays, scope of variables, return from methods.

Class and object, class members and initialization, access rights of members – public, private and protected access modifiers, constructor and copy constructor, mutability, finalization, dynamic memory management, garbage collection, this keyword, static members, scope of variables, interface – declaration, implementation and extending, package and package visibility. (9L)

MODULE IV

Inheritance and Collection classes: multi level and single inheritance, multiple inheritance of interfaces, Object class, access rights in subclasses and packages,

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constructor calling sequence, super keyword, dynamic binding of methods, abstract class, overriding, shadowing and hiding, finalize, association, aggregation and composition. String, StringBuffer, Date, Calendar, Math, Object, Class, Exception class.
(8L)

MODULE V

Input/Output and JAVA Applets: Stream clases – InputStream, OutputStream, Buffered Stream, file classes and handling, pushback streams, reader and writer classes, file reader and writer, serialization.Applet code example, HTML tags for applet, applet lifecycle, color, font and basic GUI handling, basic graphics, animation. (8L)

Text books:

E. Balagurusamy - Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi.(T1)

Reference books:

Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.(R1)

Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	3	3	2	2	1	1	1	1	2	3	2	2
CO2	2	2	1	2	2	1	1	1	1	1	1	1	2	2	2
CO3	2	3	2	3	3	1	1	1	1	1	2	2	3	3	3
CO4	3	2	2	1	3	1	1	1	1	1	1	2	2	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CA202
Course title: **Object Oriented Programming using Java Lab**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 0 T: 0 P:3
Class schedule per week: 3
Class: B.Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To write programs using abstract classes.
2.	To write programs for solving real world problems using java collection frame work.
3.	To write multithreaded programs and impart hands on experience with java programming.
4.	To write GUI programs using swing controls in Java.
5.	To introduce java compiler and eclipse platform.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Impart hands on experience with java programming.
CO2	Write programs using abstract classes.
CO3	Write multithreaded programs.
CO4	Write GUI programs using swing controls in Java.
CO5	Simulate basic Engineering problems

Syllabus

1. Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
3.
    a. Develop an applet in Java that displays a simple message.
    b. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named “Compute” is clicked.
4. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

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5. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
6. Write a Java program for the following:

    i. Create a doubly linked list of elements.
    ii. Delete a given element from the above list.
    iii. Display the contents of the list after deletion.

2. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially, there is no message shown.
3. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
4. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.
5. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).
6. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).
7. Write a Java program that correctly implements the producer – consumer problem using the concept of interthread communication.
8. Write a Java program to list all the files in a directory including the files present in all its subdirectories.
9. Write a Java program that implements Quick sort algorithm for sorting a list of names in ascending order
10. Write a Java program that implements Bubble sort algorithm for sorting in descending order and also shows the number of interchanges occurred for the given set of integers.

REFERENCE BOOKS

1. Java for Programmers, P. J. Deitel and H. M. Deitel, 10th Edition Pearson education.
2. Thinking in Java, Bruce Eckel, Pearson Education.
3. Java Programming, D. S. Malik and P. S. Nair, Cengage Learning.
4. Core Java, Volume 1, 9th edition, Cay S. Horstmann and G Cornell, Pearson.

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Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects

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CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	3	3	2	2	1	1	1	1	2	3	2	2
CO2	2	2	1	2	2	1	1	1	1	1	1	1	2	2	2
CO3	2	3	2	3	3	1	1	1	1	1	2	2	3	3	3
CO4	3	2	2	1	3	1	1	1	1	1	1	2	2	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT302
Course title: DCCN Lab
Pre-requisite(s):
Co- requisite(s): None
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B.Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To familiarize the student in introducing and exploring various Network topologies and networking protocols
2.	To understand the use of client/server architecture in application
3.	To enable the student on how to approach for networking problems using networking simulation tools.
4.	To Design reliable servers using both TCP and UDP sockets
5.	Familiarwithnetworktoolsandnetworkprogramming.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Express programming & simulation for networking problems.
CO2	Understand of various aspects of networking devices
CO3	Design and implement simulation of a simple LAN and a WAN that meet a specific set of criteria
CO4	Identify the elements of a communication network
CO5	Simulate various OSI layer protocols using C/C++/ Java

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Syllabus
List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Q1. To familiarize with the Lab Network Topology, Locating different interfaces, routers and switches. Studying different pools of IP addresses.
   Q2. Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.
   Q3. To learn and observe the usage of different networking commands e.g.PING, TRACEROUTE. Learning remote login using telnet session. Measuringtypical average delays between different locations of the network.

2. **Lab Assignment No: 2**

   Q1. What is the IP of the machine you are using? Compare it with the IP of your neighbors.Are the IPs of your neighbors same? Why or Why not?

   Q2. Ping" is a tool used to determine if a server is responding and to estimate the round triptime of a message sent to that server. Use the ping command for the following URLs andrecord the success or failure statistics along with the average round trip time.

   a) google.com
   b) facebook.com
   c) bitmesra.ac.in

   Q3. Trace the route that is taken when you try to access:
   a) google.com
   b) facebook.com
   c) bitmesra.ac.in

   Q4. Network Commands on Linux / Unix

3. **Lab Assignment No: 3**

   Q1. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC 32.

   Q2. Implementation of Sub-netting and Super-netting.

   Q3. To study different types of transmission media, various topologies, and configure modem of computer HUB and Switches.

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4. **Lab Assignment No: 4**

Q1. Write a C/C++ program to determine if the IP address is in Class A, B, C, D, or E.

Q2. Write a C/C++ program to determine if the IP address is in Class A, B, or C.

Q3. Write a C/C++ program to translate dotted decimal IP address into 32 bit address.

Q4. To implement a routing protocol and check its connectivity in a variable length subnet masked network

Q5. Write a C/C++ program to perform bit stuffing and de-stuffing.

5. **Lab Assignment No: 5**

Q1. Implement Dijkstra‘s algorithm to compute the Shortest path through a graph.

Q2. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

Q3. Take an example subnet of hosts. Obtain broadcast tree for it.

6. **Lab Assignment No: 6**

Q1. Build implementations of the Internet protocols
Q2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
Q3. Write a code simulating ARP /RARP protocols.

7. **Lab Assignment No: 7**

Q1. Create a socket for HTTP for web page upload and download
Q2. Write a code simulating PING and TRACEROUTE commands.

8. **Lab Assignment No: 8**

Q1. Study and implement model for Socket Programming and Client – Server model.
Q2. Experiments with NS2(or any other simulator) to study behavior (especially performance of) link layer protocols such as Ethernet and802.11 wireless LAN..

9. **Lab Assignment No: 9**

Q1. Experimental study of applicationprotocolssuch as HTTP, FTP,SMTP, using network packetsniffersandanalyzerssuchas**Wireshark**. Small exercisesinsocketprogramming in C/C++/Java..

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10. Lab Assignment No: 10

Q1. Take a 64 bit playing text and encrypt the same using DES algorithm.

Q2. Write a program to break the above DES coding

Q3. Using RSA algorithm encrypts a text data and Decrypt the samebjective: To Understand and Implement Data Interpolation

11. Lab Assignment No: 11

Q1. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer
Q2.Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
Q3.Echo client and echo server b. Chat c. File Transfer

Books recommended:

Text books

1. William Stallings, Data and Computer Communication, Prentice Hall of India. (T1)
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill. (T2)
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.(T3)

Reference books

1. W. Richard Stevens, TCP/IP Illustrated, Volume 1, Addison-Wesley.(R1)
2. Douglas Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India.(R2)

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

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Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	1			2	2	3	3	3	3
CO2	3	2	2	2	2	1	1		2	2	2	3	3	3	3
CO3	3	3	2	2	2	2	1		2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT220
Course title: **Shell and Kernel Programming**
Pre-requisite(s): Operating System, UNIX Programming
Co- requisite(s): NIL
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

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Course Objectives

This course enables the students:

1.	To understand the basic concepts of UNIX & shell programming.
2.	Understand the basic operations of an operating system.
3.	To explore the function of a kernel.
4.	To understand the basic function of a device driver.
5.	To understand the structure of a file system.

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain the design of Linux kernel components
2.	Experiencing the kernel by passive/active observation
3.	Extend the Linux kernel for understanding, self-satisfaction/falsification.
4.	Identify the current research trends in OS, Linux being the reference OS
5.	Illustrate the design of Linux kernel components

Syllabus

Module I

Introduction to UNIX, file system, system calls, AWK script, Bourne shell programming.
(8L)

Module II

Korn Shell Programming, C Shell Programming, Different tools & Debuggers.
(8L)

Module III

Introduction: OS concepts catch-up, Linux kernel overview, Extending the kernel: building a modified kernel, writing simple kernel modules, User-kernel interfacing: system calls, proc/sys, character devices, device memory maps, Kernel execution contexts: processes, threads, kernel threads, interrupts, bottom halves/soft IRQs.
(8L)

Module IV

Process management: Linux kernel scheduler, context switching, kernel synchronization
Memory management: Virtual memory, page cache, File systems: The VFS layer, Kernel-File system interfacing. (8L)

Module V

Generic block layer: Block I/O interfacing, kernel block I/O scheduler
Device drivers: Device probe and software / hardware configurations, event registration, communication.
(8L)

Head of Department

Text Books:

HARWANI B.M., UNIX and Shell Programming, First Publication,Oxford University Press, 2013. (T1)
Love Robert, Linux Kernel Development, 3rd Edition.(T2)
Corbet Jonathan, Kroah-Hartman Greg, Rubini Alessandro, Linux Device Drivers, 3rd Edition. (T3)
Bovet Daniel P. , CesatiMarco,Understanding the Linux Kernel, Publisher: O'Reilly.(T4)
Nutt Gary, Kernel Projects for Linux, Addison Wesley, ISBN: 0-201-61243-7, July 2000.(T5)

References Books:

Sarwar Syed Mansoor, Koretsky Robert, & Sarwar Syed Aqeel ,Linux: The Textbook Addison Wesley, ISBN: 0-201-72595-9. (R1)
Gagné Marcel, Linux System Administration: A User's Guide, Addison Wesley, ISBN: 0-201-71934-7 Paperback, September 2001. (R2)
Rubini Alessandro & Corbet Jonathan ,Linux Device Drivers, O'Reilly & Associates, ISBN 0-596-00008-1Paperback, June 2001.(R3)
Bar Moshe, Linux File Systems, McGraw-Hill; ISBN: 0-07-212955-7 Paperback.(R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	2	3	3	1	1	1	3	2
2	2	3	1	2	2	2	2	2	2	3	2	1	1	2	1
3	2	3	3	3	3	1	1	1	2	3	1	2	2	3	1
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	1
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	1

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	2	2	3	2	3	1				1		1	3	2	3
CO2	3	2	3	2	3	3	1	3		2	1	1	3	2	3
CO3	2	2	3	2	3	1						1	3	2	3
CO4	3	2	3	2	3	2	1	3		2	1	1	3	2	3
CO5	3	2	3	2	3	3	1	2		2	1	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: IT306
Course title: **Software Engineering Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T:0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Familiarize the students with the fundamental concepts of Software Engineering
2.	Impart state-of-the-art knowledge on SRSand UML
3.	Explore case studies to demonstrate practical applications of different concepts
4.	Provide a platform where they can solve real life problems

Course Outcomes

After the completion of this course, students will be able to:

CO1	Prepare efficient models for development of software for various projects
CO2	Collect the requirements the client wants for the software being produced
CO3	Design the UML diagrams necessary for the software being developed
CO4	Create and specify feasible software designs based on the requirements/specifications
CO5	Assess the extent and costs of a project with the help of several different assessment methods

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SYLLABUS

List of Programs as Assignments:

13. Lab Assignment No: 1

Objective: To Understand and Implement Identification of Requirements from Problem Statements

Q1. To consider the problem statement for a project to be developed and list out the ambiguities, inconsistencies and incompleteness of the problem statement.

Q2. To identify different functionaries to be obtained from a system and characteristics that a system should have, but not possessed by the system itself

14. Lab Assignment No: 2

Objective: To Understand and Implement Estimation ofProject Metrics

Q1. To estimate the minimum size of the team one would require to develop a project through application of intermediate COCOMO.

Q2. To use Halstead's metrics to estimate the effort required to recreate a program in JAVA from C.

15. Lab Assignment No: 3

Objective: To Understand and Implement Modeling UML Use Case Diagrams and Capturing Use Case Scenarios

Q1. To draw a use case diagram for the given case study.

Q2. To identify the primary and secondary actors for the system and generalization of use cases and «include» stereotypes to prevent redundancy in the coding phase.

16. Lab Assignment No: 4

Objective: To Understand and Implement E-R Modeling from the Problem Statements

Q1. To identify the possible entity sets, their attributes, and relationships for the given case study.

Q2. To draw an ER diagram for the given case study.

17. Lab Assignment No: 5

Objective: To Understand and Implement Identification of Domain Classes from the Problem Statements

Q1. To identify potential classes and their attributes for the given case study.

Q2. To utilize expert knowledge on the subject matter to identify other relevant classes.

18. Lab Assignment No: 6

Objective: To Understand and Implement Identification of Components from the Problem Statements

Q1. To identify potential components for the given case study.

Q2. To draw component diagram for the given case study

19. Lab Assignment No: 7

Objective: To Understand and Implement State Chart and Activity Modeling

Q1. To draw a statechart diagram to graphically represent the given case study.

Q2. To draw an activity diagram to graphically represent the workflow of the given case study.

Head of Department

20. Lab Assignment No: 8

Objective: To Understand and Implement Modeling UML Class Diagrams and Sequence diagrams

Q1. To draw class diagram for the given case study.

Q2. To draw sequence diagram for the given case study.

21. Lab Assignment No: 9

Objective: To Understand and Implement Modeling Data Flow Diagrams

Q1. To draw data flow diagram (Level 0, 1 and 2) for the given case study.

22. Lab Assignment No: 10

Objective: To Understand and Implement Estimation of Test Coverage Metrics and Structural Complexity

Q1. To identify the basic blocks for a given program

Q2. To draw a CFG using the basic blocks

Q3. To determine McCabe's complexity from a CFG.

23. Lab Assignment No: 11

Objective: To Understand and Implement Designing Test Suites

Q1. To design a test suite for the given case study.

Q2. To verify implementation of functional requirements by writing test cases.

Q3. To analyze results of testing to ascertain the current state of the project.

24. Lab Assignment No: 12

Objective: To Understand and Implement Forward and Reverse Engineering

Q1. To obtain programs from UML diagrams.

Q2. To obtain UML diagrams from programs.

Books recommended:

TEXT BOOKS

3. Software Engineering, Ian Sommerville, Pearson, 10th Edition, 2016.**(T1)**
4. Software Engineering: A Practioner's Approach, Roger S. Pressman, McGraw Hills, 7th Edition, 2009.**(T2)**

REFERENCE BOOKS

2. Fundamentals of Software Engineering, Rajib Mall, Prentice-Hall of India, 3rd Edition, 2009.**(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

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Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO2, 5 & 6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	2	2	1	1	1	1	3	1	3	3
CO2	3	2	1	1	2	1	1	1	2	1	3	3	3	2	3
CO3	3	3	2	1	3	2	2	1	3	3	1	3	3	3	3
CO4	2	3	2	2	3	3	2	3	3	2	3	3	3	3	2
CO5	3	1	1	3	2	2	3	1	2	1	2	2	1	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3,CD6
CO5	CD1,CD2, CD3, CD6, CD7

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Head of Department

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

COURSE INFORMATION SHEET

Course code: CS305
Course title: **Compiler Design**
Pre-requisite(s): Formal Language and Automata Theory
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Understand the need of compiler in Computer Engineering
2.	Provide a thorough understanding of design, working, and implementation of programming languages
3.	Trace the major concept areas of language translation and compiler design
4.	Create an awareness of the functioning and complexity of modern compilers

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Course Outcomes

After the completion of this course, students will be:

1.	Analyze the need of compiler for interfacing between user and machine
2.	Explain the role of several phases of compilation process
3.	Create an awareness of the function and complexity of modern compilers
4.	Outline the major concept areas of languages translation and Compiler design
5.	Develop a comprehensive Compiler for a given language
6.	Apply knowledge for developing tool for natural language processing

Syllabus

Module I

Introduction to Compilers and its Cousins, Structure of a Compiler, Science of building Compiler and its Application, Lexical Analyzer, Input Buffering, Specification and Recognition of Tokens, Introduction to Lex. (5L)

Module II

Introduction to Syntax Analysis, Elimination of Ambiguity, Left Recursion and Left Factoring, Recursive and Non-Recursive Top-Down Parsers, Bottom-up Parsers: Shift Reduce Parser techniques and conflicts, all variants of LR Parsers, Handling Ambiguous grammar in Bottom-Up Parsing, Error handling while parsing, The Parser generator YAAC.
(15L)

Module III

Syntax-Directed Definition(SDD), Evaluation Order of SDD's and its application, Syntax-Directed Translation Schemes and their Implementation.
(7L)

Module IV

Intermediate code Generation: Variants of Syntax Tree, Three Address Code, Translation of Expressions, Control flow, Back Patching , Run Time Environment: Storage Organization.
(8L)

Module V

Code Generation: Issues in its Design, Target Language, Addresses in Target Code, Basic Blocks and Flow Graphs, Optimization of Basic BlocksMachine Independent Optimization: Sources of Optimization, Data Flow analysis.
(5L)

Text book:

Aho A. V., Lam M. S., Sethi R., Ullman J. D., Compilers, Principles, Techniques, and Tool, 2nd Edition, Pearson Education Asia.(T1)

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Reference books:

Fischer C. N., LeBlanc R. J., Crafting a Compiler with C, Pearson Education Asia. (R1)

Louden K. C., Compiler Construction, Principles and Practice, Thomson, Brooks/Cole. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	3	1	1	2	1	2	3	3	1	1	1	3	1
2	2	3	1	2	2	2	2	2	2	3	2	1	1	2	1
3	2	3	3	3	3	1	1	1	2	3	1	2	2	3	1
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	2
5	2	2	1	2	3	1	3	3	1	3	2	3	1	2	3

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1	1	1	1	1	1	1	1	1	1	
2	3	2	1	1	1	1	1	1	1	1	1	
3	2	2	1	3	1	1	1	1	1	1	1	
4	1	1	1	1	3	3	1	1	1	1	1	
5	1	1	1	3	1	1	1	2	1	1	1	

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS307
Course title: **Graph Theory**
Pre-requisite(s): Discrete Mathematics
Co- requisite(s): None
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Learn and become comfortable with graphs and its terminologies
2.	Understand applications of graph theory to practical problems and other branches of mathematics
3.	Understand various graphs algorithms along with its analysis.
4.	Practice creative problem solving and improve skills in this area

Course Outcomes

After the completion of this course, students will be able to:

1.	Analyze different types of graphs and their applications in real world.
2.	Perceive the role of cut-set, cut-vertex and fundamental circuits in network flows.
3.	Create an awareness of planar and dual graph.
4.	Explain how to represent graphs in a computer system
5.	Apply the concept of graph coloring and partitioning techniques in NP-problems

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Syllabus

Module I

Introduction: Graphs and its applications, Finite and infinite graphs, incidence and degree, isolated Vertex, pendant Vertex, and Null graph, paths and circuits, isomorphism, sub graphs, walks, paths, and circuits, connected graphs, disconnected graphs and components, Connectivity checking algorithm, Euler graphs, Operations on graphs, more on Euler graphs, Hamiltonian paths and circuits, Travelling Salesman problem.
(8L)

Module II

Trees and Fundamental circuits: Trees and its properties, Distance and centres in a tree, Algorithm for checking if a graph is Tree, Partial k-trees, Dynamic Programming in partial k-trees, Spanning trees, Spanning trees in a Weighted graph, Prim's and Kruskal's algorithms
Cut set and cut vertices: Properties of a cut set, Fundamental circuits and cut sets, connectivity and separability, Computing connected components, Menger's theorem, Network flows, 1-Isomorphism, 2-Isomorphism. (8L)

Module III

Planar and Dual Graphs: Planar graph, Kuratowski's Graphs, Representations of a planar graph, Detection of planarity, Planar Separator Theorem, Geometric Dual, Combinatorial, Duel, Thickness and crossings, Algorithms for finding Clique and maximum clique**.** (8L)

Module IV

Matrix Representation of Graphs: Incidence matrix, Adjacency matrix, Adjacency list, Circuits Matrix, Fundamental Circuit Matrix and RankofB, Cut-set Matrix, Relationships among A*f*, B*f* and C*f*, path Matrix**.**
(8L)

Module V

Coloring, Covering and partitioning: Chromatic number, Chromatic partitioning, Chromatics polynomial, Coverings, Four colour problem, Algorithm for graph colouring.
Directed Graphs: Digraphs and its types, Digraphs and binary Relations, Directed paths and connectedness, Euler Digraphs, Trees with Directed Edges, Fundamental Circuitsin Digraphs, Matrices A,B and C of Digraphs, Adjacency Matrix of a Digraph, Paired Comparisons and Tournaments, Acyclic Digraphsand De-cyclization**.** (8L)

Text Books:

Deo Narasingh, Graph Theory with Applications to engineering and Computer Science, Prentice Hall of India, 2001.(T1)
Raman Tulasi and Swamy M.N.S., Graph, Networks and Algorithms, John Wiley, 1981.(T2)

Reference Books:

West Douglas B., Introduction to Graph theory, Pearson Education, 2002.(R1)
Harary F., Graph Theory, Addison Wesley/ Narosa, 1998. (R2)
Reingold E. M., Nievergelt J., Deo N., Combinatorial Algorithms: Theory and Practice, R.(R3)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars

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CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	2	1	1	1	1	1	1	1	1	3	1	1	1
2	3	2	1	1	1	1	1	1	1	1	1	2	1	2	1
3	3	2	2	1	1	1	1	3	3	1	1	2	2	2	2
4	2	3	2	2	1	1	1	1	1	1	1	1	1	2	1
5	2	2	2	3	3	2	1	1	1	1	1	1	1	2	3

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	3	3	2	2	3	3	2	2	2	
2	3	2	2	2	1	3	2	2	1	1	1	
3	3	3	3	1	2	3	1	1	1	1	1	
4	3	3	3	1	1	2	2	1	1	1	1	
5	3	3	3	1	2	2	1	2	2	1	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT326
Course title: **Wireless Sensor Networks**
Pre-requisite(s): IT301 Data Communication and Computer Networks
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Familiarize with the principles of sensor nodes, network deployment and architectures.
2.	Know the data transmission and routing protocols. Know the differences among different networks.
3.	Analyze or compare the performance of different routing and MAC protocol
4.	Evaluate the performance of different MAC protocols and clustering algorithm
5.	Compute the throughput and channel utilization for different network scenarios.

Course Outcomes
After the completion of this course, students will be:

1.	Obtain a broad understanding about the network architecture of wireless sensor network.
2.	Understand all basic characteristics of wireless sensor networks and sensor nodes.
3.	Understand the principles of data transmission, clustering algorithm and routing protocols.
4.	Analyse and evaluate different constraint of wireless sensor network, e.g., coverage, powermanagement, security and data collisions.
5.	Design and development of new sensor network architecture.

Head of Department

Syllabus

Module I

Introduction: Wireless channel and communication fundamentals, Features of Wireless sensor network, Design principles for WSNs, Service interfaces of WSNs and Gateways, Applications, Hardware components, Sensor deployment mechanism.
(6L)

Module II

Network and Component Technologies: Topologies and characteristics, Sensor network characteristics, energy consumption model, Power management, Localization, hierarchical and cluster based topology control.
(10L)

Module III

Data Transmission and Routing: Data processing and aggregation, Data storage, Network clustering protocols, Multi-hop communication protocols, Energy efficient routing, Data aggregation and data centric routing.
(8L)

Module IV

Protocols: MAC Protocols, Framing and error control in WSNs, Medium access control protocols, Congestion control and rate control protocols.
(8L)

Module V

QOS Issues:
Coverage and deployment, Reliable data transport, Single packet and block delivery, Congestion control and rate control, Collisions, Collision avoidance mechanism.
(8L)

Text books:

Karl Holger and Willig Andreas, "Protocols and Architectures for Wireless Sensor Networks".(T1)

Callaway Jr. Edgar H. and Callaway Edgar H., "Wireless Sensor Networks: Architectures and Protocols".(T2)

Reference books:

Zhang Yan, Jejunum, Hu Honglin, "Wireless Mesh Networking, Architecture, Protocols and Standards".(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	3	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	3

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT327
Course title: Wireless Sensor Networks Lab
Pre-requisite(s): IT326 Wireless Sensor Networks
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B.Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2.	Application of established engineering methods to complex engineering problem solving.
3.	Fluent application of engineering techniques, tools and resources
4.	High levels of technical competence in the field
5.	Be able to apply problem solving approaches to work challenges and make decisions using sound engineering methodologies

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply knowledge of wireless sensor networks(WSN) to various application areas.
CO2	Design and implement WSN and IoT.
CO3	Conduct performance analysis of WSN.

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Syllabus
List of Programs as Assignments:

1. Wireless technology for distributed sensor networks in perspective of deployment mechanisms
2. Clustering techniques in WSN; multi-hop to single hop communication analysis
3. Analyzing Routing in WSN: AODV, DSR
4. Industrial WSN protocols: ZigBee, Bluetooth applications
5. WSN network design and implementation; in perspective of gateway-based communications
6. Employing of wireless technologies in IoT.
7. IoT Structure and Framework

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Assessment Components	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation	√	√	√	√	√
End SEM Evaluation	√	√	√	√	√

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	3	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	3

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COURSE INFORMATION SHEET

Course code: IT328
Course title: **Pattern Recognition**
Pre-requisite(s): IT307 Image Processing
Co- requisite(s): NIL
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Be familiar with both the theoretical and practical aspects Pattern Recognition.
2.	Have described the foundation of pattern formation, measurement, and analysis.
3.	Understand the mathematical and computer aspects of while extracting features of an object.
4.	Learn the techniques of clustering and classification for various applications.

Course Outcomes

After the completion of this course, students will be able to:

1.	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
2.	Solve Decision making model using Statistical and Mathematical Decision Theory.
3.	Design clusters for various Pattern using classical and Modern clustering techniques.
4.	Analyzing various Techniques for Pattern Classification and Clustering.
5.	Develop Model for Pattern classification through Probabilistic or fuzzy.

Syllabus

Module I
Introduction: Feature Vectors, Classifiers, Supervised, Unsupervised, MATLAB Tools. Classifiers Based on Bayesian Theory, Linear Classifiers, Nonlinear Classifiers. (10L)

Module II
Feature Selection, Feature Generation I: Data Transformation and Dimensionality Reduction, Feature Generation II.
(10L)

Module III
Template Matching, Context Dependent Classification, Supervised Learning.
(10L)

Module IV
Clustering: Basic Concepts, sequential Algorithms.
(5L)

Module V
Hierarchical algorithms, Fuzzy clustering, probabilistic clustering, Hard Clustering, Optimization.
(5L)

Head of Department

Text Books:

Theodoridis S., Koutroumbas K., Elsevier, "Pattern Recognition", 5th Edition 2015.(T1)

Murty N. Narshima "Pattern Recognition", Springer, University Press2nd edition,2015.(T2)

Reference Book:

DudaR.O.,Hart E. Peter,Stork G. David," Pattern Classification" 2nd Edition, John Wiley, New York, 2002.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	3	2	1	1	2	1	2	2	3	2	3
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	2	2	3	2	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT329
Course title: **Pattern Recognition Lab**
Pre-requisite(s): IT328 Pattern Recognition
Co- requisite(s): NIL
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
2.	Solve Decision making model using Statistical and Mathematical Decision Theory.
3.	Design clusters for various Pattern using classical and Modern clustering techniques.
4.	Analyzing various Techniques for Pattern Classification and Clustering.
5.	Develop Model for Pattern classification through Probabilistic or fuzzy.

Course Outcomes

After the completion of this course, students will be able to:

1.	formulate and describe various applications in pattern recognition
2.	understand the Bayesian approach to pattern recognition
3.	Be able to mathematically derive, construct, and utilize various classifiers both theoretically and practically.
4.	be able to identify the strengths and weaknesses of different types of classifiers
5.	validate and assess different clustering techniques

Syllabus

41. Implement a function for extracting the colour histogram of an image.
42. Read all the images from the training set. For each image compute the colour histogram with general bin size *m* and save it as a row in the feature matrix ***X***. Save the corresponding class label in the label vector ***y*.**
43. Implement the k-NN classifier for an unknown image and for a general *K* value.
44. Evaluate the classifier on the test set by calculating the confusion matrix and the overall accuracy.
45. Try out different values for the number of bins for the histogram and the parameter *K* to see which feature attains the best performance.
46. Convert the input image into Luv or HSV colour-space before histogram calculation.

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Text books:

4. Pattern Recognition and Machine Learning, Christopher Bishop, Springer 2006.

Reference books:

5. Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2013.
6. Pattern Classification, 2nd Ed., Richard Duda, Peter Hart, David Stork, John Wiley & Sons, 2001.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	3	1	3	2	2	2	1	2	3	3	2
CO2	3	2	3	1	2	1	2	3	2	1	1	2	2	3	2
CO3	3	3	3	1	2	1	2	3	1	2	1	2	3	2	2
CO4	3	3	3	1	2	2	2	2	1	2	3	2	3	1	2
CO5	3	2	3	1	2	2	1	3	2	2	3	2	3	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: CS327
Course title: **Computer Graphics**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To understand different hardware used for graphical requirement
2.	To perform visual computations for geometrical drawings.
3.	To display 3D objects in a 2D display devices using projection techniques
4.	To model 3D
5.	To create realistic images using color and shading techniques

Course Outcomes
After the completion of this course, students will be:

1.	Able to understand different hardware used for graphical requirement.
2.	Able to perform visual computations for geometrical drawings.
3.	Able to display 3D objects in a 2D display devices using projection techniques
4.	Able to model 3D objects
5.	Able to create realistic images using color and shading techniques

Syllabus
Module I
Introduction and Overview of Graphics Systems
Use of Computer graphics, Video Display Devices, Raster and Random Scan Displays, Colour CRT Monitors, Flat Panel Displays, Three-Dimensional Viewing Devices, Stereoscopic & Virtual Reality, Graphics system architecture, Input Devices, Graphics Software.

Output Primitives
Points and Lines, Line Drawing Algorithms (DDA &Bresenham's), Circle and Ellipse Generating Algorithms, Conic Sections.Filling Polygons, Pattern Filling, Thick Primitives, Line Style and PenStyle, Generating Characters, Aliasing and Antialiasing.
(7L)

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Module II

Geometric Transformations

Two dimensional transformations and their matrix representations, Translation, Rotation, Scaling, Reflection, Shears, Homogeneous Coordinates, Composite Transformations, transformations between Coordinate Systems, Affine transformations, 2-Dimensional viewing pipeline, Window-to-Viewport Coordinate transformation, Clipping-Point, Line clipping-Cohen Sutherland, Liang Bursky, Polygon clipping – Sutherland Hodgeman, weilerArtherton, Curve and Text Clipping, Three Dimensional Transformations, Translation, Rotation, Scaling, Reflection, Shears. (8L)

Module III

Three Dimensional Concepts and Object Representation

Three Dimensional Display Methods, Polygon Surfaces, Curved Lines & Surfaces, Quadric Surfaces, Spline Representations, Cubic Spline interpolation methods, Hermite Interpolation, Bezier Curves and Surfaces, Properties of B-splines, Fractal.

Three Dimensional Transformations and Viewing

Three dimensional viewing pipe line, Projections- Parallel and Perspective, Projection Transformations, Clipping. (7L)

Module IV

Color Model and Color application

Properties of light, Standard primaries and chromaticity diagram, XYZ Color model, RGB color model. YIQ color model, HSV color model, HLS color model

Illumination Model and Surface Rendering

Light sources, Basic Illumination Models, Ambient light, Defuse and specular reflection. Shadows, Transparency, Assigning intensity levels, Polygon Rendering Methods, Constant intensity shading, Gourad shading, Phong shading, Detail. (7L)

Module V

Visible Surface Detection Methods

Classification of Visible Surface Detection Algorithms, Back Face Detection, Depth Buffer Method, A-Buffer Method, Scan-Line Method, Depth Sorting Method, BSP-Tree Method & Area Subdivision Method. Octrees, Ray castiny method.

Graphical User Interfaces and Interactive Input Methods

The User Dialogues, Input of graphical data.

Computer Animation

Design of animation sequences, General computer animation functions, Raster animation, Computer animation languages, Key frame systems. (7L)

Text books:

Hearn D. & Baker M.P. , Computer Graphics, 2/e , Pearson Education, New Delhi, 2005.(T1)

Reference books:

Foley J.D. et. Al, A Fundamental of Computer Graphics, Addition Wesley, London, 1993.(R1)

Krishnamurthy N, Introduction to Computer Graphics, 1st Edn., TMH, 2002.(R2)

Rogers B., Mathematical elements of Computer Graphics, McGraw Hill, 1989.(R3)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	2	2	2	3	2	1	1	2	1	1	2	3	2	2
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	2	2	3	2	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS328
Course title: **Computer graphics lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

A.	Able to understand different hardware used for graphical requirement.
B.	Able to perform visual computations for geometrical drawings.
C.	Able to display 3D objects in a 2D display devices using projection techniques
D.	Able to create realistic images using color and shading techniques
E.	Able to model 3D objects

Course Outcomes

After the completion of this course, students will be able to:

1.	To list the basic concept used in Computer Graphics
2.	To describe the importance of viewing and projections.
3.	To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
4.	To design an application with the principles of Computer Graphics
5.	To define the fundamentals of animation, virtual reality and its related technologies.

Syllabus

47. Study of basic graphics functions defined in “graphics.h”.
48. Write a program to draw a line using Bresenham’s Algorithm
49. Write a program to draw a line using DDA Algorithm.
50. Write a program to draw a line using Mid-Point Algorithm.
51. Write a program to draw a Circle using Mid-Point Algorithm.
52. Write a program to draw a Ellipse using Mid-Point Algorithm.
53. Programs using 2-D transformations in C.
54. Implement Polygon filling algorithms [Flood-Fill Algorithm] in C.
55. Program for Cohen Sutherland Line clipping algorithm in C.
56. Write a program to implement reflection of a point, Line.

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57. Write a program to rotate a circle around any arbitrary point or around the boundary of another circle.
58. Write a program to implement polygon filling.
59. Programs to study 3-D transformations in C.

Text books:

5. D. Hearn & M.P. Baker - Computer Graphics, 2/e , Pearson Education, New Delhi, 2005.

6. Prabat K Andleigh and KiranThakrar, "Multimedia Systems and Design", PHI, 2005.

Reference books:

7. W.M. Newman. et. al.- Principle of Interactive Computer Graphics, McGraw Hill Publication, New Delhi, 1995.
8. S. Harrington -Computer Graphics- A Programming Approach, McGraw Hill Publication, New Delhi, 1994.
9. J.D. Foley et. al- A Fundamental of Computer Graphics Addition Wesley, London, 1993.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5

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Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	3	2	1	2	1	2	2	1	2	3	3	2
CO2	3	3	3	2	2	1	2	1	1	1	2	2	2	3	3
CO3	3	2	2	2	3	2	2	2	2	2	3	2	3	3	3
CO4	3	3	3	2	3	2	2	1	2	1	1	1	2	2	1
CO5	2	3	3	2	3	3	3	3	3	2	3	3	3	3	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT330
Course title: **Cryptography and Network Security**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

1.	To Learn Basic Concepts of Cryptography and Network Security and Apply them in various Real life Application.
2.	To understand the basic concepts of Network Security
3.	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
4.	To understand how to deploy encryption techniques to secure data in transit across data networks
5.	To design security applications in the field of Information technology

Course Outcomes

After the completion of this course, students will be:

1.	Understand the basic concept of Cryptography and Network Security and their mathematical models, and to be familiar with different types of threats
2.	Learning and applying various Ciphering Techniques.
3.	Apply Symmetric and Asymmetric Cryptographic Algorithms and Standards in Networks.
4.	Examine the issues and structure of Authentication Service and Electronic Mail Security
5.	To explain and classify different malicious programs, worms and viruses, and to learn the working and design principles of Firewalls

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Syllabus

Module I

Introduction to Cryptography: ComputerSecurity concepts, The OSI Security Architecture, Security Attacks, Security Services, A model for Network Security, Classical Encryption Techniques.

(8L)

Module II

Mathematical Foundations of Cryptography: Modular Arithmetic, Euclidean Algorithm, Groups, Rings, Fields, Finite Fields of the Form GF(p), Polynomial Arithmetic, Finite Fields of the Form GF(2^n), Prime Numbers, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Quadratic Congruence, Discrete Logarithms.

(8L)

Module III

Symmetric and Asymmetric Cryptography: Difference Between Symmetric and Asymmetric Cryptography, DES, Triple DES, AES, RSA Cryptosystem, Symmetric and Asymmetric Key Cryptography Together, Elgamal Cryptosystem, Elliptic Curve Cryptosystems, , Diffie-Hellman Key Exchange , Cryptographic Hash Functions, Message Authentication Codes, Digital Signature.

(8L)

Module IV

Internet Security Protocols : Basic Concepts, Security Socket Layer (SSL), Secure Hyper Text Transfer Protocol (SHTTP), Time stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol(WAP) Security, Security in GSM.

(8L)

Module V

Network Security: Users, Trusts and Trusted Systems, Buffer Overflow and Malicious Software, Malicious Programs, Worms, Viruses, Intrusion Detection Systems (IDS), Firewalls: Definitions, Constructions and Working Principles.

(8L)

Text Book:

Forouzan B. A., Mukhopadhyay D., "Cryptography and Network Security", 3rd Edition, Mcgraw Higher Education, 2016. (T1)

Reference Books:

Stallings W., "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson, 2017.(R1)
Kahate A., "Crptography and Network Security", 3rd Edition, McGraw Hill Education, New Delhi, 2013.(R2)
Schneier B., "Applied Cryptogaphy: Protocols, Algorithms And Source Code In C", 2nd Edition, Wiley, 2007. (R3)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects

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CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	3	3	2	2	1	2	2	2	3	1
CO2	3	3	3	3	3	3	3	2	2	2	1	2	1	2	3
CO3	3	2	3	3	3	2	2	2	2	2	2	2	2	3	3
CO4	3	2	3	3	2	2	1	2	2	2	2	2	1	2	3
CO5	3	2	3	3	1	2	2	2	2	1	1	2	2	1	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS391
Course title: **Introduction to Distributed System**
Pre-requisite(s): NIL
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Identifying trends in distributed systems
2.	Introducing peer to peer services and distributed file systems
3.	Understanding the issues in process and resource management
4.	Understanding the requirements for designing and supporting distributed systems

Course Outcomes
After the completion of this course, students will be able to:

1.	Define distributed systems and their architecture.
2.	outline peer to peer services and distributed file systems
3.	Elaborate on concepts of process and resource management
4.	Analyze the requirements for designing and supporting distributed systems
5.	Discuss and design the working of distributed systems

Syllabus
Module I
Introduction: Introduction to "Large-Scale"distributed systems, Consequences of "large-scale" Some large-scale distributed systems, Architectures of large scale distributed systems.
(8L)

Module II
Design principles of Distributed system: Introduction to peer-to-peer systems, The peer-to-peer paradigms, Services on structured overlays, Building trust in P2P systems.
(8L)

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Module III

Communication in Distributed system: System Model – Inter Process Communication – the API for internet protocols – External data representation and Multicast communication.

Peer to Peer Services: Peer-to-peer Systems - Introduction - Napster and its legacy - Peer-to-peer - Middleware - Routing overlays.

File System: Features-File model -File accessing models- File sharing semantics

Naming: Identifiers, Addresses, Name Resolution - Name Space Implementation - Name Caches - LDAP.

(8L)

Module IV

Remote Method Invocation and Objects: Remote Invocation - Introduction - Request-reply protocols - Remote procedure call - Remote method invocation.

Case study: Java RMI – Group communication - Publish-subscribe systems - Message queues - Shared memory approaches -Distributed objects - Case study: Enterprise Java Beans -from objects to components.

(8L)

Module V

Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation.

Resource Management: Introduction- Features of Scheduling Algorithms -Task Assignment Approach - Load Balancing Approach - Load Sharing Approach.

(8L)

Text Books:

Coulouris G., Dollimore J., and Kindberg T., "Distributed Systems Concepts and Design", 5th Edition, Pearson Education, 2012.(T1)

Distributed Systems: Design and Algorithms, Editors(s):SergeHaddadFabriceKordonLaurentPautetLaure Petrucci, Wiley online Library.(T2)

Reference Books:

A. S. Tanenbaum, M. Van Steen, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.(R1)

P. K. Sinha, "Distributed Systems: Concepts and Design", Prentice Hall, 2007.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	2	1	1	2	1	3	3	2	2
CO2	3	2	2	2	2	1	2	1	2	2	1	3	3	2	2
CO3	3	2	3	3	2	2	2	2	2	2	3	3	3	3	3
CO4	3	2	3	2	3	2	2	2	2	3	2	3	3	2	3
CO5	3	2	3	3	3	1	2	2	2	3	3	3	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS275
Course title: **Bio Informatics**
Pre-requisite(s): Programming for Problem Solving
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: II
Branch: CSE/IT

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Course Objective

This course enables the students to:

1.	To enable the students to understand the tools used in Bioinformatics & how to use them.
2.	Understand the basic features of databases.
3.	Analyze the importance of sequence similarity.
4.	Understand the basic features of Phylogenetic Analysis.

Course Outcomes

After the completion of this course, students will be:

1.	Identify the scope of Bioinformatics.
2.	Utilize the biological databases to retrieve various biological information
3.	Apply the tools to do biological analysis.
4.	Identify and solving various biological challenges.
5.	Analyze Phylogenetic tree to find a relation in between proteins.

Syllabus

Module I

Introduction to Bioinformatics- Historical overview, Bioinformatics Applications, Molecular Biology and Bioinformatics, Central Dogma of Molecular Biology.

Biological Databases and Information Retrieval- Major Databases in Bioinformatics, Tools for Web Search, Data Retrieval Tools, Data Mining in Bioinformatics.

(8L)

Module II

Genome Analysis and Gene Mapping- Introduction, The Sequence Assembly Problem, Physical Maps, Cloning, Genome Sequencing, Application of Genetic Maps, Sequence Assembly Tool, The Human Genome Project.

(8L)

Module III

Alignment of Pair of Sequences- Motivation, Methods of Sequence Alignment, Measuring Sequence Detection Efficiency

Alignment of Multiple Sequences- Methods of Multiple Sequence Alignment, Evaluating Multiple Alignments, Applications.

(8L)

Head of Department

Module IV

Phylogenetic Analysis- Introduction, Terminologies, Tree Topologies, Gene Trees, Methods of Phylogenetic Analysis, Tree Evaluation, Problems in Phylogenetic Analysis, Tools. (8L)

Module V

Tools for Similarity Search and Sequence Alignment- FASTA, BLAST, Comparison, Other Programs

Gene Identification and Prediction- Introduction, Basis of Gene Prediction, Pattern Recognition, Gene Prediction Methods, Other Gene Prediction Tools. (8L)

Text Books:

Rastogi S. C., Namita Mendiratta, Parag Rastogi, "Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery", Fourth Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.(T1)

An Introduction to Bioinformatics algorithms: Neil C Jones, Pavel A Pevzner, MIT Press, 2004.(T2)

Reference Books:

Bryan Bergeron, "Bioinformatics Computing", PHI Learning, New Delhi, 2010.(R1)

Arthur M. Lesk, "Introduction to Bioinformatics", Third Edition, OxfordUniversity Press, Chennai, 2010.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	1
CO2	3	3	3	1	3	1	1	1				2	2	2	1
CO3	3	3	3	3	3	1	1	1		1	1	2	3	2	1
CO4	3	3	3	1	3		1	1		1	1	2	3	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1	2	3	2	1

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code:IT270
Course title**: Introduction to R**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To develop problem solving skills
2.	To learn programming and to solve problems using computers
3.	To learn Data Manipulation, Analysis and Visualization using Computers
4.	To introduce students to the key concepts and ideas of a statistical computing environment
	To introduce students to fundamental concepts in (scientific) programming in general.

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Course Outcomes

After the completion of this course, students will be to do the following:

1.	Design programs with Interactive Input and Output, utilizing arithmetic expression, repetitions and decision making
2.	Design programs using the fundamental data structures in R
3.	Develop programs in R interfacing files and URLs
4.	Solve Mathematical problems using R
5.	Design graphs and simulations in R

Syllabus

Module I

Introduction- R reserved words, Variables and Constants, Operators, Operator Precedence

Getting Data In and Out of R –Accessing the Keyboard and Monitor, Reading in Larger Datasets.

(6L)

Module II

Control Statements- if ..else, for loop, while loop, repeat loop, break and next

Data Structures- Vectors, Arrays, Matrices, Lists, Data Frames, Factors, Operations on Dates and Times.

(7L)

Module III

Strings: Overview of String Manipulation Functions

Functions: Function Syntax, Environment and Scope, Recursive Function

Interfaces to the Outside World: File Connections, Reading Lines of a Text File Reading From a URL Connection.

(7L)

Head of Department

Module IV

Maths in R- Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations, Set Operations.

Simulation -Generating Random Numbers, Simulating a Linear Model, Random Sampling. (8L)

Module V

Graphics-Creating Graphs, Customising Graphs

Introduction to Object Oriented Features- Concept of Class and Object, S3 Classes, S4 Classes.

(7L)

Text books:

Peng Roger D., R Programming for Data Science.(T1)

Matloff Norman, The Art of R Programming – A Tour of Statistical Software Design. (T2)

Reference books:

Grolemund Garret, Hands-On Programming with R. (R1)

Gardener Mark, Beginning R: The Statistical Programming Language.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				1	3	2	1
CO2	3	3	3	2	3	1	1	1				1	3	2	1
CO3	3	3	3	2	3	1	1	1		1	1	1	3	2	1
CO4	3	3	3	2	3		1	1		1	1	1	3	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1		3	2	1

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT271
Course title: **Introduction to Python**
Pre-requisite(s):
Co- requisite(s):NIL
Credits: L: 3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To facilitate skills required to Install and run the Python interpreter
2.	To facilitate skills required to Create and execute Python programs
3.	To introduce the Understanding the concepts of file I/O
4.	To provide skills to read data from a text file using Python
5.	To discover the interesting patterns using appropriate Python visualization libraries

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Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Show how to convert the problems into algorithms
2.	Analyze and develop the algorithms to Python programs.
3.	Design programs with Interactive Input and Output, utilizing arithmetic expression repetitions, decision making, arrays.
4.	Develop modular Python programs using functions.
5.	Design programs using file Input and Output.

Syllabus

Module I **[6 L]**

Problem Analysis-Formal Definition of a Problem, Algorithms, Flowcharts, Examples for Algorithms and Flowcharts

Introduction to Python- Variables, Operators, Expressions, Evaluation of Expressions, String Operations, Input and Output functions

Module II **[7 L]**

Control Statements- Decision making statements, Iterative Statements, Loop Control Statements

Strings and Lists- String Operations, Tuples and Dictionaries-Operations and Examples

Module III **[7 L]**

Functions- Function Definition and Call, Mathematical functions, User defined Functions, Parameters and Arguments, Type Conversion and Coercion

Module IV **[8 L]**

Files – Different File Operations, File Object Attributes, Directories

Exceptions- Except clause, Exception with arguments, Raising an Exception, User Defined Exceptions

Module V **[7 L]**

Introduction to Classes and Objects- Object Oriented Features, Attributes, Instances, Garbage Collection

Text book:

1. Downey A., How to think like a computer scientist: Learning with Python.

Reference books:

1. Jose Jeeva, Taming Python by Programming, Khanna Publishing House.
2. Jose J. Introduction to Computing and Problem Solving with Python, (ISBN: 978-93-82609-810).

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
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CD5	Industrial visits/in-plant training
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Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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CO1	3	3	3	1	3	1	1	1				1	2	2	1
CO2	3	3	3	1	3	1	1	1				1	2	2	1
CO3	3	3	3	1	3	1	1	1		1	1	1	2	2	1
CO4	3	3	3	1	3		1	1		1	1	1	2	2	1
CO5	3	3	3	1	3	1	1	1	1	1	1		2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS271
Course title: **Cyber Law and Security**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the necessity of cyber laws.
2.	To explore the Constitutional & Human Rights Issues in Cyberspace
3.	To understand the criteria for Cyber Stalking/Harassment
4.	To understand the different aspects of cyber crimes

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

1.	Construct a strategy to Safeguard the society from cybercrime.
2.	Organize the evidence in terms of court terminology.
3.	Define the legal issues and its applications.
4.	Apply Computer forensics and digital detective and various processes, policies and procedures.
5.	Compose the techniques to produce data from computer and hand held devices.

Syllabus

Module I

Introduction

Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level.

Cyber Law - International Perspectives

UN & International Telecommunication Union (ITU) Initiatives, Council of Europe - Budapest Convention on Cybercrime, Asia-Pacific Economic Cooperation (APEC), Organization for Economic Co-operation and Development (OECD), World Bank, Commonwealth of Nations, Indian Context of Jurisdiction and IT Act, 2000, International Law and Jurisdictional Issues in Cyberspace.

(8L)

Module II

Constitutional & Human Rights Issues in Cyberspace

Freedom of Speech and Expression in Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection

Cyber Crimes & Legal Framework

Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under Indian IT Act, 2000.

(8L)

Module III

Cyber Torts

Cyber Defamation, Different Types of Civil Wrongs under the IT Act, 2000

Intellectual Property Issues in Cyber Space

Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

(8L)

Module IV

Introduction to Cybercrime, Classifications of Cyber Crimes, Local and Global perspectives on Cybercrime, Cyber offences, Cyberstalking, Cybercrime and cloud computing, cybercrimes through hand held devices., Tools and Methods used in Cybercrime, phishing, steganography, attacks on wireless network.

(8L)

Head of Department

Module V

Understanding Digital forensic, Forensics science, computer forensics, and digital forensics. Criminalistics, Analysis of cyber-criminalistics area, Holistic approach to cyber-forensics, Computer forensic tools, Forensics of Hand held devices, tools for hand held device forensics., intellectual property in the cyberspace, The ethical dimension of Cybercrimes. (8L)

Text Books:

1. Reed Chris & Angel John, *Computer Law*, OUP, New York, 2007. (T1)
2. Singh Justice Yatindra, *Cyber Laws*, Universal Law Publishing Co, New Delhi, 2012. (T2)
3. Verma S, K, Mittal Raman, *Legal Dimensions of Cyber Space*, Indian Law Institute, New Delhi, 2004. (T3)
4. JonthanRosenoer, *Cyber Law*, Springer, New York, 1997. (T4)
5. Naib Sudhir, The Information Technology Act, 2005: A Handbook, OUP, New York, 2011.(T5)
6. Godbole Nina, BelapureSunit, Cyber Security, Wiley Indian Print, 2014.(T6)
7. Sammons John, The Basics of Digital Forensics, Elsevier.(T7)
8. Hyaes D.R., A Practical Guide to Computer Forensics Investigations , Person IT education 2014.(T8)

Reference Books:

1. Bhansali S. R., *Information Technology Act, 2000*, University Book House Pvt. Ltd.,Jaipur, 2003. (R1)
2. Deva Vasu, *Cyber Crimes and Law Enforcement*, Commonwealth Publishers, New Delhi, 2003. (R2)
3. Nelson Bil, Philips A, Stuarts Christopher, Guide to Computer Forensics and Investigations: Processing Digital evidence , Cengage Learning, 5th Edition 2015.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	2	2	2				2	2	2	1
CO2	3	3	3	3	2	2	2	2				2	2	2	1
CO3	3	3	3	3	2	1	2	2		1	1	2	2	2	1
CO4	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO5	3	3	3	3	3	1	2	2	1	1	1	2	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: MT123
Course title: **Business Communications**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: I
Branch: CSE/IT

Head of Department

Course Objectives

This course enables the students:

A.	To analyze and demonstrate writing and speaking processes through invention, organization, drafting, revision, editing, and presentation.
B.	To understand the importance of specifying audience and purpose and to select appropriate communication choices.
C.	To interpret and appropriately apply modes of expression, i.e., descriptive, expositive, Narrative, scientific, and self-expressive, in written, visual, and oral communication
D.	To participate effectively in groups with emphasis on listening, critical and reflective thinking, and responding.
.E	To develop the ability to research and write a documented paper and/or to give an oral presentation.

Course Outcomes

After the completion of this course, students will be able to:

1.	Apply business communication strategies and principles to prepare effective communication for domestic and international business situations.
2.	Utilize analytical and problem-solving skills appropriate to business communication.
3.	Participate in team activities that lead to the development of collaborative work skills.
4.	Select appropriate organizational formats and channels used in developing and presenting business messages
5.	Communicate via electronic mail, Internet, and other technologies and deliver an effective oral business presentation.

Syllabus

MT123: Business Communication

<u>Module I</u>(4 lectures)

Introduction to Business Communication:
Importance and Objectives of Business communication, Process of communication, Barriers to effective communication, Techniques of effective communication. Forms of communication (Written, Oral, audio-visual communication).

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Module II(5 lectures)

Managing Business Communication:
Formal and Informal communication, Non- verbal communication (Body language, Gestures, Postures, Facial expressions). The cross cultural dimensions of business communication. Techniques to effective listening, methods and styles of reading.

Module III (5 lectures)

Other aspects of communication:
Vocabulary:
Single word substitution, Idioms and phrases, Precis writing, Comprehension.

Group Discussions, Extempore, Principles of effective speech and presentations, Role playing.

Module IV: (6 lectures)

Introduction to managerial writing:

Business letters: Inquiries, Circulars, Quotations, Orders, Acknowledgement, Claims & adjustments, Collection letters, Sales letters, Drafting of different resumes, Covering letters Applying for a job, Social correspondence, Invitation to speak.

Official Correspondence: Memorandum, Notice, Agenda, Minutes, Circular letters.

Module V: (3 lectures)

Report writing and Technical Proposals:
Business reports, Types, Characteristics, Importance, Elements of structure, Process of writing, Order of writing, the final draft, check lists for reports.

Technical proposals, Definitions, types and format.

Text Books:
T1. Communication Skills, Sanjay Kumar &PushpLata, Oxford University Press
T2. Business Correspondence and Report Writing,R.C.Sharma, Krishna Mohan.Mcgraw Hill
T3. Communication for Business,Shirley Taylor, V.Chandra, Pearson

Reference Books:

R1. Business Communication- HorySankar Mukherjee, Oxford University Press
R2. Basic Business Communication- .Lesikar I Flatley, McGraw Hill.
R3. Business Communication Today ,Bovee, Thill and Chaterjee, Pearson

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Gaps in the syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design
POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Quiz(I,II)	20
Mid Term Examination Marks	25
Attendance	5
End Term Examination Marks	50

AssessmentComponents	CO1	CO2	CO3	CO4	CO5
Quiz(I,II)	√	√	√		
End Sem Examination Marks	√	√	√	√	√
Mid Term Examination Marks			√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	1	1	1	1	2	3	3	3	3	3	3	2	2	1	1
CO2	1	2	1	1	1	3	3	2	3	3	2	2	1	1	2
CO3	1	2	2	1	1	1	3	3	3	3	2	2	1	1	3
CO4	1	2	2	1	3	3	2	2	3	3	1	2	1	1	2
CO5	2	1	1	2	2	3	3	3	3	3	2	1	1	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD	Course Delivery methods		Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1,CD2,CD3
CD2	Tutorials/Assignments		CO2	CD1,CD2,CD3
CD3	Seminars		CO3	CD1,CD2,CD3
CD4	Mini projects/Projects		CO4	CD1,CD2,CD3,CO4 CD5
CD5	Laboratory experiments/teaching aids		CO5	CD1,CD2,CO5
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

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COURSE INFORMATION SHEET

Course code: MT204
Course title: **Constitution of India**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 2 T: 0 P: 0
Class schedule per week: 2
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives:
This course enables the students:

A.	To describe the importance and role of Constitution of India
B.	To resolve the social problems and issues.
C.	To maintain and bolster the unity and integrity in the society.
D.	To formulate and design policies in accordance with the constitutional provisions.

Course Outcomes

After the completion of this course, students will be:

1.	Outlinethe need and importance of the Indian constitution.
2.	Explain the fundamental rights and duties of the citizens of India.
3.	Relate appropriate constitutional provisions with relevant social issues
4.	Describe the role of different departments of government.
5.	Crique the Government policies and programmes designed for the society at large.

Syllabus

Module 1: Introduction to the Constitution of India, Salient Features of the Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Module 2: Union and State Executives: President and Prime Minister, Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.Governor: Role and Position, Chief Ministers and Council of ministers.

Module 3: The Indian Judicial System – The Supreme Court and The High Court's – composition, Jurisdiction and functions, The Role of the Judiciary.

Module 4: Local Government- District's Administration: Role and Importance, The Panchayatas – Gram Sabha, Constitution and Composition of Panchayatas ,Constitution and Composition of Municipalities

Module 5: Miscellaneous- Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Head of Department

Suggested Readings

1. The Constitution of India by " Ministry of Law India" Kindle Edition
2. Constitutional History of India by Prof.M.V.PYLEE-S.Chand Publishing
3. Indian Administration by Avasti and Avasti-Lakshmi Narain Agarwal Educational Publishers.2017 edition.
4. Introduction to the Constitution of India by D DBasu by Lexis Nexis : 20th edition.
5. Constitution of India V.N.Shukla's EBC Explorer Edition 13th ,2017

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
1.Lecture by use of boards/LCD projectors/OHP projectors
2. Tutorials/Assignments
3. Seminars
4. Mini projects/Projects
5.Laboratory experiments/teaching aids
6.Industrial/guest lectures
7.Industrial visits/in-plant training
8.Self- learning such as use of NPTEL materials and internets
9.Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End SemExamination Marks	60
Assignment / Quiz (s)	15

AssessmentCompoents	CO1	CO2	CO3	CO4	CO5
Mid Sem Examination Marks	√	√			
End Sem Examination Marks	√	√	√	√	√
Assignment	√	√	√		

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1						3	3	3	3	3		2	1	1	1
CO2						3	3	2	3	3		2	1	1	2
CO3						1	3	3	3	3		2	1	1	1
CO4						3	2	2	3	3		2	1	1	1
CO5						3	3	3	3	3		1	1	1	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1
CD2	Tutorials/Assignments		CO2	CD1
CD3	Seminars		CO3	CD1, CD2
CD4	Mini projects/Projects		CO4,	CD1, CD2
CD5	Laboratory experiments/teaching aids		CO5	CD1, CD3, CD6
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

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COURSE INFORMATION SHEET

Course code: CS306
Course title: COMPILER DESIGN LAB
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To provide a deep insight into the various programmatic stages in building a compiler.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply different compiler writing tools to implement the different Phases.
CO2	Analyze the data flow and control flow.
CO3	Construct the intermediate representation.
CO4	Design and develop various modules of a compiler.
CO5	Develop modules of compiler using Lex and Yacc tools.

Syllabus

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To Understand the concept of tokens.

Q1. C program to count white spaces, numbers, words in a file./

2. **Lab Assignment No: 2**

Objective: To Understand the process of identification of tokens.

Q1. C program to design Finite automata to identify different tokens(identifiers, constants, operators, etc.).

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3. **Lab Assignment No: 3**

Objective: To have a brief Understanding to lex programming.

Q1. Count number of a's in given string.

Q2. Identify different patterns like aa, ab, not containing a, etc. in given string .

4. **Lab Assignment No: 4**

Objective: To Understand lex programming tool.

Q1. Lex program to Identify all tokens of C programs.

5. **Lab Assignment No: 5**

Objective: To Understand and Implement structure of any programming language.

Q1.Design and Code individual programming code with all possible tokens in programming language.

6. **Lab Assignment No: 6**

Objective: To Understand lex programming tool in depth.

Q1. Starting and ending with 'a'.

Q2. # a's divisible by 2 or b's divisble by 3.

Q3. 4th Symbol 'a' from RHS.

Q4. Output code after removing white spaces and comment.

7. **Lab Assignment No: 7**

Objective: To Understand and Implement Parser using yacc.

Q1. Build parsers using yacc for L(G)=$\{a^n b^n \mid n >= 1\}$ over {a,b}

8. **Lab Assignment No: 8**

Objective: To Understand and Implement parser for different grammars.

Q1.Build Parser using yacc for L(G) where rule set of G is { S ->aSb, S->bSa, S->c} over {a,b,c}.

9. **Lab Assignment No: 9**

Objective: To Understand and Implement parser coding.

Q1. Build parser using yacc to convert the infix expression to postfix expression.

10. **Lab Assignment No: 10**

Objective: To Understand and Implement parser coding.

Q1. Build a calculator in yacc which takes expression in postfix notation.

Q2. Build parsers using yacc to convert the prefix expression into the postfix expression.

11. **Lab Assignment No: 11**

Objective: To Understand and Implement parser for validation and operations.

Q1. Build parsers using yacc to validate the C statements. E.g int a,b,c;(valid)

Q2. Build calculator in yacc.

Head of Department

Books recommended:

Text books

lex&yacc (2nd ed.) :O'Reilly & Associates, Inc. Sebastopol, CA, USA ©1992 . **(T1)**

Reference books

Lex &Yacc:O'Reilly & Associates, Inc. Sebastopol, CA, USA ©1992. **(R1)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	3	3	2	2	1	1	1	1	2	3	2	2
CO2	2	2	1	2	2	1	1	1	1	1	1	1	2	2	2
CO3	2	3	2	3	3	1	1	1	1	1	2	2	3	3	3
CO4	3	2	2	1	3	1	1	1	1	1	1	2	2	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD2,CD3
CO2	CD1, CD2,CD3
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD5
CO5	CD1,CD2,CD4

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COURSE INFORMATION SHEET

Course code: CS308
Course title: **Mobile Interface Lab**
Pre-requisite(s):
Co- requisite(s): NIL
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To introduce Android platform and its Architecture.
2.	To learn activity creation and Android UI designing.
3.	To be familiarized with Intent, Broadcast receivers and Internet services.
4.	To integrate multimedia, camera and Location based services in Android Application.
5.	To explore Mobile security issues.

Course Outcomes

After the completion of this course, students will be able to:

1.	Describe Android platform, Architecture and features.
2.	Design User Interface and develop activity for Android App.
3.	Design and implement Database Application and Content providers.
4.	Use multimedia, camera and Location based services in Android App.
5.	Discuss various security issues in Android platform.

Syllabus

60. Develop an application that uses GUI components, Font and Colors.
61. Develop an application that uses Layout Managers and event listeners.
62. Write an application that draws basic graphical primitives on the screen.
63. Develop an application that makes use of database.
64. Develop a native calculator application.
65. Implement an application that implements Multi-threading.
66. Develop a native application that uses GPS location information.
67. Implement an application that writes data to the SD card.
68. Implement an application that creates an alert upon receiving a message.
69. Write a mobile application that creates alarm clock.

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Text books:

7. Pattern Recognition and Machine Learning, Christopher Bishop, Springer 2006.

Reference books:

10. Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2013.
11. Pattern Classification, 2nd Ed., Richard Duda, Peter Hart, David Stork, John Wiley & Sons, 2001.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	2	3	1	2	1	2	1	1	2	1	2
CO2	3	2	3	3	2	1	2	3	2	1	3	2	2	3	2
CO3	3	3	1	3	2	1	3	3	3	2	1	2	3	2	2
CO4	2	3	3	2	2	2	2	2	2	2	2	1	3	2	2
CO5	3	3	3	1	2	3	1	1	2	3	2	2	3	2	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: IT404
Course title: **Intellectual Property Rights and Cyber Laws**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 2 T:0 P: 0
Class schedule per week: 2
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Outcomes
After the completion of this course, students will be:

1.	Understand the importance of Intellectual property, their implications and their types.
2.	Identify the process for registration and use of copyrights and patents and the rights involved with them.
3.	Discover the functioning of trademarks and domain names, the rights of the holders and process of dispute resolution.
4.	Assess the importance and procedure for registration of Designs and Geographical Indications, the rights of the owner and arbitration process.
5.	Develop an understanding of the Cyber Laws, trends in Cyber crimes and procedures to tackle them.

Syllabus

Module I

Introduction to Intellectual Property, Justifications for protection of IP, Major forms of IP- Copyright; Patent; Trade Marks; Designs; Geographic indication; Semi conductors; Plant varieties, Berne Convention, Paris Convention, TRIPS

Module II

Copyrights- Historical development of copyright, Original literary, dramatic, musical, artistic works, Cinematograph films, Sound recordings, Ownership of copyright, Term of copyright, Infringement of copyright, Exceptions of infringement, Remedies, Registration

Patents- Historical development of patents, Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Revocation, Infringement of patents, Remedies

Module III

Trade Marks and Domain Names - Historical development of trademarks, Functions of marks, Concept of distinctiveness, Absolute grounds of refusal, Procedure for registration, Term of mark, Rights of holder, Assignment and licensing of marks,

Head of Department

Infringement, Passing Off, Domain Name Protection, Domain Name Disputes, Cyber squatting, Arbitration

Module IV

Designs- meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indications- meaning and its evolution, Difference between GI and Trade Marks, Registration, Rights, Authorised user

Module V

Cyber Law- Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Cyber Crime and IT Act 2000, Nature of cyber criminality, Strategies to tackle cyber crime and Trends, Defamation, Harassment and Email abuse, Law of Digital Contracts, The System of Digital Signatures

Text books:

1. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, Delmar Cengage Learning, 4th Edition, 2013.
2. Vivek Sood, Cyber Law Simplified, Tata McGraw-Hill Publishing, Fourth Reprint, 2008.

Reference books:

1. Miller and Davis' Intellectual Property, Patents, Trademarks, and Copyright in a nutshell, West Publishing, 5th edition, 2012.
2. William Rodolph Cornish, David Llewelyn, Tanya Frances Aplin, Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights, Sweet & Maxwell, 7th Edition, 2010.
3. Henri J. A. Charmasson, John Buchaca, Patents, Copyrights and Trademarks For Dummies, Wiley, 2nd Edition, 2008.

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1			1	1	1	3	3	3	1	3	2	2	1	1	2
CO2				1	1	3	3	2	1	3	2	2	1	1	2
CO3				1	1	1	3	3	1	3	2	2	1	1	2
CO4		2	2	1	1	3	2	2	1	3	2	2	1	1	2
CO5		2	2	1	1	3	3	3	1	3	2	1	1	1	2

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT331
Course title: **Biometric Security**
Pre-requisite(s): CS201 Data Structure
Co- requisite(s): CS206 Design and Analysis of Algorithm
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To understand the brief functioning of biometric system.
2.	To know the different types of biometric and their accuracy.
3.	To increase the likelihood that biometric technologies, when deployed, will be as protective of personal and informational privacy as possible.
4.	To raise awareness of privacy issues for end users and for students.
5.	To increase security of the system as well as data.

Course Outcomes
After the completion of this course, students will be able to:

1.	Determine knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2.	Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
3.	Develop new advanced authentication algorithms.
4.	Analyze the accurate discrimination between individuals.
5.	Illustrate the two factor authentication system.

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Syllabus

Module I

Biometrics- Introduction- benefits of biometrics over traditional authentication systems -benefits of biometrics in identification systems-selecting a biometric for a system –Applications - Key biometric terms and processes - biometric matching methods -Accuracy in biometric systems. (8L)

Module II

Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern. (8L)

Module III

Technical description – characteristics - strengths – weaknesses – deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.
(8L)

Module IV

signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.
(8L)

Module V

Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation plan. (8L)

Text Books :

Nanavathi Samir, Thieme Michel, and Nanavathi Raj, Biometrics -Identity Verification in a Network, 1st Edition, Wiley Eastern, 2002. (T1)
Chirillo John and Blaul Scott, Implementing Biometric Security, 1st Edition, Wiley Eastern Publication, 2005. (T2)

Reference Book :

Berger John, Biometrics for Network Security, 1st Edition, Prentice Hall, 2004.(R1)

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	2	1	2	2				2	2	2	1
CO2	3	3	3	2	2	1	2	2				2	2	2	1
CO3	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO4	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO5	3	3	3	3	3	1	2	2	1	1	1	2	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS370
Course title: **Cyber Crime and Investigation**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the importance of the cyber law for crime investigation.
2.	To understand the web based criminal activity
3.	To understand the different methods for hacking.
4.	To understand the criminal activities over the web.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identifythecomputer-based crime.
2.	Analyze Technical and legal aspects of computer crime investigations
3.	Identify the limitations of law and its enforcement agencies.
4.	Utilize the procedures of recovering computer evidence and seize process.
5.	Apply techniques for finding, preserving, presenting, and extracting information from the digital devices.

Syllabus

Module I

Introduction: Cyberspace and Criminal Behavior, Traditional problems associated with computer-based crime, e cash problems, Computer Technology and History: Computer Language, Hardware, software, operating system, Internet, Network language.
(8L)

Module II

Early Hackers and Theft Components: Phreakers, Hacking, Commodities, Intellectual property. Contempory computer crime: web based criminal activity, money laundering.
(8L)

Head of Department

Module III
Identity theft and identity fraud: Typologies of internet theft, virtual identity, credit identity. Prevalence and victimology, physical methods, of identity theft, phishing, spyware, trojans, insurance and loan fraud, immigration fraud. Terrorism and organized crime:Terror online, criminal activities, organized crime as cyber gangs., technology used in organized crime. Data piracy.
(8L)

Module IV
Avenues for Prosecution and Government efforts: Act, Law enforcement agencies, International efforts, Cyber law and its amendments of current state, other legal considerations.
(8L)

Module V
Forensic Terminologies and Developing forensic capabilities, Searching and seizing computer related evidence, Processing of evidence and report preparation.
(8L)

Text Books:

1. Britz M.T., Computer Forensics and Cyber Crime, First Impression, Pearson Education, 2012.(T1)
2. Casey E., Computer Crime and investigations, First Edition, Springer, 2001.(T2)

Reference Book:

1. Easttom C. & Taylor D.J., Computer Crime Investigations and Law, Carenage Learning.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	2	2	2				2	2	2	1
CO2	3	3	3	3	2	2	2	2				2	2	2	1
CO3	3	3	3	3	2	1	2	2		1	1	2	2	2	1
CO4	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO5	3	3	3	3	3	1	2	2	1	1	1	2	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS371
Course title: **Genetic Algorithm**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Able to understand the basic concepts of GA
2.	Able to find the application areas of GA
3.	Able to understand the importance of optimization using GA
4.	Able to know about the traditional GA model

Course Outcomes
After the completion of this course, students will be able to:

1.	Define Traditional GA model.
2.	Build code for GA.
3.	Apply different techniques of GA.
4.	Design schema for various problems of optimization using GA.
5.	Develop Classifier system using GA.

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Syllabus

Module I

Introduction to Genetic Algorithm, Genetic Algorithms, Traditional and Search Methods and their Differences, A Simple Genetic Algorithm. The Fundamental Theorem, Schema Processing.

(8L)

Module II

Two & k-Armed Bandit Problem, Hypothesis, Schemata and Revisited., Computer Implementation of A Genetic Algorithm**:** Data Structures, Reproduction, Crossover and Mutation, A Time to Reproduce, A Time to Cross, How Well Does It Work, Mapping Objective Functions to Fitness Form, Fitness Scaling.
(8L)

Module IV

Coding, A Multiparameter Mapped, Fixed-Point Coding, Discretization, Constraints.Applications of Genetic Algorithms **:**The Rise of Genetic Algorithms, Genetic Algorithm Applications of Historical Interest, De Jong and Function Optimization.
(8L)

Module V

Improvements in Basic Technique, Current Applications of Genetic Algorithms.Genetics-Based Machine Learning, Whence It Came, What is Classifier System, Rule and Message, Genetic Algorithm.

(8L)

Text Book :

Goldberg D. E., Genetic Algorithms in Search Optimization and Machine Learning, Pearson Education, New Delhi, 2005.(T1)

Reference Book :

Vose M. D., The Simple Genetic Algorithm, PHI, New Delhi, 2004.(R1)

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	1	1	1	1	1				2	2	2	1
CO2	3	3	3	1	2	1	1	1				2	2	2	1
CO3	3	3	3	3	3	1	1	1		1	1	2	3	2	1
CO4	3	3	3	2	3	1	1	1		1	1	2	3	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1	2	3	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT402
Course title: **Dot NET Programming**
Pre-requisite(s): Nil
Co- requisite(s):
Credits:L:0 T:0 P:1.5
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To study basic and advanced features of the C# language
2.	To create form based and web based applications
3.	To study the internals of the .NET framework
4.	To know and study about the Common Language Runtime (CLR) and Common Language Infrastructure (CLI)

Course Outcomes
After the completion of this course, students will be able to:

1.	Install and configure Dot Net application development tools.
2.	develop, implement and creating Applications with C#
3	develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web
4.	explain Security in the .NET framework and Deployment in the .NET.
5.	develop Assemblies and Deployment in .NET, Mobile Application Development.

Syllabus
Module I
C# basics
C# and the .NET framework – C# basics – Objects and types – Inheritance –Arrays – Operators and casts – Indexers. (8L)

Module II
Advanced C# features
Delegates and events – Strings and regular expressions – Generics – Collections–Memory management and pointers – Errors and exceptions. (8L)

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Module III
I/O and network programming
Tracing and events - threading and synchronization - .Net security – localization –Manipulating XML - Managing the file system – basic network programming. (8L)

Module IV
Window and web applications
Window based applications – Data access with .NET – basics of ASP .NET -Introduction to web services. (8L)

Module V
.NET Features
Architecture – Assemblies – shared assemblies – CLR hosting – Appdomains –Reflection. (8L)

Text Books:

Nagel,C. , Evjen,B. , Glynn,J. , Watson,K. , and Skinner,M.,"Professional C# 4 with .NET 4," Wiley India, 2010.(T1)
Liberty ,J., and MacDonald ,B., "Learning C# 3.0," First Edition ,O'Reilly, 2008.(T2)

References Book:

Troelson ,A., "Pro C# 5.0 and the.NET 4.5 Framework," Sixth Edition, Apress,2012.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	1	1	3	1	2	2	1	1	1	2	2	1	2
CO2	3	3	3	3	3	2	2	2	2	2	2	2	3	2	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO4	2	3	3	1	3	2	2	2	3	3	3	3	2	2	3
CO5	3	3	3	3	3	1	1	2	2	2	3	3	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT429
Course title: **Machine Learning**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co- requisite(s):NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic concept of machine learning.
2.	To explore the application of machine learning.
3.	To understand the concept of supervised learning.
4.	To learn the advantage of neural network.
5.	To learn the utility of clustering techniques.

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Course Outcomes

After the completion of this course, students will be able to:

1.	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity
2.	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses
3.	Implement machine learning solutions to classification, regression, and clustering problems
4.	Design and implement various machine learning algorithms in a range of real-world applications
5.	Evaluate and analyse the performance of machine learning algorithm or a system based on machine learning algorithm.

Syllabus

Module I

Introduction to Machine learning

Machine Learning – what and why? Basics of Linear Algebra and Statistics, Overview of target function representations; Linear Regression.

(8L)

Module II

Supervised Learning

Basics of Feature Selection and Evaluation, Decision Tree, Overfitting and Pruning, Logistic regression, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts. (10L)

Module III

Neural Networks

Perceptions: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

(8L)

Head of Department

Module IV
Unsupervised and Semi Supervised Learning
Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labelled and unlabeled data.

(8L)

Module V
Ensemble
Committees of multiple hypotheses, bagging, boosting, active learning with ensembles, (6L)

Text book:

1. Mitchell Tom, Machine Learning, Latest Edition, Mc-Graw Hill.(T1)

Reference books:

1. Shalev-Shwartz Shai and Ben-David Shai, Understanding Machine Learning, Cambridge University Press. 2017.(R1)
2. Bishop Christopher, Pattern Recognition and Machine Learning, Springer, 2006.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Head of Department

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	2	1	1	1	1	1	1	1	2	3	1	1
CO2	3	3	2	2	1	1	1	1	1	1	1	2	3	3	1
CO3	3	3	3	3	3	3	2	2	2	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	2	2	3	3	2
CO5	2	3	2	3	3	2	1	1	2	2	1	2	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT490
Course title: **Natural Language Processing**
Pre-requisite(s): CS305 Compiler Design
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the basic component of Natural Language Processing.
2.	To explore the application areas of Natural Language Processing.
3.	To understand the idea of Language Modelling.
4.	To explore the basic concepts of Parts-of-speech Tagging.
5.	To understand the concepts of language modelling.

Course Outcomes
After the completion of this course, students will be able to:

1.	Describe the typical NLP problem, their importance & difficulty; and concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
2.	Demonstrate understanding of the relationship between NLP and statistics& machine learning.
3.	Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.
4.	Analyse NLP problems to decompose them into appropriate components.
5.	Evaluate a NLP system, identify shortcomings and suggest solutions for these shortcomings.

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Syllabus
Module I

Introduction to NLP :introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

(8L)

Module II

Language Modelling: N-gram and NeuralLanguageModelsLanguage Modelling with N-gram, Simple N-gram models, Smoothing(basic techniques), Evaluating language models;Neural Network basics, Training;Neural Language Model, Case study: application of neural language model in NLP system development**.**

(8L)

Module III

Parts-of-speech Tagging**: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, POS Tagging using Maximum Entropy Model.** (8L)

Module IV

ParsingBasic concepts: top down and bottom up parsing, Treebank; Syntactic parsing: CKY parsing; Statistical parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

(8L)

Module V

Semantics: Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WorldNet.

(8L)

Text books:

Jurafsky Dan and Martin James H., Speech and Language Processing **(3rd ed.)***To be published in 2018*. Available at: https://web.stanford.edu/~jurafsky/slp3/. (T1)

Head of Department

Reference books:

Jurafsky D. and Martin J. H., Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.(R1)

Goldberg Yoav, A Primer on Neural Network Models for Natural Language Processing.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	2	2	2	1	1	1	2	1	3	1	1	3	2	1
CO2	3	3	3	1	3	1	1	1	3	1	2	2	3	2	1
CO3	3	3	3	3	3	1	2	2	2	1	1	2	3	3	2
CO4	3	3	3	1	3	2	1	1	2	1	1	2	3	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT420
Course title: **Artificial Intelligence**
Pre-requisite(s): IT201 Basics of Intelligent Computing
Credits: L:3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/ IT

Program Outcome

This course enables the students to:

1.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
2.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
3.	An ability to design a system, component or process to meet desired needs within realistic constraints.
4.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
5.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Course Outcomes

After the completion of this course, students will be to:

1.	Analyze the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
2.	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
3.	Analyze the various concepts of knowledge representations and demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.
4.	Develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
5.	Explain various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

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Syllabus

Module I

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature Of Environment, Structure Of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining The Problem As State Space Search, Production System, Problem Characteristics, Issues In The Design Of Search Programs.

(9L)

Module II

Search Techniques: Solving Problems By Searching, Problem Solving Agents, Searching For Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search For Constraint Satisfaction Problems.

Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Mini Max Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

(9L)

Module III

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, and Natural Deduction.

Representing Knowledge Using Rules: Procedural Verses Declarative Knowledge, Logic Programming, Forward Verses Backward Reasoning, Matching, Control Knowledge. (7L)

Module IV

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster-Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning.

Learning: Forms Of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning. (8L)

Module V

Natural Language Processing: Brief introduction to Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planning uncertain movements, robotic software architecture, application domains.

(6L)

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Text Books:

Russel S. and Norvig P., Artificial Intelligence a Modern Approach, 3rd edition, Pearson Education.(T1)

Rich E. & Knight K., Artificial Intelligence, 3rd edition, TMH, New Delhi.(T2)

Reference books:

Patterson Dan W., Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.(R1)

Rolston D.W., Principles of AI & Expert System Development, TMH, New Delhi.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	3	2	1	1	1	2	1	3	2	3	2
CO2	3	2	2	3	3	2	1	1	3	3	2	3	2	2	1
CO3	3	2	2	2	3	2	2	2	3	3	1	3	2	3	2
CO4	2	3	2	2	2	3	2	1	3	3	1	3	2	2	3
CO5	3	3	2	3	2	3	2	2	2	1	2	2	2	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS470
Course title: **Wireless Communication**
Pre-requisite(s): IT301 Data Communication and Computer Network
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week:
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Understand the basic concept ofwireless communication
2.	Know the state of art architecture for wireless LANs and PANs
3.	Learn about the Propagation Models for Wireless Networks, Multipath Effects in Mobile Communication in Cellular Mobile Wireless Networks
4.	Understand the basics of Coding and Error Control,
5.	Classify MAC Protocols, Transport Layer Protocols,Routing Protocols

Course Outcomes

After the completion of this course, students will be:

1.	DefineTransmission fundamentals and Modulation Techniques
2.	Elaborate Wireless LAN Standards, Bluetooth, Mobile IP characteristics
3.	Analyse Frequency Reuse, Co-channel and Adjacent channel interference in cellular networks.
4.	Compare QoS constraints in wireless networks and their security.
5.	Summarize features of MAC Protocols, Transport Layer Protocols,Routing Protocols.

Head of Department

Syllabus

Module -I

Introduction: Fundamentals of Wireless Communication - Transmission fundamentals –- Antennas and Propagation, ModulationTechniques

Module -II

Wireless Networking, Wireless LANS & PANS: Wireless Networking – Satellite Communication, Wireless LANs -Wireless LAN Technology, IEEE 802.11 Wireless LAN Standards, Bluetooth, Mobile IP and Wireless Access Protocol ,HIPERLAN Standard.

Module -III

Cellular Mobile Wireless Networks: Systems and Design Fundamentals, Propagation Models Description of cellular system, Frequency Reuse, Co-channel and Adjacent channel interference, Propagation Models for Wireless Networks, Multipath Effects in Mobile Communication, Models for Multipath Reception.

Module -IV

Error-control&Security : Coding and Error Control,Introduction - Issues in Ad Hoc Wireless Networks -– Wired Equivalent Privacy(WEP), WPA – The Extensible Authentication Protocol - Security in Ad Hoc Wireless Networks.

Module –V

Protocols in Wireless Networks: Classifications of MAC Protocols, Classifications of Transport Layer Protocols, Classifications of Routing Protocols, QoS in wireless networks.

Text Books:

Stallings William, Wireless Communications and Networking, 2nd Edition, Pearson Education, 2005.(T1)

Rappaport Theodore S., Wireless Communication: Principles and Practice, 2nd Edition. Prentice Hall of India, 2005. (T2)

Reference Books:

Siva Ram Murthy C, Manoj B.S, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall, 2004.(R1)

William C.Y.Lec, Mobile Cellular Telecommunication, Analog and Digital Systems, McGrawHill Inc.(R2)

Pahlavan Kaveh and Krishnamurthy Prashant, Principles of Wireless Networks, 1st Edn., Pearson Education Asia, 2002.(R3)

Rappaport T.S, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall. (R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	3	3	3	2	3	1	2	2	3	3	1	3	2
2	3	3	2	2	3	1	3	1	3	3	3	2	1	3	1
3	2	3	1	3	1	3	3	3	3	1	3	2	2	3	3
4	3	3	1	3	1	1	1	1	2	2	3	2	1	3	1
5	1	3	3	1	3	1	1	3	2	1	3	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS471
Course title: **Medical Image Processing**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic concepts of image pre processing.
2.	To explore the importance of image processing in medical domain.
3.	To understand the basic classification of image processing.
4.	To explore the different image presentation techniques.

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Course Outcomes

After the completion of this course, students will be able to:

1.	Apply image processing concepts for medical images.
2.	Analyze Morphology, Segmentation techniques and implement these in images.
3.	Analysis and visualize of medical images of numerous modalities.
4.	Find the clear domain knowledge in the various Medical Imaging techniques and its diagnostic applications.
5.	Apply the image processing techniques for problem solving related to medical domain.

Syllabus

Module I

Image Fundamentals and Pre-Processing

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two-dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms. Image enhancement – point operation, Histogram modeling, spatial operations, Transform operations.
(10L)

Module II

Basics of Medical Image Sources

Radiology- The electromagnetic spectrum-Computed Tomography-Magnetic Resonance Tomography –ultrasound-nuclear medicine and molecular imaging-other imaging techniques-radiation protection and dosimetry.
(5L)

Module III

Medical Image Representation

Pixels and voxels – algebraic image operations - gray scale and color representation- depth-color and look up tables - image file formats- DICOM- other formats- Analyze 7.5, NifTI and Interfile, Image quality and the signal to noise ratio- MATLAB based simple operations. (5L)

Module IV

Medical Image Analysis and Classification

Image segmentation- pixel based, edge based, region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification – Statistical, Rule based, Neural Network approaches (10L)

Module V

Image Registrations and Visualization

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.
(10L)

Head of Department

Text Books:

Birkfellner Wolfgang, Applied Medical Image Processing – A Basic course, CRC Press, 2011.(T1)

Dhawan Atam P., edical Image Analysis, Wiley Interscience Publication, NJ, USA 2003.(T2)

Gonzalez R.C. and Woods R.E., Digital Image Processing, 2nd Edition, Pearson Education, 2002.(T3)

Jain Anil. K., Fundamentals of Digital Image Processing, Pearson Education, Indian Reprint 2003. (T4)

Horowitz Alfred, MRI Physics for Radiologists – A Visual Approach, 2nd edition Springer Verlag Network, 1991.(T5)

Reference Books:

NajarianKavyan and Splerstor Robert, Biomedical signals and Image processing, CRC – Taylor and Francis, New York, 2006.(R1)

Semmlow John L., Biosignal and Biomedical Image Processing Matlab Based applications, Marcel Dekker Inc., New York, 2004.(R2)

Prince Jerry L. and Links Jnathan M., Medical Imaging Signals and Systems, Pearson Education Inc., 2002.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
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CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	3	1	1	2	1	1	2	1	2	
2	2	3	2	2	1	1	2	2	1	1	1	
3	3	3	2	3	3	1	1	1	1	1	2	
4	3	1	2	1	2	2	2	2	1	1	1	
5	2	2	1	2	3	1	2	1	2	3	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS472
Course title: **Programming for Bio Informatics**
Pre-requisite(s): Nil
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To know the basic components of Bio informatics.
2.	To understand how programming can apply for biology.
3.	To learn the basic concepts of pattern matching.
4.	To understand different databases of Bio informatics.

Course Outcomes
After the completion of this course, students will be able to:

1.	Convert the Bio problems into computer compatible problems.
2.	Apply the computer programming for Bio data storage and retrieval.
3.	Solve complex problems using programming approach.
4.	Learn the limitations of machine while handling the Bio image and data files.
5.	Integrate the techniques to apply on various bio informatics problem.

Syllabus
Module I
Primitives, Names Function and Modules, Collections and Control statements**.** (8L)

Module II
Classes, Utilities, Pattern Matching, Structured Text, Web Programming, Relational Database, Structured Graphics. (8L)

Module III
Introduction to pearl, Scalars, Arrays, Using Standard Peral Modules, Pearl Regular Expressions.

(8L)
Module IV
Perl Debugger, Advanced Array Operations, Perl Regular Expression II, Perl Control Statements (8L)

Module V
File I/O in Python and Perl, Subroutines and functions in Python and Perl.
(8L)

Head of Department

Text Books:

Model Michell L., Bioinformatics Programming using Python, O'Reilly publication, 2010.(T1)
Bal H. P., Perl Programming for Bioinformatics, Tata Mc Graw Hill, 2006.(T2)

Reference Books:

Thareja Reema, Python Programming, Oxford University Press, 2017.(R1)
Modern Perl, Chromatic, Pragmatic Bookshelf, 2015.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	2	1	1	1	1	2	1	1	1	2	
2	3	3	3	2	1	2	1	1	2	1	1	
3	2	3	3	3	1	1	1	2	1	1	2	
4	3	2	2	3	3	1	1	1	1	2	1	
5	2	2	2	3	3	1	1	1	1	1	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT470
Course title: **Genomic Data Science**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Able to understand the basic elements of data science
2.	Able to understand the use of data science in biological data.
3.	Able to know the use of regression model.
4.	Able to understand the basic structure of DNA, RNA & protein databases.

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain how data is collected, managed and stored for data science;
2.	Define key concepts in data science, including their real-world applications and the toolkit used by data scientists;
3.	Apply statistical knowledge on Biological data.
4.	Integrate concept and techniques to apply on genomic data.
5.	Design ode for the biological data.

Syllabus

Module I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. (8L)

Module II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources. (8L)

Module III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes. (8L)

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Module IV

Analyzing DNA, RNA, and Protein Sequences Introduction, Access to Sequence Data and Related Information, Pairwise Sequence Alignment, Basic Local Alignment Search Tool (BLAST), Advanced Database Searching,Multiple Sequence Alignment.
(8L)

Module V

Genomewide Analysis of DNA, RNA, and Protein DNA: The Eukaryotic Chromosome, Analysis of Next-Generation Sequence Data, Bioinformatic Approaches to Ribonucleic Acid (RNA), Gene Expression: Microarray and RNA-seq Data Analysis, Protein Analysis and Proteomics, Protein Structure, Functional Genomics. (8L)

Text Books:

Neil Cathy O. and Schutt Rachel, Doing Data Science, Straight Talk from the Frontline. O'Reilly.(T1)
Leskovek Jure, Rajaraman Anand and Ullman Jeffrey, Mining of Massive Datasets, v2.1, Cambridge University Press. (T2)
Pevsner Jonathan, Bioinformatics and functional Genomics, 3rd edition, ISBN:978-1-118-58178-0.(T3)

Reference Book:

Azuaje Francisco, Dopazo Joaquín, Data Analysis and Visualization in Genomics and Proteomics,First published:15 June 2005.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	1	1	1	1	2	1	1	1	1	
2	3	3	2	2	2	2	1	1	2	1	1	
3	2	3	3	3	1	1	1	2	1	1	2	
4	3	2	2	3	3	1	2	1	2	2	1	
5	2	2	2	3	3	2	1	1	1	1	1	

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS473
Course title: **Deep Learning**
Pre-requisite(s): IT429 Machine Learning
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic component of Machine Learning.
2.	To explore the application areas of Neural Networks.
3.	To understand the idea of Recurrent Neural Networks.
4.	To explore the basic concepts of Feed forward Neural Networks.
5.	To understand the concepts of mathematical modelling.

Course Outcomes

After the completion of this course, students will be:

1.	Able to differentiate between machine learning and deep learning
2.	Identify problems suitable for application of deep learning.
3.	Illustrate the working of FF Neural Networks and their modifications.
4.	Apply Convolutional & Recurrent Neural Networks to solve problems
5.	Analyse the efficiency of deep learning systems.

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Syllabus

Module I

Introduction and Basics of Machine Learning

Beginnings of ANN, XOR Problem, From Cognitive Science to Deep Learning, NNs and their importance. Elementary classification problem, evaluating classification results, Simple Classifier – Naïve Bayesian Classifier, Simple NN: Logistic Regression, Learning without Labels, Learning alternative representation of data – PCA. (8L)

Module II

Feed forward Neural Networks:

Basic concept and terminology, Representing networks, Perceptron rule, Delta rule, From logistic regression to Backpropagation, Backpropagation, Complete Feedforward NNs. (8L)

Module III

Modifications & Extensions of FF Neural Nets

Regularization, L1 & L2 regularization, Learning Rate, Momentum and Dropout, Stochastic Gradient Descent and Online Learning, Problems with multiple hidden layers, Vanishing and exploding gradients.
(4L)

Module IV

Convolution & Recurrent Neural Networks

Introduction, Feature maps and Pooling, Building a complete convolutional neural network. Recurrent Neural Networks – Sequences of unequal length, Settings for learning with recurrent neural networks, Adding feedback loops and Unfolding neural networks, Elman Networks, LSTM. (12L)

Module V

Auto encoders

Learning Representations, Different Autoencoder Architectures, Stacking Autoencoders.
(8L)

Text book:

Skansi S., Introduction to Deep Learning - From Logical Calculus to Artificial Intelligence, 1st Edition, Springer International Publishing, 2018.(T1)

Reference book:

Buduma N., Fundamentals of Deep Learning, 1st Edition, O Reilly Media, 2016.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Head of Department

Topics beyond syllabus/Advanced topics/Design: N/A

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars

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CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
1	3	2	3	2	1	2	2	1	2	2	2	
2	2	3	2	1	1	1	1	1	1	1	1	
3	3	3	1	3	H	3	2	1	1	1	1	
4	3	1	2	1	M	2	1	2	1	1	2	
5	2	2	1	2	3	1	1	1	2	3	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT426
Course title: **Data Mining Concepts and Technique**
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L:3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

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Course Objectives

This course enables the students:

1.	Examine the types of the data to be mined and apply pre-processing methods on raw data.
2.	To introduce the basic concepts of Data Warehouse and Data Mining techniques
3.	Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data
4.	Prepare students for research in the area of data mining and related applications and Enhance students communication and problem solving skills
5.	Provide the students with practice on applying data mining solutions using common data mining software tool /programming languages.

Course Outcomes

After the completion of this course, students will be able to:

1.	Illustrate the fundamentals of data mining systems as well as issues related to access and retrieval of data at scale.
2.	Explain the various data mining functionalities and data warehousing techniques.
3.	Apply the various data mining techniques to solve classification, clustering and association rule mining problems.
4.	Analyze and choose among different approaches of a data mining task.
5.	Design and evaluate data mining models to be used in solving real life problems, keeping in view social impacts of data mining.

Syllabus

Module I

Data Mining: Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

(6L)

ModuleII

Data Warehouse: Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining.Data Cube Computation and Data Generalization. (8L)

Module III

Mining Association Rules in Large Databases: Association Rule Mining, Single – Dimensional Boolean Association Rules, Multilevel Association Rules from

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Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis, Constraint – Based Association Mining.
(10L)

Module IV

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule Analysis, Other Classification Methods, Prediction, Classification Accuracy.
(8L)

Module V
Cluster Analysis: Introduction , Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Method - k- Medoids Algorithm, CLARANS, Hierarchical Methods - BIRCH, ROCK Density-Based Methods - DBSCAN, Grid-Based Methods – STING, WaveCluster. Outlier Analysis.
(8L)

Text book:

Han Jiawei &Kamber Micheline - Data Mining Concepts & Techniques, 2nd Edition, Publisher Harcout India. Private Limited.(T1)

Reference books:

Gupta G.K., Introduction to Data Mining with case Studies, PHI, New Delhi, 2006.(R1)
Berson A. & Smith S. J., Data Warehousing Data Mining, COLAP, TMH, New Delhi, 2004.(R2)
Dunham H.M. & Sridhar S., Data Mining, Pearson Education, New Delhi, 2006.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50

Head of Department

Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	2	2	2	1	2	2	1	1	3	3	1
CO2	2	3	2	3	2	2	1	2	2	2	2	1	2	2	2
CO3	2	3	3	3	3	3	3	2	3	2	3	1	2	2	3
CO4	3	2	2	3	3	2	2	1	3	2	2	2	3	3	2
CO5	3	3	3	3	2	2	2	1	3	3	3	2	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT427
Course title: **Data Mining Concepts and Technique Lab**
Pre-requisite(s): IT426 Data Mining Concepts and technique
Co- requisite(s):
Credits: L:3 T:0 P:
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

SYLLABUS

List of Programs as Assignments:

Q1. Build a Data Warehouse and Explore WEKA tool.

Q2. Demonstration of preprocessingon various datasets.

Q3.Demonstration of Association rule process on dataset using apriori algorithm.

Q4.Demonstrate performance of classification on various data sets.

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Q5. Demonstrate performance of clustering on various data sets.

Q6. Demonstrate performance of Regression on various data sets

Q7. Implement following algorithms for various datasets

A. Apriori Algorithm.
B. FP-Growth Algorithm.
C. K-means clustering.

Q8. Implement Bayesian Classification for various datasets

Q9 Implement Decision Tree for various datasets.

Q10. Implement Support Vector Machines.

Q11 Applications of classification for web mining.

Q12. Case Study on Text Mining or any commercial application

Books recommended:

Text Books :

1. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques Publisher Harcout India. Private Limited.

Reference Books :

1. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.
2. A. Berson& S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004.
3. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	2	2	2	1	2	3	3	3	3	3	1
CO2	2	3	2	3	2	2	1	2	2	3	3	3	2	2	2
CO3	2	3	3	3	3	3	3	2	3	3	3	3	2	2	3
CO4	3	2	2	3	3	2	2	1	3	3	3	3	3	3	2
CO5	3	3	3	3	2	2	2	1	3	3	3	3	3	3	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT401
Course title: **Data Analysis and Interpretation**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Examine the different types of the data and its interpretation and analysis.
2.	To introduce the basic Statistics Probability Distributions.
3.	Apply the techniques of hypothesis tests, supervised and unsupervised learning, feature selection and visualization to real world data.
4.	Prepare students for latest research in the area of data analysis such as deep learning and related applications and Enhance student's communication and problem solving skills.
5.	Provide the students to practice on different datasets for data analysis and interpretation using common statistical software tool /programming languages.

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Course Outcomes

After the completion of this course, students will be:

1.	Analyze data to convert information to useful knowledge.
2.	Develop an appreciation for what is involved in learning from data.
3.	Understand a wide variety of learning algorithms and also understand how to apply a variety of learning algorithms to data.
4.	understand the fundamental principles, theory and approaches for Neural Network and learning with deep neural networks

Syllabus:

Module I

Descriptive Statistics- Introduction to the course Descriptive Statistics Probability Distributions **Inferential Statistics-**Inferential Statistics through hypothesis tests Permutation &Randomization Test. (6L)

Module II

Machine Learning: Introduction and Concepts Differentiating algorithmic and model based frameworks **Regression**: Regression & ANOVA Regression ANOVA (Analysis of Variance) Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification.
(10L)

Module III

Supervised Learning with Regression and Classification techniques - Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines

(10L)

Module IV

Ensemble Methods- Random Forest, Neural Networks, Deep learning.
(8L)

Module V

Unsupervised Learning and Challenges for Big Data Analytics- K-Means and Hierarchical Clustering, Associative Rule Mining, Challenges for big data analytics

Head of Department

Prescriptive analytics- Creating data for analytics through designed experiments, Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning.
(6L)

Text books:

Hastie, Trevor,**Tibshirani,** Robert, **Friedman**, Jerome, "The Elements of Statistical Learning". Vol. 2. No. 1. Springer, New York, 2009.(T1)
Montgomery, Douglas C., and Runger George C., "Applied statistics and probability for
Engineers" . John Wiley & Sons, 2010. (T2)

Reference Books:

DeGroot, Morris H., and Schervish Mark J., "Probability and Statistics", 3rd Edition, Boston, MA: Addison-Wesley., 2002. (R1)
Box, G.E.P., Hunter, J.S and Hunter, W.G, "Statistics for Experimenters - Design, Innovation and Discovery, 2nd Edition, Wiley, 2005. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	2	1	1	1	1	1	1	1	1	3	1	1	1
2	3	2	1	1	1	1	1	1	1	1	1	2	1	2	1
3	3	2	2	1	1	1	1	1	1	1	1	2	2	2	2
4	2	3	2	2	1	1	1	1	1	1	1	1	1	2	1
5	2	2	2	3	3	2	1	1	1	1	1	1	1	2	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT421
Course title: **Artificial Intelligence Lab**
Pre-requisite(s): IT420 Artificial Intelligence, Data Structure And Database Management System
Credits: L:3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV

Course Objectives
This course enables the students to:

1.	To familiarize the student in introducing AI Problems
2.	Develop mathematical thinking and problem-solving skill using AI
3.	To enable the student on how to approach for solving Engineering problems using simulation tools.
4.	To provide a foundation so as to use AI techniques in real world puzzle solving

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply AI techniques to different complex problems using programs.
CO2	Create knowledge base and serve their applications in different fields.
CO3	Implement perfect and better heuristics for different applications.
CO4	Analyze and Implement real world complex problems.
CO5	Create Expert systems

SYLLABUS

List of Programs as Assignments:

PUZZLE SOLVING:

12. **Lab Assignment No: 1**
    Objective: To understand and solve simple AI problems.
    To solve Tic-Tac-Toe problem such that computer always win.
    (Min-Max Search)
13. **Lab Assignment No: 2**
    Objective: To understand and solve simple AI problems.
    To solve Monkey-Banana Problem

14. **Lab Assignment No: 3**
    Objective: To understand and solve simple AI problems.
    To solve Missionaries and Cannabal Problem.

15. **Lab Assignment No: 4**
    Objective: To understand and solve simple AI problems.
    To solve Water-Jug problem.

SEARCHING PROBLEM: 8-PUZZLE OR 8-QUEEN

16. **Lab Assignment No: 5**
    Objective: To Understand blind search algorithms.
    Q1.Toimplement Depth First Search (DFS)
    Q2. To implement Breadth First Search (BFS)

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17. **Lab Assignment No: 6**
    Objective: To apply DFS in problems.
    To solve Hill Climbing
18. **Lab Assignment No: 7**
    Objective: To apply BFS in problems.
    To solve Best First Search
19. **Lab Assignment No: 8**
    Objective: To understand and implement informed search algorithms.
    To solve A*.
20. **Lab Assignment No: 9**
    Objective: To understand and implement informed search algorithms.
    To solve AO*.

OTHER PROBLEMS:

21. **Lab Assignment No: 10**
    Objective: To implement real world Games.
    Chess Playing (Computer vs Human)
22. **Lab Assignment No: 11**
    Objective: To implement real-world Games.
    Sudoku Puzzle

Books recommended:

TEXT BOOKS

2. Prolog Programming by Bratko, PHI publishing.
3. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	3	2	1	1	1	2	1	3	2	3	2
CO2	3	2	2	3	3	2	1	1	3	3	2	3	2	2	1
CO3	3	2	2	2	3	2	2	2	3	3	1	3	2	3	2
CO4	2	3	2	2	2	3	2	1	3	3	1	3	2	2	3
CO5	3	3	2	3	2	3	2	2	2	1	2	2	2	2	3

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COURSE INFORMATION SHEET

Course code: IT422
Course title: **Principles of Multimedia**
Pre-requisite(s): NIL
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Program Objectives:

1	Formulate a working definition of interactive multimedia.
2	Demonstrate competence in using the authoring programs.
3	Demonstrate the use of animation, digitized sound, video control, and scanned images
4	Study the concepts related to compression standards available in the current scenario
5	Use basic instructional design principles in the development of multimedia applications

Program Outcomes:

1	Understand of the standards for representing audio files
2	Compare the standards and issues concerned in representing static/dynamic visual input/output
3	Analysing audio and video aspects of multimedia design
4	Applying the tools available for multimedia production and image/audio processing
5	Assess multimedia applications by using concepts of multimedia

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Module I

Introduction to Multimedia

Multimedia Definition, Properties of a Multimedia System, Multimedia Building Blocks, Modes of data transmission, Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous, Transmission Mode.Multimedia Information Representation: Analog Signal, Waves, General properties of Analog Signals, Digital Representation, Need for digital representation, Analog to digital conversion, Nyquist's Sampling Theorem, Encoder Design, Digital to Analog conversion, Decoder design and its principles, Encoder – Decoder, Relation between sampling rate and bit depth. (8L)

Module II

Discrete Media: Types of Media, Time Independent Media, Time dependent Media, Text, Unformatted Text, Formatted Text, Hyper Text, Essential Features of HTML, Graphics and Images, Creation of Computer Graphics, Digitised documents, Digitised Pictures, Digitised Cameras, Raster Scan Principles, Image Analysis, Image Transmission

Continuous Media: Audio, Speech Signals, Analog Signals, PCM Speech, CD- Quality audio, Synthesised audio, Types of Synthesizers, Characteristics of Synthesizers, Streaming Video, File Formats, Streaming Methods, Sound Fundamentals, Music, MIDI Basic concepts, MIDI Devices, MIDI Messages, Video, Broadcast Television, Digital Video – Format, 0 Format, HDTV Format, SIF, CIF, QCIF, PC Video and Video Content. (8L)

Module III

Text Representation and Compression: Compression Principles, Source Encoders and destination decoders, Lossless and Lossy Compression, Entropy Encoding, Source Encoding, Text Compression, Static Huffman coding, Arithmetic Coding,.

Image Storage and Compression: Digital image representation, Vector Graphics and Bitmapped images, Captured Image Format, Stored Image Format, Graphics Interchange Format (GIF), GIF Coding Standard, Tagged Image File Format (TIFF), Joint Photographic Experts Group (JPEG), Image/Block Preparation, Forward DCT, Quantization, Entropy Encoding, Frame building, JPEG decoding. (8L)

Module IV

Audio Representation and Compression: Introduction to Audio Compression, Differential pulse code modulation, Adaptive differential PCM, Adaptive Predictive Coding, Linear Predictive Coding, Code- excited LPG, Perceptual Coding, Sensitivity of the ear, Frequency marking, Temporal marking, G series Voice coding standards, MPEG audio Coders. (8L)

Module V

Video Representation and Compression: Video Compression Principles, Frame types, Motion estimation and Compression, Implementation Issues, Performance, Characteristics of Digital Video, Streaming Video, Combining sound and Pictures, H.261 Video Compression Standard, H.263, Digitisation Formats, Motion Pictures Experts Group (MPEG), MPEG-1, MPEG-2, MPEG-4, Audio and Video Compression. (8L)

Head of Department

Text Books:

Andleigh&Thakrar, "Multimedia", PHI, New Delhi, 2004.(T1)
Buford J. K. , "Multimedia Systems" , Pearson Education, New Delhi, 2001.(T2)

Reference Book:

Chapman Nigel & Chapman Jenny, "Digital Multimedia", Third edition, 2009, or Second edition, John Wiley & Sons. 2004.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	2	3	2	2	3	3	2	2	3	2	2	1	1	2	2
CO2	2	3	2	2	2	3	2	1	3	2	2	1	2	2	2
CO3	3	2	3	2	3	2	2	1	2	1	2	2	1	2	2
CO4	2	3	2	2	2	3	1	1	2	1	1	1	1	1	1
CO5	2	2	2	2	1	2	2	1	1	1	1	1	1	1	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT423
Course title: **Internet of Things(IoT)**
Pre-requisite(s): IT201 Basics of Intelligent Computing
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech

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Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes

After the completion of this course, students will be:

1.	Identify the IoT Components and its capabilities
2.	Explain the architectural view of IoT under real world constraints
3.	Analyse the different Network and link layer protocols
4.	Evaluate and choose among the transport layer protocols
5.	Design an IoT application

Syllabus

Module I

Introduction to IOT

The definition of the Internet of Things, main assumptions and perspectives. Platform for IoT devices Device architectures. Conventional and renewable power sources for resource-constrained devices. Operating systems for resource-constrained devices.
(8L)

Module II

Architecture of IOT

Node structure: Sensing, Processing, Communication, Powering IOT networking: Topologies, Layer/Stack architecture, The data link layer for IoT- Wireless communication technologies. Wire communication technologies. Manet Networks.

(8L)

Module III

Communication Technologies

Introduction to ZigBee, BLE, WiFi, LTE, IEEE 802.11ah, Discuss data rate, range, power, computations/bandwidth, QoS, Service oriented protocols (COAP). Communication protocols based on the exchange of messages (MQTT). Service discovery protocols.
(8L)

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Module IV
M2M and IoT Technology Fundamentals

Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management. (8L)

Module V
The data processing for IoT

Organization of data processing for the Internet of things. Cloud computing. Fog computing. Application case studies: Smart Grid. Home Automation. Smart City.
(8L)

Text books:

Madisetti Vijay and BahgaArshdeep, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.(T1)

Raj Pethuru and Raman Anupama C., The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.(T2)

Reference books:

Vermesan Dr. Ovidiu, Friess Dr. Peter, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers.(R1)

Holler Jan, TsiatsisVlasios, Mulligan Catherine, Avesand Stefan, Karnouskos Stamatis, Boyle David, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	1	2	1	2	1	1	2	2	2	2
CO2	2	3	3	3	2	2	1	1	1	1	1	2	2	3	2
CO3	2	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO4	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2
CO5	2	3	3	3	2	1	1	2	1	1	1	3	3	2	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT424
Course title: **Internet of Things(IoT) Lab**
Pre-requisite(s): IT423 Internet of Things(IoT)
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

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Course Outcomes

After the completion of this course, students will be:

1.	Identify the IoT Components and its capabilities
2.	Explain the architectural view of IoT under real world constraints
3.	Analyse the different Network and link layer protocols
4.	Evaluate and choose among the transport layer protocols
5.	Design an IoT application

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Glowing LEDs.
   Toggling LED's.
2. **Lab Assignment No: 2**
   Transmitting a string through UART
   Controlling LEDs blinking pattern through UART.
3. **Lab Assignment No: 3**
   Echo each character typed on HyperTerminal
   Digital IO configuration.
   Timer based LED Toggle.
4. **Lab Assignment No: 4**
   Scanning the available SSID's in the range of Wi-FI Mote.
   Connect to the SSID of choice
5. **Lab Assignment No: 5**
   Demonstration of a peer to peer network topology.
   check the connectivity to any device in the same network.
6. **Lab Assignment No: 6**
   Send hello world to TCP server existing in the same network
   Reading of atmospheric pressure value from pressure sensor.
7. **Lab Assignment No: 7**
   I2C protocol study
   Reading Temperature and Relative Humidity value from the sensor.
   Reading Light intensity value from light sensor.
8. **Lab Assignment No: 8**
   Proximity detection with IR LED.
   Generation of alarm through Buzzer.
9. **Lab Assignment No: 9**
   Timestamp with RTC
   IO Expander.
   Relay control.

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10. **Lab Assignment No: 10**
    I2C based 12-channel ADC
    EEPROM read and write
11. **Lab Assignment No: 11**
    Transmitting the measured physical value from the UbiSense Over the Air.

Text books:

Madisetti Vijay and BahgaArshdeep, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.(T1)

Raj Pethuru and Raman Anupama C., The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.(T2)

Reference books:

Vermesan Dr. Ovidiu, Friess Dr. Peter, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers.(R1)

Holler Jan, TsiatsisVlasios, Mulligan Catherine, Avesand Stefan, Karnouskos Stamatis, Boyle David, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	1	2	1	2	1	1	2	2	2	2
CO2	2	3	3	3	2	2	1	1	1	1	1	2	2	3	2
CO3	2	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO4	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2
CO5	2	3	3	3	2	1	1	2	1	1	1	3	3	2	2

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COURSE INFORMATION SHEET

Course code: CS420
Course title: Advanced Data Structures
Pre-requisite(s): CS201 Data structure
Co-requisite(s):
Credits: L:3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To understand the concepts of advanced data structure.
2.	To explore the different applications of advanced data structure.
3.	To understand the concept of Amortized Analysis.
4.	To explore the idea of Adaptive Data Structures.
5.	To understand the concepts of advanced tree structures.

Course Outcomes
After the completion of this course, students are expected to

1.	Develop programs that effectively used various advanced data structures.
2.	Apply mathematical foundations in the modelling of computer-based systems in a Way that demonstrates comprehension of the trade-offs involved in design.
3.	Develop programs using priority queues and other variations of queues.
4.	Demonstrate the usage of advanced optimal trees and heaps.
5.	Develop programs using advanced algorithms in graph theory.

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Syllabus

Module I
List, Iterator ADTs and Maps: The Lists ADT, Array Lists, Positional Lists, Iterators, Sorting a Positional List. Maps, Sorted Maps, Hash Tables and Skip Lists, Sets, Multisets and Multi Maps. (8L)

Module II
Balanced Search Trees: Height-Balanced Trees, Weight-Balanced Trees, (a-b) and B-Trees, Red-Black Trees and Trees of Almost Optimal Height, Trees with Partial Rebuilding: Amortized Analysis, Splay Trees: Adaptive Data Structures. (9L)

Module III
Heaps: Balanced Search Trees as Heaps ,Array-Based Heaps, Heap-Ordered Trees and Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps, Heap-Related Structures with Constant-Time Updates. (9L)

Module IV
Priority Queues: Priority Queue Abstract Data Type, Implementing a Priority Queue, Sorting with a Priority Queue, Adaptable Priority Queue.
(7L)

Module V **Graph**
Algorithms: Graphs, Data Structures for graphs, Graph Traversals, Directed Acyclic

Graphs, Shortest Paths, Minimum Spanning Trees. (7L)

Text books:

Brass Peter,"Advanced Data Structures", 1st Edition,Cambridge University Press, 2008. (T1)
Goodrich Michael T., TamassiaRoberto, GoldwasserMichaelH.,"Data Structures and Algorithms in Java".6th Edition, Wiley Publication, 2014. (T2)

Reference books:

Horwitz, Sahni, Anderson-Freed, "Fundamentals of Data Structures in C", University Press, 2008. (R1)

Cormen T. H.,Lieserson C. E., Rivest R. L., and Stein C., "Introduction to Algorithms", 3rd Edition, MIT Press, 2009. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	2	1	3	2	3	1	1	1	2	3	1	
2	3	3	2	3	3	1	1	2	2	3	1	
3	2	2	2	2	3	1	1	1	1	3	1	
4	3	2	1	1	1	3	3	3	1	1	1	
5	2	1	3	1	2	1	1	1	2	3	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS421
Course title: **Parallel Computing**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Learn different types of parallelisms achieved over different computer models

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2.	Write parallel algorithms (and programs) for computer problems
3.	Map parallel algorithms from architecture to architecture
4.	Identify the issues in concurrency control

Course Outcomes
After the completion of this course, students will be able to:

1.	Understand the need of concurrent execution of problems
2.	Reduce the issues of concurrency control
3.	Map the parallel algorithm from organization to organization
4.	Make familiar with a range of parallel algorithms on different architectures.
5.	Apply the concept parallelism in solving the problems of different domains

Module I
Introduction: Parallel Processing Environment- Pipelining and Data Parallelism, Flynn's Taxonomy, Speedup, Scaled Speedup, Analysing parallel algorithms, P-RAM Algorithms. (8L)

Module II
Processor Array, MIMD: Multiprocessors (shared) and Multi-computers (distributed), Networks(Processor organizations):Static and dynamic Interconnection Networks, Message Transferring procedures.
(8L)

Module III
Mapping and Scheduling, Dynamic Load Balancing on Multi-computers, Static Scheduling on UMA Multiprocessors, Parallel Programming model using process and thread, Deadlock and Synchronization issues. (8L)

Module IV
Elementary Parallel Algorithm: Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors, Algorithms for Multi-computers. (8L)

Module V
Solving set of linear equations: Gaussian Elimination, The Jacobi Algorithm, Finding roots of non-linear equations, Sorting algorithms: Enumeration Sort, ODD-

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EVEN Transposition sort, BITONIC Merge, Quicksort Based Algorithms, Graph Algorithms. (8L)

Text books:

Quin M. J., "Parallel Computing: Theory and Practice", McGraw Hill, New York, 1994.(T1)

Reference books:

Akl Selim G., "The Design and Analysis of Parallel Algorithms", Prentice Hall International. (R1)

Sasikumar M., Shikhare D. and Prakash P. Ravi, "Introduction to Parallel Processing", PHI, 2006. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	1	1	3	2	2	3	2	1	2	3	2	2	3	3	2
CO2	3	2	3	3	2	1	1	1	2	3	2	2	3	3	2
CO3	1	1	2	3	1	2	2	1	3	3	2	3	2	1	3
CO4	2	2	2	3	3	2	3	1	3	2	2	1	2	3	2
CO5	3	2	2	2	2	1	2	1	3	2	2	1	1	1	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS422
Course title: **Parallel Computing Lab**
Pre-requisite(s): Cs421 Parallel Computing
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To describe benefits and applications of parallel computing.
2.	Explain architectures of multicore CPU, GPUs and HPC clusters, including the key concepts in parallel computer architectures, e.g. shared memory system, distributed system, NUMA and cache coherence, interconnection
3.	Understand principles for parallel and concurrent program design, e.g. decomposition of works, task and data parallelism, processor mapping, mutual exclusion, locks.
4.	write programs that effectively use parallel collections to achieve performance.
5.	To use large scale parallel machines to solve problems as well as discuss the issues related to their construction and use.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Reason about task and data parallel programs.
CO2	Express common algorithms in a functional style and solve them in parallel.
CO3	To analyse a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
CO4	Write parallel program using OpenMP, CUDA, MPI programming models.
CO5	Perform analysis and optimization of parallel program.

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SYLLABUS

List of Programs as Assignments:

23. Lab Assignment No: 1

Objective: To understand and Implement basic MPI program.

Q1. Write a program that uses MPI and has each MPI process print 'Hello world from process i of n' using the rank in MPI_COMM_WORLD for i and the size of MPI_COMM_WORLD for n.

Q2. Write a parallel program to print any input message supplied by user.

24. Lab Assignment No: 2

Objective: To Understand and Implement MPI program.

Q1. Write a parallel program to add two one dimensional arrays of size 'n'.

Q2. Write a parallel program to add two matrices of order n * n.

25. Lab Assignment No: 3

Objective: To Understand and Implement MPI program.

Q1.Write a parallel program to multiply two matrices.

Q2. Write a parallel program to multiply a matrix of order n x n by a vector of size n.

26. Lab Assignment No: 4

Objective: To Understand and Implement MPI program.

Q1. Write a parallel Program to count the no. of vowels in a text.

Q2. Write a parallel program to find the largest element of n elements.

27. Lab Assignment No: 5

Objective: To Understand and Implement MPI program.

Q1.Write a parallel program to count no. of characters, words and lines in a file.

Q2. Write a parallel program to find factorial value of an integer.

28. Lab Assignment No: 6

Objective: To Understand and ImplementMPI program.

Q1.Write a parallel program to find the transpose of a given Matrix.

Q2. Write a parallel program to implement ring topology.

29. Lab Assignment No: 7

Objective: To Understand and Implement MPI program.

Q1.Write a parallel program to find the largest and the second largest from a list of elements considering minimum no. of comparisons.

Q2. Write a parallel program to sort n elements, using any sorting technique.

30. Lab Assignment No: 8

Objective: To Understand and Implement MPI program.

Q1. Write a parallel program to solve a set of linear equations using gauss elimination method.

Q2. Write a parallel program to find the inverse of a given matrix of n*n order.

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31. Lab Assignment No: 9

Objective: To Understand and Implement MPI program.

Q1. Write a parallel program to find minimal path (minimal cost) in an undirected graph.

Q2. Write a parallel program to find roots of an equation using N-R method.

Books recommended:

TEXT BOOKS

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Introduction to Parallel Computing (2nd Edition).
2. Edition), PDF, Amazon, cover theory, MPI and OpenMP introduction Recommended: John Cheng, Max Grossman, and Ty McKercher, Professional CUDA C Programming, 1st Edition 2014.

REFERENCE BOOKS

1. Barbara Chapman, Gabriele Jost, and Ruud van der Pas, Using OpenMP: Portable Shared Memory Parallel Programming, 2007

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	1	1	1	2	3	1	2	3	2	2
CO2	3	2	2	2	2	1	1	3	2	1	1	1	3	3	2
CO3	2	2	3	3	3	2	1	1	3	3	1	2	2	2	3
CO4	2	2	3	3	3	3	2	1	2	2	1	1	2	2	2
CO5	2	2	1	1	3	3	2	1	3	3	3	1	2	3	3

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Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

COURSE INFORMATION SHEET

Course code: IT425
Course title: **Image Analysis**
Pre-requisite(s): IT307 Image Processing
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: IV
Branch: B Tech/IT

Course Objectives

This course enables the students:

1.	To understand the basic concepts for representation of an image mathematically.
2.	To know the application areas of Image analysis.
3.	To understand the basic concepts of clustering and its importance.
4.	To know the performances of different clustering algorithms.

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Course Outcomes

After the completion of this course, students will be:

1.	Identify the characteristics if images, and their mathematical formulation
2.	Analyze an image on the basis of Algorithms like clustering
3.	Applying entropy and mutual information for alignment, segmentation and Classification
4.	Evaluate hierarchical, k-means, spectral Applications for grouping in images
	Implement algorithms for analysis of images

Syllabus

Module I

Introduction to Image Analysis, Mathematical Theory for Image Representation, Subspace (Manifold) learning Theory: PCA Applications: Eigen faces, Active Shape & Active Appearance Models, kernel PCA, LLE, Basic theory of Gaussian Processes for Image analysis.
(8L)

Module II

Boundary Detection Theory: Calculus of variations Applications: Mumford-Shah functional, snakes, level sets,EM Theory: EM algorithm Applications: segmentation, tracking. Building classical shape models.
(8L)

Module III

Graph algorithms Theory: Graph cut algorithms Applications: segmentation, stereo etc Graphical Models Theory: MRFs, inference in graphical models Applications: regularization, part/layer models, time series Analysis.
(8L)

Module IV

Clustering Theory: hierarchical, k-means, spectral Applications: grouping in images Shape Descriptors Shape context, SIFT Medial axis, skeletons Transformations and their manipulation Theory: diffeomorphisms, splines Applications: shape representation, registration.
(8L)

Module V

Information Theoretic Methods Theory: entropy and mutual information Application: alignment, segmentation Classification Theory: nearest neighbor, perceptron, Fisher Linear Discriminant, SVMs, Ada Boosting Applications, fitting statistical shape models to surfaces. Can be Module Heading as: Data Analysis, Structure Analysis, EXIF Analysis, Quantization Table Analysis, Pixel Level Analysis, Global Analysis, Compression Level Analysis, Color Filter Array, DCT Analysis, Local Analysis Blocking Artifacts Analysis.
(8L)

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Text Book:

Umabaugh,S.E.,"Computer Imaging: Digital Image Analysis,"FirstEdison,CRC Press,2005.(T1)
Russ ,J. C.,"Introduction to Image Analysis," CRC Press,2008.(T2)
Basics of Image Processing and Anlysis by Kota Miura.(T3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	2	2	2	2	1	3	2	1	2	3	3	2
CO2	2	2	3	3	2	3	2	2	3	2	1	2	2	2	3
CO3	3	2	2	2	3	3	1	1	2	2	2	1	2	2	3
CO4	2	3	3	2	2	2	2	2	2	3	1	1	2	2	2
CO5	2	2	1	1	3	3	2	1	3	3	3	1	2	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course Code: CS423
Course title: **Advanced Algorithm**
Pre-requisite(s): CS206 Design and Analysis of Algorithms
Co- requisite(s): None
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

After the completion of this course, students will be able to:

1.	Understand different notions of asymptotic complexity
2.	Find about and infer the practical implications of asymptotic notations
3.	know and use basic and advanced graph algorithms
4.	Analyse the difference between the dynamic programming concept and a greedy approach.
5.	Implement, analyze, and compare algorithm.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations
2.	Determine the practical implications of asymptotic notations.
3.	Apply, analyze, and compare algorithms.
4.	Describe and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.
5.	Analyse the difference between the dynamic programming concept and a greedy approach

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Syllabus

Module I

Design Paradigms

Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.
(8L)

Module II

Theory of NP- Hard and NP-Complete Problems

P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes. (8L)

Module III

Approximation Algorithms

Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms. (8L)

Module IV

Parallel Algorithms

Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity. (8L)

Module V

Probabilistic Algorithms & Randomized Algorithms

Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems. (8L)

Text Books:

Cormen ,T.H. Leiserson ,C. E., Rivest ,R. L., and Stein,C.,"Introduction to Algorithms,"Third Edison, MIT Press,2009. (T1)
Brassard,G.,and Bratley ,P.,"Fundamentals of Algorithmics,"First Edison,Pearson,2015.(T2)
Vazirani ,V. V., "Approximation Algorithms," First Edison,Springer,2003.(T3)

Reference Books:

David ,H.,Feldman, and Yishai, "Algorithmics: The spirit of computing,"ThirdEdison,Addison Wesley,2004.(R1)
Motwani ,R., and Raghavan ,P., "Randomized Algorithms," Cambridge University Press, 1995.(R2)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	2	2	2	2	2	1	3	3	3
CO2	3	2	3	2	1	1	1	1	2	1	2	2	2	3	2
CO3	2	3	3	3	3	1	1	1	2	3	2	2	2	3	3
CO4	2	3	3	2	3	2	2	1	2	2	2	1	3	3	2
CO5	3	2	2	3	2	2	1	1	3	2	2	1	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
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COURSE INFORMATION SHEET

Course code:CS425
Course title: **Advanced Operating System**
Pre-requisite(s): CS303 Operating System
Co- requisite(s): None
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Introducing the advance concepts of modern operating systems
2.	Understand the advance concepts of modern operating systems
3.	Evaluating design choices with performance analysis
4.	Identifying thrust areas in research in operating systems

Course Outcomes
After the completion of this course, students will be able to:

1.	Illustrating various design issues in different environments
2.	Analyze various design issues in different environments
3.	Compare design choices with performance analysis
4.	Identify thrust areas in research in operating systems

Syllabus
Module I
Introduction: History, Hardware Review, Types of Operating Systems, Operating System Concepts, System Calls, Operating System Structure, Research on Operating systems. (8L)
Module II
Virtualization and Clouds: Requirements, Hypervisors, Techniques, Memory Virtualization, I/O Virtualization, Multicore CPUs, Clouds. (8L)

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Module III

Multiple Processor Systems: Multiprocessors, Multicomputers, Distributed Systems, Research on Multiple Processor Systems. (8L)

Module IV

Security: Security Problems, /controlling Access to Resources, Formal Models, Cryptography, Authentication, Exploiting Software, Attacks, Malwares, Defenses. (8L)

Module V

Operating system Design: Design Problem, Interface Design, Implementation, Performance, Trends. (8L)

Text Books:

Tanenbaum ,A. S., "Modern Operating Systems", 4th Edition, Pearson Education, 2014.(T1)

Reference Books

Stalling ,W.," Operating System: Internal and Design Principles,"8th Edition, Pearson International, 2014.(R1)

Galvin ,S., and Gagne," Operating System Concepts,"10th Edition, Wiley, 2017.(R2)

Dhamdhare, D. M.," Operating Systems," Third Edison,Tata McGraw Hill India,2012.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	3	2	1	2	2	2	1	2	3	2
CO2	2	3	3	2	3	3	3	2	2	2	2	2	3	3	2
CO3	2	3	3	3	3	2	3	1	2	2	2	1	2	3	3
CO4	3	3	2	2	2	3	2	2	3	3	3	2	2	2	3
CO5	3	3	2	2	2	3	2	2	3	3	3	2	2	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT428
Course title: **Information Retrieval**
Pre-requisite(s): Design of Algorithms
Co- requisite(s): NIL
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To understand the basic component of data retrieval.
2.	To explore the application areas of information retrieval.
3.	To understand the idea of indexing and pre-processing of data.
4.	To explore the different IR evolution techniques.
5.	To understand the concepts of Query Expansion techniques.

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Course Outcomes

After the completion of this course, students will be able to:

1.	Explain the working of a search engine and details of the individual components.
2.	Apply efficient techniques for the indexing of documents
3.	Implement various indexing, scoring, ranking and relevance feedback models and techniques for information retrieval
4.	Develop a complete IR system from scratch
5.	Evaluate and analyse the performance of a retrieval systems using a suitable test collection

Syllabus

Module I

Introduction

Introduction; Search Engine Architecture; An overview of crawling, text transformation, index creation, user interaction, ranking, link analysis, evaluation and deep web.

(8L)

Module II

Pre-processing and Indexing

Pre-processing: tokenization, stop word, normalization, stemming, wildcard queries, spelling correction – edit distance and k-gram; Indexing: Index construction; Index compression. (12L)

Module III

Scoring

Parametric and zone indexes; term frequency and weighting; vector space model; efficient scoring and ranking; vector space scoring.

(8L)

Module IV

IR Evaluation

Evaluation; Standard test collection; Evaluation of unranked and ranked retrieval; Assessing relevance; System quality and user utility. (6L)

Module V

Relevance Feedback and Query Expansion

Relevance feedback and pseudo relevance feedback; query reformulation. (6L)

Text book:

Manning, Christopher D., Raghavan Prabhakar, and SchützeHinrich, "Introduction to Information Retrieval", Cambridge: Cambridge University Press, 2008.(T1)

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Reference books:

Grossman David A., Frieder Ophir "Information Retrieval: Algorithms and Heuristics", Springer.(R1)

Croft Bruce, Metzler Donald, and Strohman Trevor "Search Engines: Information Retrieval in Practice", Pearson Education, 2009.(R2)

Ricardo Baeza-Yates and Neto Berthier Ribeiro "Modern Information Retrieval", 2nd Edition, Addison-Wesley, 2011.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	3	2	2	1	1	2	2	1	1	3	3	2
CO2	3	3	2	3	3	2	2	1	3	2	1	1	2	3	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	3
CO4	3	3	3	2	2	3	3	1	2	2	2	2	3	3	2
CO5	2	3	3	3	3	3	2	1	2	2	2	1	2	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
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COURSE INFORMATION SHEET

Course code: CS429
Course title: **Information and Coding Theory**
Pre-requisite(s): MA303 Discrete Mathematics
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the role of information theory for an efficient, error-free and secure delivery of information using binary data streams.
2.	To have a complete understanding of error-control coding.
3.	To understand encoding and decoding of digital data streams.
4.	To introduce methods for the generation of these codes and their decoding techniques.
5.	To have a detailed knowledge of compression and decompression techniques.
6	To evaluate the performance of various coding techniques over noisy communication channels

Course Outcomes

After the completion of this course, students will be:

1.	To be able to understand the principles behind an efficient, correct and secure transmission of digital data stream.
2.	To be familiar with the basics of error-coding techniques.
3.	. To have knowledge about the encoding and decoding of digital data streams.
4.	. Generation of codes and knowledge about compression and decompression techniques.
5.	. To be able to understand the performance requirements of various coding techniques.
6	. To produce professionals who will be able to conduct research in information theory.

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Syllabus

Module I

Source Coding-Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measure for Continuous Random Variables, Source coding theorem, Huffman Coding, Shannon- Fano -Elias Coding, Arithmetic Coding , The Lempel-Ziv ,Algorithm , Run Length Encoding.
And the PCX Format, Rate Distribution Function, Optimum Quantizer Design, Entropy Rate of a Stochastic Process, Introduction to Image Compression, The JPEG Standard for Lossless Compression, The JPEG Standard for Lossy Compression. (8L)

Module II

Channel Capacity and Coding- Introduction, Channel Model, Channel Capacity, Channel Coding, Information Capacity Theorem, the Shannon Limit, Channel Capacity for MIMO System, Random Selection of Code. Error Control Coding (Channel Coding). (8L)

Module III

Linear Block Codes for Error Correction- Introduction to Error Correction Codes, Basic Definitions, Matrix Description of Linear Block Codes , Equivalent Codes , Parity Check Matrix, Decoding of Linear Block Code ,Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check (LDPC) Codes , Optimal Linear Codes, Maximum Distance Separable (MDS) Codes, Bound on Minimum Distance, Space Time Block Codes.

(10L)

Module IV

Cyclic Codes- Introduction to the Cyclic Codes, Polynomials, The Division Algorithm for Polynomials ,A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Burst Error Correction , Fire Codes, Golay Codes, Cyclic Redundancy Check(CRC) Codes, Circuit Implementation of Cyclic Codes. (6L)

Module V

Bose –Chaudhuri Hocquenghem(BCH)Codes- introduction to the Codes , Primitive Elements, Minimal Polynomials, Generator Polynomials , in Terms of Minimal Polynomials, Some Examples if BCH Codes, Reed –Solomon Codes, Implementation of Reed –Solomon Encoders and Decoders, Performance of RS Codes Over Real Channels, Nested Codes.

Module VI

Convolution Codes-Introduction to the Convolution Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolution Codes(Analytical Representation), Distance Notions for Convolution Codes, The Generating Function, Matrix Description of Convolution Codes, Viterbi Decoding and Convolution Codes , Distance Bounds for Convolution Codes , Turbo Codes.

Trellis Coded ModulatioN- Introduction to TCM , The concept of Coded Modulation , Mapping by Set partitioning.

(8L)

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Text book:

Bose R., "Information theory Coding and Cryptography", 2nd Edition, McGraw-Hill, 2008. (T1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	2	1	1	1	1	1	1	1	1	3	1	1	1
2	3	2	1	1	1	1	1	1	1	1	1	2	1	2	1
3	3	2	2	1	1	1	1	1	1	1	1	2	2	2	2
4	2	3	2	2	1	1	1	1	1	1	1	1	1	2	1
5	2	2	2	3	3	2	1	1	1	1	1	1	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
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CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS430
Course title: **Information and Coding Theory Lab**
Pre-requisite(s): MA303 Discrete Mathematics
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives:

This course enables the students:

1.	To understand the role of information theory for an efficient, error-free and secure delivery of information using binary data streams.
2.	To have a complete understanding of error-control coding.
3.	To understand encoding and decoding of digital data streams.
4.	To introduce methods for the generation of these codes and their decoding techniques.
5.	To have a detailed knowledge of compression and decompression techniques.
6	To evaluate the performance of various coding techniques over noisy communication channels

Course Outcomes:

After the completion of this course, students will be:

1.	To be able to understand the principles behind an efficient, correct and secure transmission of digital data stream.
2.	To be familiar with the basics of error-coding techniques.
3.	To have knowledge about the encoding and decoding of digital data streams.
4.	Generation of codes and knowledge about compression and decompression techniques.
5.	To be able to understand the performance requirements of various coding techniques.
6	To produce professionals who will be able to conduct research in information theory.

Head of Department

Syllabus:

1. Write a program for determination of various entropies and mutual information of a given channel.
Test various types of channel such as
a) Noise free channel.
b) Error free channel
c) Binary symmetric channel
d) Noisy channel Compare channel capacity of above channels.
2. Write a program for generation and evaluation of variable length source coding using C/MATLAB (Any 2) a) Shannon – Fano coding and decoding b) Huffman Coding and decoding c) Lempel Ziv Coding and decoding
3. Write a Program for coding & decoding of linear block codes.
4. Write a Program for coding & decoding of cyclic codes.
5. Write a program for coding and decoding of convolutional codes.
6. Write a program for coding and decoding of BCH and RS codes.
7. Write a program to study performance of a coded and encoded communication system (Calculate the error probability).
8. Write a simulation program to implement source coding and channel coding for transmitting a text file.
9. Write a program to implement of any compression algorithm for either audio, image or video data

Text Book:

1. Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication, 2ndEdition
2. J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition

References:

1. BernadSklar, "Digital Communication Fundamentals & applications", 2ndEd. Pearson Education.
2. Shulin and Daniel j, Cistellojr., "Error control Coding" Pearson, 2nd Edition.
3. Todd Moon, "Error Correction Coding: Mathematical Methods and Algorithms", Wiley Publication
4. Khalid Sayood, "Introduction to data compression", Morgan Kaufmann Publishers
International Institute of Information Technology, Hinjawadi, Pune.Page 3

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	1	1	2	2	2	2	3	3	2
CO2	3	3	3	1	2	1	2	1	2	1	2	2	3	3	2
CO3	3	3	3	3	3	1	2	1	2	1	1	2	3	3	2
CO4	3	3	3	2	3	1	1	1	2	2	1	2	3	3	2
CO5	3	3	3	2	3	1	2	1	2	2	1	2	3	3	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS431
Course title: **Computational Network Analysis**
Pre-requisite(s): IT301 Data Communication and Computer Network
Co- requisite(s):
Credits: L:3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Head of Department

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Course Objectives

This course enables the students:

1.	Knowledge of basics of **Graph Theory** and their appropriate application
2.	Knowledge of basic concepts about **Regular Networks**
3.	To relate the distinct roles of **Random Networks**analytics for various applications
4.	To understand and analyse different types of networks
5.	To Understand and different analysis techniques for graph

Course Outcomes

After the completion of this course, students will be:

1.	Use mathematical principles in the study of graphs
2.	Apply the knowledge of graph theory to graphs of large size.
3.	Visualize the growth patterns of large networks
4.	Compute the various attributes that are characteristic of a large network
5.	Analyse mathematical models of large networks and evaluate their modelling capabilities.

Syllabus

Module I

Origins and Related Graph Theory: What is network science? General Principles. Set theoretic definition of a graph. Matrix algebra definition of a graph. The Konigsberg Graph. Spectral properties of graphs. Types of graphs. Topological structures. (10L)

Module II

Regular Networks: Defining regular networks, Network Characteristics - Diameter, Centrality, and Average Path Length, Binary Tree Network, Toroidal Network, Hypercube Networks. (6L)

Module III

Random Networks : Generation of Random Networks, Degree Distribution of Random Networks, Entropy of Random Networks, Properties of Random Networks, Weak Ties in Random Networks, Randomization of Regular Networks, Analysis. (8L)

Module IV

Small World Networks: Generating a Small-World Network, Properties of Small-World Networks, Phase Transition, Navigating Small Worlds, Weak Ties in Small-World Networks, Analysis. (8L)

Module V

Scale Free Networks: Generating a Scale-Free Network, Properties of Scale-Free Networks, Navigation in Scale-Free Networks, Analysis. (8L)

Text book:

Lewis T. G., "Network Science: Theory & Practice", 1st Edition, John Wiley & Sons. Inc. Publications, 2009.(T1)

Head of Department

Reference book:

Newman M., "Networks: An Introduction", 1st Edition, Oxford University Press, 2010.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
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3	3	3	3	3	2	1	1	1	1	1	3	2	2	3	3
4	3	3	3	3	2	1	1	1	1	1	3	1	1	3	1
5	3	3	3	3	2	1	1	1	1	1	3	1	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

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Head of Department

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COURSE INFORMATION SHEET

Course code: IT431
Course title: Emerging Storage Technologies
Pre-requisite(s): CS301 Database Management System
Credits: L:3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	An understanding of personal, professional and ethical responsibility.
2.	An ability to communicate effectively both in an oral and written form.
3.	Recognition of the need for, and an ability to engage in lifelong learning.
4.	Knowledge of contemporary issues in computer engineering.
5.	An ability to use the techniques, skill and modern engineering tools necessary for computer engineering practice.

Course Outcomes:

After the completion of this course, students will be able to:

1	Understand various storage classifications and technologies
2	Analyse storage architectures, processes, components, topologies, connectivity options and zoning.
3	Evaluate different virtualization technologies related to storage solution.
4	Justify the implementation of a range of storage solutions to enable business continuity.
5	Analyse storage security design, implementation, monitoring and management.

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Syllabus:

Module I Data Storage Fundamentals:

Introduction to enterprise IT infrastructure components, server-storage connectivity, virtualization technologies: Block-level and file-level storage virtualization technology, virtual provisioning and cloud computing, storage devices such as magnetic disk drive and solid state drive, and the factors to consider for storage investment.

(8L)

Module II

Storage System:

Data Classification, Storage Evolution and Data Center infrastructure. Host components, Connectivity, Storage, and Protocols. RAID level performance and availability considerations. Components and benefits of an intelligent storage system.

(8L)

Module III

Storage Networking Technology

Direct-Attached Storage (DAS)architecture, Storage Area Network (SAN) attributes, components, topologies, connectivity options and zoning. FC protocol stack, addressing, flow control, and classes of service. Networked Attached Storage (NAS)components, protocols, IP Storage Area Network (IP SAN) iSCSI, FCIP and FCoE architecture. Content Addressed Storage (CAS) elements, storage, and retrieval processes.

(10L)

Module IV

Business Continuity:

Business Continuity measurement, terminologies, and planning. Backup designs, architecture, topologies, and technologies in SAN and NAS environments. Local and Remote replication using host and array-based replication technologies such as Synchronous and Asynchronous methods.

(7L)

Head of Department

Module V

Storage security and Management:

Storage security framework and various security domains. Security implementation in SAN, NAS and IP-SAN networking. Monitoring and Storage management activities and challenges. (7L)

Text Books:

EMC, "Information Storage and Management", 2nd Edition, Wiley [ISBN: 978-0470294215], 2012.(T1)
Barker Richard, Massiglia Paul, "Storage Area Network Essentials", Wiley New York [ISBN: 978-0471034452] 2002.(T2)

Reference Books:

Troppens Ulf, Erkens, Rainer, Friedt Wolfgang Mueller, Wolafka Rainer, Haustein Nils, "Storage Networks Explained" ,2nd Edition, Wiley[ISBN: 978- 0470741436], 2009.(R1)

Preston W. Curtis, "Using SANs and NAS", O'Reilly & Associates Sebastopol, Calif. [ISBN:
978-0596001537], 2002. (R2)

Dwivedi Himanshu, "Securing Storage", Addison-Wesley Upper Saddle River, NJ [ISBN: 978-0321349958], 2006.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	3	3	3	2	3	1	2	2	3	3	1	3	2
2	3	3	2	2	3	1	3	1	3	3	3	2	1	3	1
3	2	3	1	3	1	3	3	3	3	1	3	2	2	3	3
4	3	3	1	3	1	1	1	1	2	2	3	2	1	3	1
5	1	3	3	1	3	1	1	3	2	1	3	3	1	2	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT433
Course title: **Computer Vision**
Pre-requisite(s): CS327 Computer Graphics
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: IV
Branch: B Tech/IT

Course Objectives

This course enables the students:

1.	Be familiar with both the theoretical and practical aspects of computing with images.
2.	Have described the foundation of image formation, measurement, and analysis.
3.	Understand the geometric relationships between 2D images and the 3D world.
4.	Grasp the principles of state-of-the-art deep neural networks

Course Outcomes

After the completion of this course, students will be able to:

1.	Developed the practical skills necessary to build computer vision applications.
2.	To have gained exposure to object and scene recognition and categorization from images.
3.	Develop algorithm for classification and clustering.
4.	Illustrate the techniques of feature extraction and analysis.
5.	Apply in different engineering application such activity recognition, computational photography, biometrics.

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Syllabus

Module I Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis. (8L)

Module II

Edge detection, Edge detection performance, Hough transform, corner detection. (8L)

Module III

Segmentation, Morphological filtering, Fourier transforms Feature extraction, shape, histogram, color, spectral, texture, using CVI Ptools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing.
(8L)

Module IV

Pattern Analysis:
Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminate Function, Supervised, Un-supervised, Semi supervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods. (8L)

Module V

Recent trends in Activity Recognition, computational photography, Biometrics. (8L)

Text Books:

Szeliski , R.," Computer Vision: Algorithms and Applications,"Springer,2011.(T1)
Goodfellow, Bengio, and Courville,"Deep Learning," First Edison.MIT Press,2016.(T2)
Fisher,R.B.,Breckon,T. P. , Dawson-Howe,K,Fitzgibbon,A , Robertson,C., Trucco,E. , Williams,C. K. I., "Dictionary of Computer Vision and Image Processing," Second Edison,Wiley,2014.(T3)

Reference Book:

Forsyth,D.A.,Ponce,J.,"Computer Vision A Modern Approach," Second Edison, Pearson Education,2015.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	1	1	2	1	1	3	2
2	2	3	3	1	1	1	1	1	1	1	1	2	1	3	1
3	2	3	2	3	3	1	1	1	1	1	1	3	2	3	3
4	3	1	1	1	2	1	1	2	1	1	1	2	1	3	1
5	2	2	1	2	3	1	1	1	1	3	1	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS436
Course title: **High Performance Computing**
Pre-requisite(s): CS421 Parallel Computing
Co- requisite(s):
Credits: L:3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic component of Parallel Computer Models.
2.	To explore the application areas of Parallel Computer.
3.	To understand the idea of Processors and Memory Hierarchy.
4.	To explore the different IR evolution techniques.
5.	To understand the concepts of Multithreaded and Data Flow Architecture.

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Course Outcomes

After the completion of this course, students will be:

1.	Demonstrate different terminologies in High Performance Computer Architecture.
2.	Demonstrate and Implement the concepts of High Performance Computer Architecture
3.	Compare and differentiate the different parallel architectures in terms of various parameters.
4.	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
5.	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

Syllabus

Module I

Parallel Computer Models : The State of Computing, Multiprocessors and Multicomputer, Multifactor and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures. (8L)

Module II

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. (8L)

Module III

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

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Module IV

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear Pipeline Processor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design **Multiprocessors and Multicomputers:** Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.
(8L)

Module V

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5 **Scalable, Multithreaded and Data Flow Architecture:** Latency-Hiding Techniques, Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.
(8L)

Text Book:

Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010. (T1)

Reference Book:

Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA. (R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	2	1	1	1	1	3	2
2	2	3	1	1	1	2	2	1	1	1	2	1	1	2	1
3	2	3	3	3	3	1	1	1	2	2	1	2	2	3	3
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	2
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS437
Course title: **High Performance Computing Lab**
Pre-requisite(s): CS430 High Performance Computing
Co- requisite(s):
Credits: L:0 T:0 P:3
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Learn the concepts of parallel processing as it pertains to high performance computing.
2.	Learn to design parallel programs on high performance computing.
3.	Discuss issues of parallel programming.
4.	Learn the concepts of Multi-core processor.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Memorize parallel processing approaches.
CO2	Describe different parallel processing platforms involved in achieving High Performance Computing.
CO3	Discuss different design issues in parallel programming.
CO4	Design algorithms suited for Multicore processor and GPU systems using.
CO5	Learn parallel programmingusing message passing paradigm using open source APIs.

SYLLABUS

List of Programs as Assignments:

Lab Assignment No: 1

Objective:

Q1. To study the basic commands of linux.

Lab Assignment No: 2

Objective:

Q1. To establish Beowulf Cluster using MPI(Message Passing Interface) Library.

Lab Assignment No: 3

Objective:

Q1.Installation and configuration of Alchemi Grid.

Lab Assignment No: 4

Objective:

Q1. Running a sample application on Alchemi Grid and analysing it. 5

Lab Assignment No: 5

Objective:

Q1.To study a Grid Simulation Toolkit.

Lab Assignment No: 6

Objective:

Q1. To run two sample programs using GridSim Toolkit.

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Lab Assignment No: 7

Objective:

Q1.To study a Cloud Simulation Toolkit.

Books recommended:

TEXT BOOKS

1. Computer Architecture: Pipelined and Parallel Processor Design by M J Flynn.

REFERENCE BOOKS

1. Computer Architecture: A Quantitative Approach" by John L Hennessy and David A Patterson.

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	2	1	1	1	1	3	2
2	2	3	1	1	1	2	2	1	1	1	2	1	1	2	1
3	2	3	3	3	3	1	1	1	2	2	1	2	2	3	3
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	2
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	3

COURSE INFORMATION SHEET

Course code: IT402
Course title: **. NET Programming**
Pre-requisite(s): Nil
Co- requisite(s):
Credits:L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To study basic and advanced features of the C# language
2.	To create form based and web based applications
3.	To study the internals of the .NET framework
4.	To know and study about the Common Language Runtime (CLR) and Common Language Infrastructure (CLI)

Course Outcomes

After the completion of this course, students will be able to:

1.	Install and configure Dot Net application development tools.
2.	develop, implement and creating Applications with C#
3	develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web
4.	explain Security in the .NET framework and Deployment in the .NET.
5.	develop Assemblies and Deployment in .NET, Mobile Application Development.

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Syllabus

Module I

C# basics

C# and the .NET framework – C# basics – Objects and types – Inheritance –Arrays – Operators and casts – Indexers.

(8L)

Module II

Advanced C# features

Delegates and events – Strings and regular expressions – Generics – Collections–Memory management and pointers – Errors and exceptions. (8L)

Module III

I/O and network programming

Tracing and events - threading and synchronization - .Net security – localization –Manipulating XML - Managing the file system – basic network programming. (8L)

Module IV

Window and web applications

Window based applications – Data access with .NET – basics of ASP .NET -Introduction to web services. (8L)

Module V

.NET Features

Architecture – Assemblies – shared assemblies – CLR hosting – Appdomains –Reflection. (8L)

Text Books:

Nagel,C. , Evjen,B. , Glynn,J. , Watson,K. , and Skinner,M.,"Professional C# 4 with .NET 4," Wiley India, 2010.(T1)

Liberty ,J., and MacDonald ,B., "Learning C# 3.0," First Edition ,O'Reilly, 2008.(T2)

References Book:

Troelson ,A., "Pro C# 5.0 and the.NET 4.5 Framework," Sixth Edition, Apress,2012.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	2	2	3	2	1	1	1	1	1	3	3	1	1	1
2	1	3	3	3	2	2	2	1	1	1	3	2	1	3	1
3	1	3	3	3	2	1	1	1	1	1	3	2	2	3	3
4	2	3	3	3	2	2	2	2	1	1	3	1	1	3	1
5	2	3	3	3	2	1	1	1	1	1	3	1	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT434
Course title: **Mobile Computing**
Pre-requisite(s): Nil
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level:IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Understand basic mobile network concepts and its architectures.
2.	Know Protocols like mobile telephony and introduce to the concepts of bluetooths etc.
3.	Comprehend the GSM architectures and its features that support mobile communications.
4.	Understand the network management and Middleware services used in Ip and Mobile telephony
5.	Get accustomed to the concepts like GPRS, 3G, 4G networks

Course Outcomes

After the completion of this course, students will be to:

1.	Identify the role of cellular networks in Mobile and Pervasive Computing
2.	Analyse about the basic architecture for a pervasive computing environment
3.	Assess the principles for routing and allocating the resources on the 3G-4G wireless network
4.	Evaluate mobile computing applications based on the paradigm of context aware computing
5.	Design and elaborate applications in mobile and pervasive computing environment

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Syllabus

Module I

Introduction: Mobility of bits and bytes, wireless the beginning, mobile computing, dialogue control, Networks, middleware and gateways, application and services, developing mobile computing applications, security in mobile computing, standard bodies. Mobile Computing Architecture: architecture for mobile computing, three tier architecture, design consideration, mobile computing through internet, making existing applications –mobile enabled. (8L)

Module II

Mobile Computing through Telephony: evolution of telephony, multiple access procedures, mobile computing through telephone, developing an IVR application, voice XML, telephone application programming interface. Emerging Technologies: introduction, Bluetooth, radio frequency identification, wireless broadband, mobile IP, IPV6, java card. (10L)

Module III

Global System for Mobile Communications GSM: introduction, GSM architecture , call routing in GSM, PLMN interface, GSM address and identifiers, network aspect in GSM, GSM frequency allocation, authenticity and security. Short Message Service SMS : Mobile computing over SMS, Short message services(SMS) , value added services through SMS, Accessing the SMS bearer. (8L)

Module IV

General Packet Radio Service GPRS:GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, applications for GPRS, limitations for GPRS, billing and charging in GPRS. Wireless Application Protocol WAP: introduction , WAP, MMS, GPRS applications.CDMA and 3G

Client Programming: introduction, moving beyond the desktop, a peak under the hood: hardware overview, mobile phone, PDA, design constraints in application for handheld devices. (10L)

Module V

Voice Over Internet Protocol and Convergence: VoIP, H 323 framework for VoIP 564, SIP, comparision between H.323 and SIP 570, Real time protocol, convergence technologies, call routing, voice over IP applications, IP multimedia subsystem, Mobile VoIP. (8L)

Head of Department

Text Book:

Talukedar ,A., Ahmed ,H., and Yavagal ,R. R," Mobile Computing Technology , Applications and Service Creation," Tata McGraw - Hill Education ,2010.(T1)

Reference Book:

Schiller ,J. H.," Mobile Communications," Second Edition, Addison Wesley, .(R1)
Rajkamal," MobileComputing, "Second Edison, Oxford University Press.(R2)

Behravanfar ,R.,"Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML," Cambridge University Press, 2004. (R3)

Adelstein, Frank, Gupta, Sandeep K.S.," Richard III, Golden ,Schwiebert, Loren, Fundamentals of Mobile and Pervasive Computing," McGraw-Hill Professional, 2005. (R4)Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing," Second Edison, Springer, 2003. (R5)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	1	1	2	1	1	3	2
2	2	3	3	1	1	1	1	1	1	1	1	2	1	3	1
3	2	3	2	3	3	1	1	1	1	1	1	3	2	3	3
4	3	1	1	1	2	1	1	2	1	1	1	2	1	3	1
5	2	2	1	2	3	1	1	1	1	3	1	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT430
Course title: **Machine Learning Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: 4
Branch: CSE/IT

Course Objectives:

This course enables the students:

A.	Make use of Data sets in implementing the machine learning algorithms
B.	To choose the appropriate machine learning design method for a specified application.
C.	Implement the machine learning concepts and algorithms in any suitable language of choice.
D.	Analyze and compare the different algorithms

Course Outcomes:

After the completion of this course, students will be able to:

1.	Gain knowledge about basic concepts of Machine Learning
2.	Identify machine learning techniques suitable for a given problem
3.	Solve the problems using various machine learning techniques
4.	Apply Dimensionality reduction techniques
5	Design application using machine learning techniques.

Syllabus:

1. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

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4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct aBayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Text Books:

Floreano, D. and Mattiussi, C., "Bio-Inspired Artificial Intelligence", MIT Press, 2008. (T1)
Neumann, F. and Witt, C., "Bioinspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010. (T2)
Elben, A. E. and Smith, J. E., "Introduction to Evolutionary Computing", Springer, 2010.(T3)
Goldberg, D. E., "Genetic algorithms in search, optimization, and machine learning", Addison- Wesley, 1989.(T4)
Haykin, Simon O., "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.(T5)

Reference Books:

Dorigo, M. and Stutzle, T., "Ant Colony Optimization", A Bradford Book, 2004.(R1)
Ebelhart, R. C. et al., "Swarm Intelligence", Morgan Kaufmann, 2001.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	3	2	1	1	2	1	2	3	3	2
CO2	3	3	2	3	3	3	2	1	1	1	1	2	3	2	2
CO3	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2
CO4	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3
CO5	3	3	3	3	3	3	3	1	1	2	1	2	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS494
Course title: Big Data Analytics
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To provide an overview of approaches facilitating data analytics on huge datasets in different domain.
2.	To provide the knowledge on NoSQL and different partitioning method to handle large datasets.
3.	To provide an overview of Apache Hadoop and HDFS Concepts and Interfacing with HDFS
4.	To understand Map Reduce Jobs in Hadoop framework
5.	To provide the knowledge of various Hadoop based tool for processing large datasets.

Course Outcomes
After the completion of this course, students will be able to:

1.	Describe big data and use cases from selected business domains
2.	Explain NoSQL big data management
3.	Install, configure, and run Hadoop and HDFS
4.	Perform map-reduce analytics using Hadoop
5.	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

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Syllabus

Module I

Introduction

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics. (8L)

Module II

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations. (8L)

Module III

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures. (8L)

Module IV

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats. (8L)

Module V

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries. (8L)

Text Books:

Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.(T1)
P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.(T2)
Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.(3)

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Reference Books:

Sammer ,E., "Hadoop Operations," O'Reilley, 2012.(R1)
Capriolo ,E., Wampler ,D., and Rutherglen ,J., "Programming Hive," O'Reilley, 2012.(R2)
George ,L., "HBase: The Definitive Guide," O'Reilley, 2011.(R3)
Gates ,A., "Programming Pig," O'Reilley, 2011.(R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	1	1
CO2	2	2	2	2	3	1	1	1	2	2	2	2	2	2	3
CO3	2	2	2	1	3	2	2	2	3	2	1	2	3	2	3
CO4	3	2	3	2	3	2	2	2	2	2	2	2	3	3	3
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS495
Course title: Big Data Analytics Lab
Pre-requisite(s): CS494 Big Data Analytics
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To implement MapReduce programs for processing big data
2.	To realize storage of big data using H base, Mongo DB
3.	To analyze big data using linear models
4.	To analyze big data using machine learning techniques such as SVM Decision tree classification and clustering

Course Outcomes

After the completion of this course, students will be able to:

CO1	Process big data using Hadoop framework
CO2	Build and apply linear and logistic regression models
CO3	Perform data analysis with machine learning methods
CO4	Perform graphical data analysis
CO5	Simulate basic Engineering problems

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SYLLABUS

List of Programs as Assignments:

Lab Assignment No: 1

Objective:

Q1. To draw and explain Hadoop Architecture and Ecosystem with the help of a case study using WorkCount example. To define and install Hadoop.

Lab Assignment No: 2

Objective:

Q1. To implement the following file management tasks in Hadoop System (HDFS): Adding files and directories, Retrieving files, Deleting files

Lab Assignment No: 3

Objective:

Q1.To run a basic Word Count MapReduce program to understand MapReduce Paradigm: To count words in a given file, to view the output file, and to calculate execution time.

Lab Assignment No: 4

Objective:

Q1. Implement word count / frequency programs using MapReduce

Lab Assignment No: 5

Objective:

Q1.To study and implement basic functions and commands in R Programming.

Lab Assignment No: 6

Objective:

Q1. To implement Bloom Filters for filter on Stream Data in C++/java.

Lab Assignment No: 7

Objective:

Q1.To implement Bloom Filters for filter on Stream Data in C++/java.

Lab Assignment No: 8

Objective:

Q1.To implement clustering program using R programming.

Lab Assignment No: 9

Objective:

Q1. Visualize data using any plotting framework

Lab Assignment No: 10

Objective:

Q1.Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

Head of Department

Books recommended:

TEXT BOOKS

VigneshPrajapati, "Big Data Analytics with R and Hadoop", Packet Publishing

REFERENCE BOOKS

1. Tom White, "Hadoop: The Definitive Guide", Second Edition, O'Reilly Yahoo Press
2. Robert D. Schneider, "Hadoop for Dummies", Wiley.

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	1	1
CO2	2	2	2	2	3	1	1	1	2	2	2	2	2	2	3
CO3	2	2	2	1	3	2	2	2	3	2	1	2	3	2	3
CO4	3	2	3	2	3	2	2	2	2	2	2	2	3	3	3
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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COURSE INFORMATION SHEET

Course code: CS490
Course title: **3D Simulation**
Pre-requisite(s): CS327 Computer Graphics
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch:

Course Objectives
This course enables the students to:

1.	To understand the basic concepts of 3D simulation.
2.	To learn the application of 3D simulation to solve real world problems.
3.	To explore the utilities of collision detection.
4.	To able to analyze a problem using animation and a model.

Course Outcomes
After the completion of this course, students will be able to:

1.	Develop 3D models and simulate for real application.
2.	Learn the tools for 3D simulation.
3.	Apply in real cases and analysis
4.	Solve real cases through computer simulation
5.	Develop an algorithm to identify collision.

Syllabus
Module I:
Rendering pipeline, Vectors, Matrices, and Transforms. (8L)
Module II:
Geometry for 3D, Ray Tracing, Lighting and Shading, Visibility Determination. (8L)

Module III:
Polygonal Techniques, Shadows, Curves and Surfaces, Collision Detection. (8L)

Module IV:
Linear Physics, Kinds of Simulation, Intermediate Modeling, Model Data, Animation. (8L)

Module V:
Case Studies for Health, Transport, Defense, Game, Science Simulation. (8L)

Head of Department

Text Books:

Mathematics for 3D Game programming and Computer Graphics, Eric Lengyel Third Edition, Cengage Learning.(T1)
3D Math Premier for Graphics and Game Development, by Flecher Dunn, Ian Parberry, WordwarePublishing.(T2)

References:

Simio and Simulation: Modeling, Analysis, Applications Fourth Edition Jeffrey S. Smith (Auburn University) David T. Sturrock (Simio LLC) W. David Kelton (University of Cincinnati), Published by Simio.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Head of Department

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	2	3	1	1	1	2	2	1	2	3	2	2
CO2	2	2	2	2	3	1	1	1	2	2	2	2	2	2	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2	3	2	3
CO4	3	3	3	3	3	2	2	2	2	2	1	2	3	2	3
CO5	3	3	3	3	2	2	2	2	2	2	3	3	3	2	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
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COURSE INFORMATION SHEET

Course code: CS493
Course title: **GP-GPU Programming**
Pre-requisite(s): Operating System
Co- requisite(s): None
Credits: L: 3 T: 0 P: 0
Class schedule per week: 03
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Identify the different kinds of parallel models used in computing
2.	Identify common programming constructs used in parallel programming.
3.	Understand the basic hardware of GP-GPUs.
4.	Visualize the concepts of grids, blocks and threads in GPU computing.
	Understand the different memory types available in GPU programming.

Course Outcomes
After the completion of this course, students will be able to:

1.	Identify the various components that go into the making of GPUs.
2.	Describe the compute capabilities of a GPU based system.
3.	Formulate logic in multiple dimensions to solve problems using GPUs.
4.	Utilize the various memory modules available in GPU.
5.	Measure the gain in performance between CPUs and GPUs.

Head of Department

Syllabus

Module I: A Short History of Supercomputing
Introduction, Von Neumann Architecture, CrayConnection Machine, Cell Processor, Multinode Computing, The Early Days of GPGPU Coding, The Death of the Single-Core Solution, NVIDIA and CUDAGPU Hardware, Alternatives to CUDA,:OpenCL,DirectCompute,CPU alternatives, Directives and libraries. (8L)

Module II: Understanding Parallelism with GPUs
Introduction, Traditional Serial Code, Serial/Parallel Problems, Concurrency, Locality, Types of Parallelism, Task-based parallelism, Data-based parallelism, Flynn's Taxonomy, Some Common Parallel Patterns, Loop-based patterns, Fork/joinpattern, Tiling/grids, Divide and conquer. (8L)

Module III: CUDA Hardware
Overview, PC Architecture, GPU Hardware, CPUs and GPUsCompute Levels, Characteristics of different compute levels. (8L)

Module IV: Grids, Blocks, and Threads
What it all Means, Threads, Problemdecomposition, How CPUs and GPUs are different, Task execution model, Threading on GPUs, A peek at hardware, CUDA kernels, Blocks, Block arrangement, Grids, Stride and offset, X and Y thread indexes, Warps, Branching, GPUutilization, Block Scheduling. (8L)

Module V: Memory Handling with CUDA
Introduction, Caches, Types of data storage, RegisterUsage, Shared Memory, Sorting using shared memory, Radix sort, Merging lists, Parallel merging, Parallelreduction, A hybridapproach, Shared memory on different GPUs, Shared, Constant Memory, Constant memorycaching, Constant memory broadcast, Constant memory updates at runtime, Global Memory, Scoreboarding, Global memory sorting, Sample sort, Texture Memory, Texture caching, Hardware manipulation of memory fetches.
(8L)

Text Book:

Cook S., "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs," First Edition, Morgan Kauffman, 2013.(T1)

Reference Books:

Kirk W. B., Hwu W. W., "Programming Massively Parallel Processors", Second Edition, Morgan Kauffman, 2013.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	1	3	1	1	1	1	1	1	2	3	1	1
CO2	2	3	2	2	3	1	2	1	2	1	1	2	2	2	2
CO3	3	3	3	3	3	1	2	1	1	2	2	2	3	3	2
CO4	3	3	3	2	3	1	1	1	2	2	2	2	2	2	3
CO5	3	3	2	3	3	1	1	1	2	2	2	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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Syllabus BE IT CBCS

COURSE INFORMATION SHEET

Course code: BE101
Course title: Biological Science for Engineers
Pre-requisite(s): NIL
Co- requisite(s): NIL
Credits: 2 L:2 T:0 P:0
Class schedule per week: 02
Class: B. Tech
Semester / Level: III-IV /First
Branch: All
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Recognize and understand the basic cell biology, biomolecules, related metabolic pathways and applicable bioenergetics.
2.	Relate common biological phenomenon at molecular level.
3.	Describe the chemical nature of enzymes and mechanism of action for their function in biochemical reactions.
4.	Correlate the molecular methods of biological signal generation and propagation in living system.
5.	Comprehend the steps involved in common application of biotechnology such as applicable for creation of transgenics, stem cells, plant metabolites production, PCR, ELISA.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate an understanding of fundamental biochemical principles, such as the structure/function of biomolecules involved in living system.
CO2	Interpret the bio mechanism involved in signal generation and transmission.
CO3	Correlate the basic methods involved in common biotechnological application.
CO4	Apply and effectively communicate scientific reasoning and data involved in common biotechnological applications.

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BE101 Biological Science for Engineers

Credit:2

Module-1:
Basic Cell Biology: Origin of life, Cell theory, Cell Structure and function, Biomolecules, Cell cycle and cell division, Biological Organization. **[5L]**

Module-2:
Bioenergetics and Metabolism: Gibbs free energy and thermodynamics, aerobic and anaerobic respiration, Glycolysis, Krebs cycle and electron transport chain, Beta oxidation, Photosynthesis. **[6L]**

Module-3:
Enzymes and its Application: Classification of enzymes, Structure and mechanism of enzyme action and uses of enzymes, factors affecting enzyme activity, Immobilization of enzymes and their application. **[5L]**

Module-4:
Biological Signal Generation and Propagation: Nerve cell structure and signal propagation. Mechanism of vision and hearing, cell signaling, Circadian rhythm. **[6L]**

Module-5:
Engineering Biological Systems and its Applications:
Central dogma of molecular biology, Methods in genetic engineering and application, PCR, ELISA and its application, stem cell and tissue engineering. Artificial Intelligence in Biology, Plant factory. **[6L]**

Books Recommended
Recommended Text Book
1. Purves et al, (1998) Life: *The Science of Biology*, 4th Ed.
2. R. Dulbecco, The Design of Life.
3. Lehninger A, Principals of Biochemistry , 5th Ed

Reference Book

1. Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman.
2. K. Wilson & K.H. Goulding, (2006) *A biologist's guide to Principles and Techniques of Practical Biochemistry*.

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Head of Department

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End Sem Examination Marks	50
Assignment / Quiz (s)	10+10
Teacher's Assesment	5

Assessment Components	CO1	CO2	CO3	CO4
Mid Sem Examination Marks	√	√	√	√
End Sem Examination Marks	√	√	√	√
Quiz I	√	√	√	
Quiz II	√	√	√	

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	1	2	1	2	1	1	2	2	1
CO2	3	2	2	1	1	2	2	2	1	1	1	2	3	2	2
CO3	3	3	3	2	2	1	3	2	1	2	1	2	2	3	2
CO4	2	2	2	2	3	2	3	2	2	1	1	1	1	2	2

If satisfying< 34%=1, 34-66% =2, > 66% = 3

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD 1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, 2, 3, 4	CD1, CD2, CD3, CD8
CD 2	Tutorials/Assignments	CO1, 2, 3, 4	CD1, CD2, CD3, CD8
CD 3	Seminars		
CD 4	Mini projects/Projects		
CD 5	Laboratory experiments/teaching aids		
CD 6	Industrial/guest lectures		
CD 7	Industrial visits/in-plant training		
CD 8	Self- learning such as use of NPTEL materials and internets		
CD 9	Simulation		

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT201
Course title: **Basics of Intelligent Computing**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II/2
Branch: All

Course Objectives
This course enables the students:

F.	To know the basic functions of different AI branches.
G.	To understand the functionalities of IoT .
H.	To know the application of fuzzy logic.
I.	To understand the basic functionalities of a cloud based system.
J.	To find the basic functions of soft computing.

Course Outcomes:
After the completion of this course, students will be able to:

1.	Identify the difference between different branches of AI.
2.	Analyze a fuzzy based system.
3.	Design Neural Networks to solve problems.
4.	Analyze a problem in terms of ANN point of view.
5.	Identify the components of a cloud-based system.

SYLLABUS

Module I
Introduction
Definition of Computing, Conventional Computing vs. Intelligent Computing, Necessity of Intelligent Computing, Current trends in Intelligent Computing

AI Concepts
Introduction to AI, AI problems and Solution approaches, Fundamentals of problem solving using Search and Heuristics, Overview of Knowledge-base creation, and Intelligent Agents, Classification of AI.

(8 L)

Module II
Introduction to Soft Computing
Hard Computing vs. Soft Computing, Paradigms of Soft Computing, Real Life applications of Soft Computing

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Fuzzy Logic
Classical Sets Vs Fuzzy Sets, Membership Functions, Fuzzy operations, Fuzzy Relations, Fuzzy Composition (Max-Min, Max-Product), Defuzzification, Fuzzy Inference System

Genetic Algorithm
Principle of Optimization, Traditional vs Evolutionary optimization, Genetic Algorithm: Working Cycle of GA, Encoding, Crossover, Mutation.(8 L)

Module III
Introduction to Artificial Neural Networks:
Biological Neuron to Artificial Neuron, Mc-Culloh Pitts Perceptron Model, Layer of Neurons, Activation Function, Artificial Learning, Types of Learning, Introduction to Back Propagation Networks, Applications of Neural Network. (8L)

Module IV
Introduction to Cloud computing
Conventional Computing, Historical developments, Defining a Cloud, Cloud Computing reference model, Overview of Virtualization: Introduction, Types of cloud, Cloud Platforms: Amazon Web Services, Microsoft Azure, Cloud Applications (8L)

ModuleV
Introduction to IOT
The IoT Paradigm, Concept of Things, IoT Hardware, IoT Protocols, IoT Architecture, enabling technologies of IoT, IoT Designing and its levels. (8L)

Text books:

5. Rich Elaine, Knight Kevin, Nair S. B. Artificial Intelligence, 3rd Edition, Tata Mc. Graw Hill.
6. Padhy N. P., Simon S. P. Soft Computing: With MATLAB Programming, Oxford University Press, 2015.
7. Buyya Raj Kumar, Vecchiola Christian &Selvi S.Thamarai , Mastering Cloud Computing, McGraw Hill Publication, New Delhi, 2013.
8. Madisetti Vijay and BahgaArshdeep, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.

Reference Books:

Raj Pethuru and Raman AnupamaC.,The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.
Konar Amit, Computational Intelligence: Principles, Techniques and Applications, Springer.
Shivanandam and Deepa, Principles of Soft Computing, 2nd Edition, John Wiley and Sons, 2011.

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CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	2	2	1	1	1	2	3	1	1
CO2	3	3	3	2	1	2	2	2	2	1	1	2	2	3	2
CO3	3	3	3	2	2	1	2	2	2	2	1	3	2	3	2
CO4	3	3	3	3	2	2	2	3	2	2	1	3	3	2	3
CO5	2	2	1	1	2	1	2	3	1	1	1	2	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: MA205
Course title: Discrete Mathematics
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:1 P:0 C: 4
Class schedule per week: 3 Lectures, 1 tutorial
Class: I. M.Sc. /B. Tech
Semester / Level: 2
Branch:
Name of Teacher:

Course Objectives: This course enables the students to

1.	exposed to a wide variety of mathematical concepts that are used in the Computer Science discipline, which may include concepts drawn from the areas of Number Theory, Graph Theory and Combinatorics.
2.	come across a number of theorems and proofs. Theorems will be stated and proved formally using various techniques.
3.	gain the various graphs algorithms along with its analysis
4.	apply graph theory based tools in solving practical problems.

Course Outcomes: After the completion of this course, students will be able to

CO 1.	to model and analyze computational processes using analytic and combinatorial methods
CO 2.	solve the problems of graph theory using graph algorithms
CO 3.	apply computer programs (e.g. SAGE) to study graphs.
CO 4.	apply counting techniques to solve combinatorial problems and identify, formulate, and solve computational problems in various fields.
CO 5.	apply graph theory in the areas of computer science, operation research, biology, chemistry, physics, sociology, and engineering

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SYLLABUS

MA205 **Discrete Mathematics**

Module I

Mathematical logic and Mathematical Reasoning, Compound Statements, Propositional Equivalences, Predicates and Quantifiers, Methods of Proof, Mathematical Induction, Well-ordering principal, Recursive Definition and Algorithms. [9L]

Module II

Recurrence Relations, Classification of Recurrence Relations and their solutions by Characteristic Root method, Generating function and their various aspects, Utility of Generating function in solving Recurrence Relations.

[9L]

Module III

Set, Operations on Set, Computer representation of Set, Relations, Properties/Classification of Relations, Closure operations on Relations, Matrix representation of Relations, Digraphs. Functions and their Representation, Classification of Functions, Warshall's algorithm, Discrete Numeric Functions, Growth of Functions, Big O, Big Q, Hash Function, Growth Functions.

[9L]

Module IV

Binary Operations, Groups, Product and Quotients of Groups, Semi group, Products and Quotients of Semi groups, Permutation Group, Composition of Permutation, Inverse Permutation, Cyclic Permutation, Transposition, Even and Odd Permutation, Coding of Binary Information and Error Correction, Decoding and Error Correction.

[9L]

Module V

Introduction to Graph, Graph Terminologies and their Representation, Connected & Disconnected graphs, Isomorphic Graph, Euler & Hamilton graphs. Introduction to Trees, Versatility of Trees, Tree traversal. Spanning Trees, Minimum Spanning Tree.

[9L]

Text Books:

4. **Mott, Joe L., Abraham Kandel, and Theodore P. Baker** Discrete Mathematics for ComputerScientists& Mathematicians, PHI, 2nd edition 2002.
5. **Swapan Kumar Chakraborty and BikashKanti Sarkar**: Discrete Mathematics, Oxford Univ.Publication, 2010.
6. **Kolman, Bernard, Robert C. Busby, and Sharon Ross.** Discrete mathematical structures,Prentice-Hall, Inc., 2003**.**

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Reference Books:

7. **BikashKanti Sarkar and Swapan Kumar Chakraborty,** *Combinatorics and Graph Theory*, PHI,2016.
8. **Seymour Lipschuz and Mark Lipson**,*Discrete Mathematics*, Shaum's outlines, 2003.
9. **Liu, Chung Laung,** *Elements of Discretemathematis*, Mcgraw Hill, 2nd edition, 2001.
10. Bondy and Murty, Grapg Theory with Applications, American Elsevier,1979.
11. Robin J. Wilson, Introduction to Graph Theory, Pearson, 2010.

Course delivery methods	
Lecture by use of boards/lcd projectors/ohp projectors	√
Tutorials/assignments	√
Seminars	
Mini projects/projects	√
Laboratory experiments/teaching aids	
Industrial/guest lectures	
Industrial visits/in-plant training	
Self- learning such as use of nptel materials and internets	√
Simulation	

Course outcome (co) attainment assessment tools & evaluation procedure

Direct assessment

Assessment tool	% contribution during co assessment
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

Assessment components	CO1	CO2	CO3	CO4	CO5
Mid semester examination	√	√	√		
End semester examination	√	√	√	√	√
Quiz (s)	√	√	√		
Assignment	√	√	√	√	

Indirect assessment –

1. Student feedback on course outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	2	1	1	1	1	1	1	2	3	3	1
CO2	2	3	3	1	1	2	1	1	1	1	1	2	2	2	2
CO3	2	3	3	3	2	1	1	2	1	2	1	1	2	2	1
CO4	3	3	2	1	1	1	1	1	2	2	1	2	3	2	1
CO5	3	2	2	1	3	1	2	2	1	2	2	2	3	3	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: EC203
Course title: Digital System Design
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L: 3 T:0 P:0 C:3
Class schedule per week: 3x1
Class: B. Tech
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives

This course enables the students to:

F.	Understand the basics of the digital electronics.
G.	Apply the knowledge of digital electronics to construct various digital circuits.
H.	Analyse the characteristics and explain the outputs of digital circuits.
I.	Evaluate and asses the application of the digital circuits.
J.	Design digital machine for simple computing and control.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Explain the concept of digital electronics.
CO2	Apply the knowledge to produce digital electronics circuits.
CO3	Analyse and categorize digital circuits.
CO4	Justify the uses of different digital circuits.
CO5	Schematize and demonstrate simple computing machines.

Head of Department

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SYLLABUS

Module – 1:

Basics of Digital Electronics: Number representation, Binary number system, Number base conversion, Octal, Hexadecimal and BCD codes, binary Arithmetic, Logic gates, Introduction to VHDL and Verilog, VHDL Models, Logic Families: TTL, ECL, and CMOS Logic Circuits, Logic levels, voltages and currents, fan-in, fan-out, speed, power dissipation. Comparison of logic families.

Module – 2:

Simplification of Boolean functions: Boolean Algebra, Basic theorems and Properties, De Morgan's theorem, Canonical & Standard forms, Simplification of Boolean function using Karnaugh map, POS& SOP simplification, Prime implicant, NAND and NOR implementation,.

Module – 3:

Design of Combinational Circuits: Analysis and design procedure, Parity Generators and Checkers, Adders, Subtractors, Look ahead carry, Adder, 4-bit BCD adder/subtractor, Magnitude comparator, Decoders, Encoders, Multiplexers, De-multiplexers, , Design of 1 bit ALU for basic logic and arithmetic operations.

Module – 4:

Design of Sequential Circuits and Memories: Basic Latch, Flip-Flops (SR, D, JK, T and Master-Slave), Triggering of Flip Flops, Synchronous and asynchronous counters, Registers, Shift Registers, Memories and Programmable Logic design, Types of memories, Memory Expansion and its decoding, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

Module – 5:

Design of simple computing machines: SAP-I concepts with stress on timing diagrams, Microinstructions, Fetch and Execution cycle variable machine cycle, Hardware control Matrix, Macroinstructions, Microprogramming , Bus concepts, Multiplexed Minimum system. Pipelining concepts.

Books recommended:

Textbooks:

1. "Digital Design", Morris Mano and Michael D. Ciletti ,5th edition PHI
2. "Digital System Design using VHDL", Charles H Roth, Thomson Learning

Reference books:

1. Digital computer Electronics AP Malvino, 3rd Edition Mc Graw Hill

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements): Hands-on-practical on microprocessor trainer Kit

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Cours**Course Delivery Methods**

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Course Outcomes and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	3	1	2	1	1	2	1	2	2	2	1
CO2	3	3	3	2	3	2	3	2	2	2	1	2	3	2	1
CO3	2	2	3	2	2	2	2	2	2	2	1	2	2	2	1
CO4	2	3	3	3	3	3	3	3	2	2	1	3	3	2	2
CO5	2	2	2	3	3	2	3	3	2	2	2	2	1	1	3

< 34% = 1, 34-66% = 2, > 66% = 3

Mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: CS201
Course title: **Data Structures**
Pre-requisite(s): Programming for Problem Solving
Co- requisite(s): Data Structure Lab
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: II/2
Branch: CSE/IT

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Course Objectives

This course enables the students:

F.	To be familiar with basic techniques of algorithm analysis.
G.	To understand basic concepts about arrays, stacks, queues, linked lists, trees and graphs.
H.	To understand concepts of searching and sorting techniques.
I.	To implement various linear & non-linear data structures; and searching & sorting algorithms.
J.	To assess how the choice of data structures impacts the performance of a program**.**

Course Outcomes

After the completion of this course, students will be able to:

1.	Define various linear and non-linear data structures like stack, queue, linked list, tree and graph.
2.	Explain operations like insertion, deletion, traversal, searching, sorting etc. on various data structures.
3.	Design various data structures and their operations.
4.	Analyze the performance of data structure based operations including searching and sorting.
5.	Justify the choice of appropriate data structure as applied to specified problem definition.

SYLLABUS

Module I

Basic Concepts

Definition and basics of: Data Structure, ADT, Algorithms, Time and Space Complexity, Asymptotic Notations (O, θ, Ω), Time complexity computation of non-recursive algorithms (like Matrix addition, Selection sort – using step count), Array – basic operations, concept of multi-dimensional array, Polynomial operations using Array, Sparse Matrix.

(8L)

Module II

Stack and Queue

Stack ADT: basic operations, Queue ADT: basic operations, Circular Queue, Evaluation of Expressions, Another application or Mazing Problem.

(8L)

Module III

Linked List

Singly Linked List: concept, representation and operations, Circular Linked List, Polynomial and Sparse Matrix operations using LL, Doubly Linked List: basic concept.

(8L)

Module IV

Tree and Graph

Basic concepts and terminologies, Binary Search Tree and Heap, Disjoint Set, Graph: concept and terminologies, Concept of BFS, DFS, Spanning Tree, Connected Components.

(8L)

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Module V
Searching and Sorting
Sequential Search and Binary Search, Insertion Sort, Heap Sort, Radix Sort,External Sorting: k-way merging approach.

(8L)

Text book:

2. SahniHorwitz,, Freed Anderson, Fundamentals of Data Structures in C, 2nd Edition (or latest) , University Press.(T1)

Reference books:

3. TharejaReema, Data Structures Using C, 2nd Edition, Oxford University Press.(R1)
4. Tanenbaum, Langsam, Augenstein, Data Structures using C, Pearson. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment tool	**% contribution during co assessment**
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	3	3	3	1	2	1	1	1	1	1	1	2	2	2	1
CO4	3	3	2	1	2	1	1	1	1	1	1	2	2	3	1
CO5	2	2	3	2	2	1	1	2	1	1	1	2	3	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: EE102
Course title: EE102 ELECTRICAL ENGINEERING LABORATORY
Pre-requisite(s): Physics, Fundamentals of Mathematics and Electrical Engineering.

Credits:	L	T	P
	0	0	3

Class schedule per week: 3

Course Overview: Concepts of measuring instruments, AC RLC series parallel circuit operation, resonance, KVL and KCL, circuit theorems, 3-phase star and delta connections, measurement of low and high resistance of D.C. machine, measurement of power by three voltmeter, three-ammeter methods, measurement of power of 3-phase induction motor by two-wattmeter method.

Course Objectives

This course enables the students :

A.	To describe students practical knowledge of active and passive elements and operation of measuring instruments
B.	To demonstrate electrical circuit fundamentals and their equivalent circuit models for both 1-φ and 3- φ circuits and use circuit theorems
C.	To establish voltage & current relationships with the help of phasors and correlate them to experimental results
D.	3. To conclude performance of 1 – Φ AC series circuits by resonance phenomena 4. To evaluate different power measurement for both 1-φ and 3- φ circuits

Course Outcomes

After the completion of this course, students will be able to:

6.	classify active and passive elements, explain working and use of electrical components, different types of measuring instruments;
7.	illustrate fundamentals of operation of DC circuits, 1-φ and 3- φ circuits and also correlate the principles of DC, AC 1-φ and 3- φ circuits to rotating machines like Induction motor and D.C machine.;
8.	measure voltage, current, power, for DC and AC circuits and also represent them in phasor notations;
9.	analyse response of a circuit and calculate unknown circuit parameters;
10.	recommend and justify power factor improvement method in order to save electrical energy.

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SYLLABUS

LIST OF EXPERIMENTS :

11. **Name: Measurement of low & high resistance of DC shunt motor**
    Aim: (i) To measure low resistance of armature winding of DC shunt motor
    (ii) To measure high resistance of shunt field winding of DC shunt motor

12. **Name: AC series circuit**
    Aim: (i) To obtain current & voltage distribution in AC RLC series circuit and to draw phasor diagram
    (ii) To obtain power & power factor of single phase load using 3- Voltmeter method and to draw phasor diagram

13. **Name: AC parallel circuit**
    Aim: (i) To obtain current & voltage distribution in AC RLC parallel circuit and to draw phasor diagram
    (ii) To obtain power & power factor of single phase load using 3- Ammeter method and to draw phasor diagram

14. **Name: Resonance in AC RLC series circuit**
    Aim : (i) To obtain the condition of resonance in AC RLC series circuit
    (ii) To draw phasor diagram

15. **Name: 3 phase Star connection**
    Aim : (i) To establish the relation between line & phase quantity in 3 phase star connection
    (ii) To draw the phasor diagram

16. **Name: 3 phase Delta connection**
    Aim : (i) To establish the relation between line & phase quantity in 3 phase delta connection
    (ii) To draw phasor diagram

17. **Name: 3 phase power measurement**
    Aim : (i) To measure the power input to a 3 phase induction motor using 2 wattmeter method
    (ii) To draw phasor diagram

18. **Name: Self & mutual inductance**
    Aim : To determine self & mutual inductance of coils

19. **Name: Verification of Superposition, Thevenin's and Reciprocity theorem**
    Aim : (i) To verify Superposition theorem for a given circuit
    (ii) To verify Thevenin's theorem for a given circuit

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20. Name: Verification of Norton's, Tellegen's and Maximum Power transfer theorem

Aim : (i) To verify Norton's theorem for a given circuit

(ii) To verify Maximum Power transfer theorem for a given circuit

Gaps in the syllabus (to meet Industry/Profession requirements)

3. Application of principles of magnetic circuits to electrical machines like transformers, generators and motors
4. Visualize Phase sequence

POs met through Gaps in the Syllabus :a, b, c, g

Topics beyond syllabus/Advanced topics/Design

3. Assignment : Simulation of electrical circuits with dependent/independent sources by various techniques (Mesh current/Node Voltage/Thevenin's theorem/Norton's theorem/Maximum power transfer theorem etc.) using MATLAB/PSIM/C++ softwares
4. Active/reactive power calculation for 3 – Φ circuits

POs met through Topics beyond syllabus/Advanced topics/Design: e,f, i, j, k

Mapping of lab experiment with Course Outcomes

Experiment	Course Outcomes				
	1	**2**	**3**	**4**	**5**
1	3	3	3	2	
2	3	3	3	3	2
3	3	3	3	3	2
4	3	3	3	3	2
5	3	3	3	1	
6	3	3	3	1	
7	3	3	3	2	2
8	3	3	3	3	
9	3	3	3	2	
10	3	3	3	2	

3=High, 2=Medium, 1=Low

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors
CD2	Tutorials/Assignments
CD3	Mini projects/Projects
CD4	Laboratory experiments/teaching aids
CD5	Self- learning such as use of NPTEL materials and internets
CD6	Simulation

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Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
(3) Progressive Evaluation (60)	
Day to Day performance & Lab files	30
Quiz (s)	10
Viva	20
(4) End Semester (40)	
Examination Experiment performance	30
Quiz	10
Grand Total	100

Assessment Compoents	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation Marks					
End Semester Marks					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes onto Course Objectives

Course Outcome #	Course Objectives			
	A	B	C	D
1	3	3	3	3
2	3	3	3	3
3	3	3	3	3
4	3	3	3	3
5	2	3	3	3

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	1	1	1	2	2	1	2	1	1	1	1	1
CO2	3	3	3	1	2	2	2	2	1	2	1	1	2	1	1
CO3	3	3	3	2	2	2	2	2	1	2	1	1	3	2	1
CO4	3	3	3	2	2	2	2	2	2	2	1	1	3	2	1
CO5	3	3	3	3	3	2	3	3	3	3	2	2	3	3	2

Mapping of Course Outcomes onto Program Educational Objectives

Course Outcome #	Program Educational Objectives			
	1	2	3	4
1	3	3	2	2
2	3	3	3	
3	3	3	3	2
4	3	3	3	
5	3	3	2	2

Mapping Between COs and Course Delivery (CD) methods

Course Outcome	Course Delivery Method
CO1	CD1,CD2,CD4, CD5
CO2	CD1,CD4,CD5
CO3	CD1,CD3,CD4,CD5,CD6
CO4	CD1,CD2,CD4, CD5
CO5	CD4, CD5

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COURSE INFORMATION SHEET

Course code: EC204
Course title: Digital System design Lab
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L:0 T:0 P:3 C:1.5
Class schedule per week: 03
Class: B. Tech
Semester / Level: III/ 02
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Understand the basics of logic gates, input, output, power supply and gates IC's.
2.	Apply the knowledge of digital electronics to construct combinational and sequential circuits.
3.	Analyse controlled digital circuits with different Boolean function.
4.	Evaluate combinational/sequential circuits and memories.
5.	Translate real world problems into digital logic formulations using VHDL.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Describe the knowledge of basic logic gates and their design using universal gates.
CO2	Demonstrate the working of combinational and sequential circuits.
CO3	Integrate and experiment with controlled digital circuits.
CO4	Appraise combinational/sequential circuits and memories.
CO5	Schematize, simulate and implement combinational and sequential circuits to solve real world problems using VHDL systems.

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SYLLABUS

List of experiments:

13. Design and implement a controlled CMOS Inverter.
14. To study and verify the truth table of NAND and EX-OR gate using IC 7400.
15. Design and implement SEVEN segment display unit.
16. Design and verify half adder and full Adder circuits using gates and IC 7483.
17. Design and implement a 3:8 Decoder.
18. Design and implement 8:3 priority encoder.
19. Design a 4 bit magnitude comparator using combinational circuits.
20. Design and implement 8:1 multiplexer and 1:4 demultiplexer.
21. Design ALU with functions of ADD, SUB, INVERT, OR, AND. XOR, INC, DEC and CMP.
22. Design and verify decade Counter.
23. Design a ROM (8X4) using decoder, gates and diodes.
24. Design of pre settable up/down counter.

Implement all the above experiments using VHDL platform and verify.

Books recommended:

Textbooks:

3. "Digital Design", Morris Mano and Michael D. Ciletti ,5th edition PHI
4. "Digital System Design using VHDL", Charles H Roth, Thomson Learning

Reference books:

2. Digital computer Electronics AP Malvino, 3rd Edition Mc Graw Hill

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	1	1	1	2	2	1	2	1	1	1	1	1
CO2	3	3	3	1	2	2	2	2	1	2	1	1	2	1	1
CO3	3	3	3	2	2	2	2	2	1	2	1	1	3	2	1
CO4	3	3	3	2	2	2	2	2	2	2	1	1	3	2	1
CO5	3	3	3	3	3	2	3	3	3	3	2	2	3	3	2

< 34% = 1, 34-66% = 2, > 66% = 3

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Mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD3, CD6, CD7
CO2	CD1, CD3, CD6, CD7
CO3	CD1, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: CS202
Course title: **Data Structures Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: All

Course Objectives

This course enables the students:

A.	To assess how the choice of data structures and algorithm design methods impact the performance of programs.
B.	To choose the appropriate data structure and algorithm design method for a specified application.
C.	To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.
D.	Analyse and compare the different algorithms

Course Outcomes

After the completion of this course, students will be able to:

1.	Be able to design and analyze the time and space efficiency of the data structure
2.	Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and Quick sort
3.	Have practical knowledge on the applications of data structures
4.	Be capable to identity the appropriate data structure for given problem

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SYLLABUS

70. Program to Find the Number of Elements in an Array
71. Develop and Implement a menu driven program in C for the following Array operations
    a. Creating Array of N Integer elements.
    b. Display of Array elements with suitable headings.
    c. Inserting an element (ELEM) at a given valid position (POS).
    d. Deleting an element at a given valid position (POS).
    e. Exit
72. Programs for Stack, Queues and Circular Queues using Arrays
73. Program to convert an Infix Expression into Postfix and Postfix Evaluation
74. Program to implement stack using arrays
75. Program to implement stack using linked list
76. Program to implement multiple stack in a single array
77. Program to convert infix notation to postfix notation using stacks
78. Program to implement queue using arrays
79. Program to implement queue using pointers
80. Program to reverse elements in a queue
81. Program to implement circular queue using arrays
82. Program to create add remove & display element from single linked list
83. Program to create add remove & display element from double linked list
84. Program to count number of nodes in linear linked list
85. Program to create add remove & display element from circular linked list
86. Programs to implement stack & queues using linked representation
87. Program to concatenate two linear linked lists
88. Program to accept a singly linked list of integers & sort the list in ascending order.
89. Program to reverse linked list
90. Program to represent polynomial using linked list
91. Program to add two polynomials using linked list
92. Program for the creation of binary tree, provide insertion & deletion in c
93. Program for pre-order, post-order & in-order traversals of a binary tree using non reccursive.
94. Program to count no, of leaves of binary tree
95. Program for implementation of B-tree (insertion & deletion)
96. Program for implementation of multi-way tree in c
97. Program for implementation of AVL tree
98. Program to implement bubble sort program using arrays
99. Program to implement merge sort using arrays
100. Program to implement selection sort program using arrays
101. Program to implement insertion sort program using arrays
102. Program to implement topological sort using arrays
103. Program to implement heap sort using arrays
104. Program to implement heap sort using pointers
105. Program to implement bubble sort program using pointers
106. Program to implement linear search using pointers
107. Program to implement binary search using pointers
108. Program to implement linear search using arrays
109. Program to implement binary search using arrays

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Text books:

8. Baluja G S, "Data Structure through C", Ganpat Rai Publication, New Delhi, 2015.
9. Pai G A V, "Data Structures and Algorithms: Concepts, Techniques and Applications", 2nd Edn, Tata McGraw-Hill, 2008.
10. Horowitz E., Sahni S., Susan A., "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2010.

Reference books:

12. Tremblay J. P., Sorenson P. G, "An Introduction to Data Structures with Applications", 2nd Edn, McGraw-Hill, Inc. New York, NY, USA.
13. Lipschutz Seymour, "Data Structures", 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
14. Drozdek Adam, "Data Structures and Algorithms in C++", Thomson Learning, New Delhi – 2007.
15. Feller J., Fitzgerald B., "Understanding Open Source Software Development", Pearson Education Ltd. New Delhi

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	60
Semester End Examination	40

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Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	1	2	2	1	2	1	1	2	3	2
CO2	3	3	3	3	2	1	2	2	2	1	1	2	2	3	2
CO3	3	3	3	3	2	1	2	2	1	2	1	2	3	3	2
CO4	3	3	3	3	2	2	2	2	2	2	2	2	3	2	2
CO5	3	2	2	1	2	3	1	1	1	2	2	2	3	3	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: MA 203
Course title: Numerical Methods
Pre-requisite(s): NIL
Co- requisite(s): ---NIL
Credits: L: 2 T: 0 P: 0 C: 2
Class schedule per week: 2 Lectures
Class: B Tech
Semester / Level: 2
Branch: ALL
Name of Teacher:
Course Objectives: This course enables the students to

1.	derive appropriate numerical methods to solve algebraic and transcendental equations
2.	derive appropriate numerical methods to solve linear system of equations
3.	approximate a function using various interpolation techniques
4.	to find the numerical solution of initial value problems and boundary value problems

Course Outcomes: After the completion of this course, students will be able to

CO 1	solve algebraic and transcendental equation using an appropriate numerical method arising in various engineering problems
CO 2	solve linear system of equations using an appropriate numerical method arising in computer programming, chemical engineering problems etc.
CO 3.	Approximate a function using an appropriate numerical method in various research problems
CO 4	evaluate derivative at a value using an appropriate numerical method in various research problems
CO 5	solve differential equation numerically

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Syllabus

MA 203 Numerical Methods 2-0-0-2

Module I: Errors and Nonlinear Equations

Error Analysis: Definition and sources of errors, propagation of errors, floating-point arithmetic

Solution of Nonlinear equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson method and its variants, General Iterative method. [05L]

Module II: System of Linear Equations

Gauss-Elimination, Gauss-Jordan, LU-Decomposition, Gauss-Jacobi and Gauss- Siedel methods to solve linear system of equations and Power method to find least and largest eigenvalues.

[05L]

Module III: Interpolation

Lagrange's interpolation, Newton's divided differences interpolation formulas, inverse interpolation, interpolating polynomial using finite differences. [05L]

Module IV: Differentiation and Integration

Differentiation using interpolation formulas, Integration using Newton-Cotes formulas: Trapezoidal rule, Simpson's rule [05L]

Module V: Solution of Ordinary Differential Equations

Euler's method, modified Euler's method, Runge - Kutta Methods of second and fourth order to solve initial value problems. [05L]

Text Books:

4. Jain M.K, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age Publications, 2004.
5. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI.
6. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

4. S.C. Chapra and R. P. Canale, Numerical Methods for Engineers, McGraw Hill, 1985.
5. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, Seventh Edition, 2003.
6. R. W. Hamming: Numerical Methods for Scientists and Engineers, Second Edition, Dover

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Course delivery methods	
Lecture by use of boards/lcd projectors/ohp projectors	√
Tutorials/assignments	√
Seminars	
Mini projects/projects	√
Laboratory experiments/teaching aids	
Industrial/guest lectures	
Industrial visits/in-plant training	
Self- learning such as use of nptel materials and internets	√
Simulation	

Course outcome (co) attainment assessment tools & evaluation procedure

Direct assessment

Assessment tool	% contribution during co assessment
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

Assessment components	CO1	CO2	CO3	CO4	CO5
Mid semester examination	√	√	√		
End semester examination	√	√	√	√	√
Quiz (s)	√	√	√		
Assignment	√	√	√	√	

Indirect assessment –

1. Student feedback on course outcome

Mapping of course outcomes onto program outcomes

Course Outcome	Program Outcomes (POs)	Program Specific Outcomes (PSOs)

Head of Department

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	1	2	1	2	1	1	3	2	1
CO2	3	3	3	2	2	1	1	2	1	2	1	2	3	3	1
CO3	3	3	2	3	2	2	2	2	2	2	1	1	2	2	1
CO4	2	2	3	3	2	2	2	2	3	3	2	2	2	2	1
CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1

If satisfying< 34%=1, 34-66% =2, > 66% = 3.

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CE101
Course title: **Environmental Science**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 2 T: 0 P: 0
Class schedule per week: 2
Class: B. Tech
Semester / Level: I
Branch: All

Course Objectives
This course enables the students:

1	To develop basic knowledge of ecological principles and their applications in environment.
2	To identify the structure and composition of the spheres of the earth, the only planet sustaining life.
3	To analyse, how the environment is getting contaminated and probable control mechanisms for them.
4	To generate awareness and become a sensitive citizen towards the changing environment.

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Course Outcomes

After the completion of this course, students will be:

1	Able to explain the structure and function of ecosystems and their importance in the holistic environment.
2	Able to identify the sources, causes, impacts and control of air pollution.
3	Able to distinguish the various types of water pollution happening in the environment and understand about their effects and potential control mechanisms.
4	Able to judge the importance of soil, causes of contamination and need of solid waste management.
5	Able to predict the sources of radiation hazards and pros and cons of noise pollution.

Syllabus

Module 1. Ecosystem and Environment

Concepts of Ecology and Environmental science, ecosystem: structure, function and services, Biogeochemical cycles, energy and nutrient flow, ecosystem management, fate of environmental pollutants, environmental status and reports on climate change.

(8L)

Module 2: Air Pollution

Structure and composition of unpolluted atmosphere, classification of air pollution sources, types of air pollutants, effects of air pollution, monitoring of air pollution, control methods and equipment for air pollution control, vehicular emissions and control, indoor air pollution, air pollution episodes and case studies.

(8L)

Module 3: Water Pollution

Water Resource; Water Pollution: types and Sources of Pollutants; effects of water pollution; Water quality monitoring, various water quality indices, water and waste water treatment: primary, secondary and tertiary treatment, advanced treatments (nitrate and phosphate removal); Sludge treatment and disposal.

(8L)

Module 4: Soil Pollution and Solid Waste Management

Lithosphere – composition, soil properties, soil pollution, ecological & health effects, Municipal solid waste management – classification of solid wastes, MSW characteristics, collection, storage, transport and disposal methods, sanitary landfills, technologies for processing of MSW: incineration, composing, pyrolysis.

(8L)

Module 5: Noise pollution & Radioactive pollution

Noise pollution: introduction, sources: Point, line and area sources; outdoor and indoor noise propagation, Effects of noise on health, criteria noise standards and limit values, Noise measurement techniques and analysis, prevention of noise

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pollution; Radioactive pollution: introduction, sources, classification, health and safety aspects, Hazards associated with nuclear reactors and disposal of spent fuel rods-safe guards from exposure to radiations, international regulation, Management of radioactive wastes.

(8L)

Text books:

6. A, K. De. (3rd Ed). 2008. Environmental Chemistry. New Age Publications India Ltd.
7. R. Rajagopalan.2016.Environmental Studies: From Crisis to Future by, 3rd edition, Oxford University Press.
8. Eugene P. Odum. 1971. Fundamentals of Ecology (3rd ed.) -. WB Sunders Company, Philadelphia.
9. C. N. Sawyer, P. L. McCarty and G. F. Parkin. 2002. Chemistry for Environmental Engineering and Science. John Henry Press.
10. S.C. Santra. 2011. Environmental Science. New Central Book Agency.

Reference books:

4. D.W.Conell. Basic Concepts of Environmental Chemistry, CRC Press.
5. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International
6. G.M. Masters& Wendell Ela. 1991. Introduction to Environmental Engineering and Science, PHI Publishers.

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors √
Tutorials/Assignments √
Seminars √
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

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Course Outcome (CO) Attainment Assessment tools & Evaluation procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End Sem Examination Marks	50
Quiz (s) (1 & 2)	10+10
Teacher's assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid sem exam	√	√	√	√	√
End Sem Examination Marks	√	√	√	√	√
Assignment	√	√	√	√	√

Indirect Assessment –

1.Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	1	3	3	2	2	2	1	1	2	1	1
CO2	2	3	2	3	2	3	3	2	2	2	1	1	2	2	1
CO3	2	3	2	3	2	3	3	2	2	2	1	1	2	2	1
CO4	2	3	2	3	2	3	3	2	2	2	1	2	2	2	1
CO5	2	3	3	3	2	3	3	2	2	2	1	2	2	2	1

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

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Mapping Between Cos and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1, CD2
CD2	Tutorials/Assignments		CO2	CD1, CD2
CD3	Seminars		CO3	CD1, CD2
CD4	Mini projects/Projects		CO4	CD1, CD2
CD5	Laboratory experiments/teaching aids		CO5	CD1, CD2
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

COURSE INFORMATION SHEET

Course code: CS203
Course title: **Computer Organization Architecture**
Pre-requisite(s): Digital Logic
Co- requisite(s):
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic architecture and organization of systems along with their performances.
2.	To Familiar with Digital Logic circuits, Data representation and Instruction Set Architecture.
3.	To build a complete data path for various instructions.
4.	To understand the pipeline concepts and Hazards.
5.	To familiar with Memory and I/O Organization.

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Course Outcomes

After the completion of this course, students will be to:

1.	Explain the merits and pitfalls in computer performance measurements and analyze the impact of instruction set architecture on cost-performance of computer design
2.	Explain Digital Logic Circuits ,Data Representation, Register and Processor level Design and Instruction Set architecture
3.	Solve problems related to computer arithmetic and Determine which hardware blocks and control lines are used for specific instructions
4.	Design a pipeline for consistent execution of instructions with minimum hazards
5.	Explain memory organization, I/O organization and its impact on computer cost /performance.

Syllabus

Module I

Basic Structures of Computers

Introduction to Digital Logic, Basic Structure of Computers: Computer Types, Functional Units, Input Unit, Memory Unit, Arithmetic and Logic Unit, Output Unit, Control Unit, Basic Operational Concepts: Fixed and floating point Representation and Arithmetic Operations, Performance, Historical Perspective.

(5L)

Module II

Instruction Set Architecture

Memory Locations and Addresses: Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Subroutines, Additional Instructions, Dealing with 32-Bit Immediate Values.

(5L)

Module III

Basic Processing Unit & Pipelining

Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors.

Pipelining: Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Pipeline Performance Evaluation.

(10L)

Module IV

Memory Organization

Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage.

(10L)

Head of Department

Module V
Input Output & Parallel Processing
Basic Input Output
Accessing I/O Devices, Interrupts
Input Output Organization
Bus Structure, Bus Operation, Arbitration, Interface, Interconnection Standards.
Parallel Processing
Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling.
(10L)

Text Book:

Patterson David A., Hennessy John L., Computer Organization and Design: The Hardware / Software Interface, 5th Edition, Elsevier.(T1)

Reference Books:

Hamachar Carl et. al , Computer Organization and Embedded Systems, 6th Edition, McGraw Hill. (R1)

Mano M. Morris, Computer System Architecture, Revised 3rd Edition, Pearson.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	1	1	1	2	1	2	1	2	1	2	2	3	3	3
CO2	3	1	1	1	2	1	2	1	2	1	2	2	3	3	3
CO3	3	2	2	2	3	1	2	1	2	1	2	2	3	3	3
CO4	3	2	2	2	3	1	2	1	2	2	3	3	3	3	3
CO5	3	2	3	3	3	1	2	1	3	1	3	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS204
Course title: **Object Oriented Programming and Design Patterns**
Pre-requisite(s): Data Structure
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II/2
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	The course shall allow students to understand the basic tenets of OOP.
2.	The course will exemplify the basic syntax and constructs of JAVA.
3.	The course will help students understand the application OOP principles in various use cases.
4.	The course will explain basic JAVA GUI components and their working.
5.	The course aims to expose students to newer JAVA constructs like NIO, Lambdas etc.

Course Outcomes
After the completion of this course, students will be:

1.	Identify the difference between procedural and OO programming.
2.	Construct programs using various OOP principles.
3.	Design UI using JAVA GUI components.
4.	Operate on files and strings in real life scenarios.
5.	Analyze thread performance and inter thread communication issues

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SYLLABUS

Module I

Introduction to Classes, Objects and Java

Introduction to Object Technology, Java, Understanding the Java development environment, Programming in Java, Memory concepts, Doing basic Arithmetic, Comparing entities, Classes, Objects, Methods, Strings, Primitive vs reference types.

(8L)

Module II

Control Statements, Methods and Arrays

Basic selection statements, Iterative constructs, Relative and Logical operators, break, continue, Methods, static methods, parameter passing, argument promotion and casting, scopes, method overloading. Arrays and ArrayList in Java, Enhanced for statement, Passing arrays to methods, Multidimensional arrays, Using command line arguments.

(8L)

Module III

Object Oriented Concepts: Polymorphism & Inheritance

Controlling access to class members, the use of this keyword, getters and setters, Composition, enum, the use of static and final, Garbage collection. Superclass and subclass, protected members, constructors in subclass, the Object class, Introduction to polymorphism, Abstract classes and methods, Assignment between subclass and superclass variables, Creating and using interfaces.

(8L)

Module IV

Exception Handling & GUI Design

When to use exception handling, Java exception hierarchy, finally block, Stack unwinding, Chained exceptions, Declaring new exception types, Assertions, try with resources. Simple I/O with GUI, Basic GUI Components, GUI Event handling, Adapter classes, Layout managers, Using panels.

(8L)

Module V

Strings, characters & Files

Working with the String and StringBuilder class, Character class, Tokenizing strings, Regular Expressions, Files and Streams, Using NIO classes, Sequential file handling, Object serialization, JFileChooser, Introduction to threading, Introduction to Generics and lambda expressions.

(8L)

Text book:

Deitel P., Deitel H., Java How to Program, 10th Edition, Pearson Publications, 2016.(T1)

Reference book:

Wu C. T., Object Oriented Programming in Java, 5th Edition, McGrawHill Publications, 2010.(R1)

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Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment tool	**% contribution during co assessment**
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO2	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO3	2	1	3	3	3	3	2	1	1	1	1	2	3	2	3
CO4	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3
CO5	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS206
Course title: **Design and Analysis of Algorithm**
Pre-requisite(s): Data Structure
Co- requisite(s): Algorithms Lab
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II/2
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To analyze the performance of recursive and nor-recursive algorithms.
2.	To understand various algorithm design techniques.
3.	To use of different paradigms of problem solving.
4.	To find efficient ways to solve a given problem.
5.	To compare various algorithms of a given problem.

Course Outcomes
After the completion of this course, students will be able to:

1.	Define the concepts and mathematical foundation for analysis of algorithms.
2.	Explain different standard algorithm design techniques, namely, divide & conquer, greedy, dynamic programming, backtracking and branch & bound.
3.	Demonstrate standard algorithms for fundamental problems in Computer Science.
4.	Design algorithms for a given problem using standard algorithm design techniques.
5.	Analyze and compare the efficiency of various algorithms of a given problem.

SYLLABUS

Module I
Algorithms and Complexity
Introduction, Algorithm Complexity and various cases using Insertion Sort, Asymptotic Notations, Time complexity of Recursive Algorithm, Solving Recurrences using Iterative, Recursion Tree and Master Theorem. (8L)

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Module II
Divide and Conquer
Discussion of basic approach using Binary Search, Merge Sort , Quick Sort , Selection in Expected linear time, Maximum Subarray , Matrix Multiplication , Introduction of Transform and Conquer and AVL Tree . (8L)

Module III
Dynamic Programming
Introduction and Approach, Rod Cutting, LCS, Optimal BST, Transitive closure and All-pair Shortest Path, Travelling Salesperson Problem.
(8L)

Module IV
Greedy and other Design Approaches
Introduction to greedy using fractional knapsack, Huffman Code, Minimum Spanning Tree – Prim and Kruskal, Single Source Shortest Path Dijkstra's and Bellman-Ford, Introduction to Backtracking using N-Queens problem, Introduction to Branch and Bound using Assignment Problem or TSP.
(8L)

Module V
NP Completeness and Other Advanced Topics
Non-deterministic algorithms – searching and sorting, Class P and NP, Decision and Optimization problem, Reduction and NPC and NPH, NP Completeness proof for: SAT, Max-Clique, Vertex Cover, Introduction to Randomized Algorithms, Introduction to Approximation Algorithms. (8L)

Text Book:

2. Cormen Thomas H. et al., Introduction to Algorithms. 3rd Edition, PHI Learning, latest edition.(T1)

Reference Books:

4 Horowitz E., Sahani, Fundamentals of Computer Algorithms, Galgotia Publication Pvt. Ltd. (R1)
5 Dave and Dave, Design and Analysis of Algorithms, 2nd Edition, Pearson. (R2)
6 Goodrich, Tamassia. Algorithm Design. Wiley. (R3)

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

Head of Department

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO2	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO3	2	2	3	2	1	1	1	1	1	2	2	2	3	3	3
CO4	3	3	3	3	2	1	1	1	1	2	2	3	3	3	3
CO5	3	3	3	3	2	1	1	1	1	2	2	3	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS211
Course title: **Operating System**
Pre-requisite(s): Data Structure, Computer System Architecture, Basic Course on Computer Programming
Co- requisite(s): None
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: BTech
Semester / Level: V
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Present the main components of OS and their working
2.	Introduce the concepts of process and thread and their scheduling policies
3.	Handling synchronization of concurrent processes and deadlocks
4.	Analyze the different techniques for managing memory, I/O, disk and files
5.	Design the components of operating system

Course Outcomes
After the completion of the course student will be able to:

1.	Describe the main components of OS and their working
2.	Explain the concepts of process and thread and their scheduling policies
3.	Solve synchronization and deadlock issues
4.	Compare the different techniques for managing memory, I/O, disk and files
5.	Design components of operating system

Syllabus

Module I **[8L]**

Operating system Overview

Operating system Objective and Functions, Evolution of Operating System, Major Advances in OS Components, Characteristics of Modern Operating Systems

Process Description and Control

Process Concept, Process States, Process Description, Process Control, Threads, Types of Threads, Multicore and Multithreading

Module II **[8L]**

Scheduling

Type of scheduling, Uniprocessor Scheduling, Multiprocessor Scheduling

Module III **[8L]**

Concurrency

Mutual Exclusion and Synchronization

Principle of Concurrency, Mutual Exclusion, Hardware Support, Semaphores, Monitors, Message Passing, Readers/Writers Problem

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Deadlock and Starvation
Principle of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher Problem

Module IV **[8L]**

Memory Management
Memory Management Requirements, Memory Partitioning, Paging, Segmentation

Virtual Memory
Hardware and Control Structures, Operating System Policies for Virtual Memory

Module V **[8L]**

I/O Management and Disk Scheduling
I/O device, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling, RAID, Disk Cache

File Management
Overview, File Organization and Access, File Directories, File Sharing, Record Blocking, File Allocation and Free Space Management

Text Book:

2. StallingsW., Operating systems - Internals and Design Principles, , 8th Edition, Pearson, 2014.

Reference Books:

6. SilberchatzAbraham, Galvin Peter B.,Gagne Greg, Operating System Principles, 9th Edition, Wiley Student Edition, 2013.
7. Tanenbaum Andrew S., Modern Operating Systems, 4th Edition, Pearson, 2014.
8. Dhamdhere D. M. ,Operating Systems A concept - based Approach, 3rd Edition, McGrawHill Education, 2017.
9. Stuart B. L., Principles of Operating Systems, 1st Edition, 2008, Cengage learning, India Edition.
10. Godbole A. S., Operating Systems, 3rd Edition, McGrawHill Education, 2017.

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

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CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	1	1	2	1	1	1	1	2	2	2	1
CO2	2	2	2	2	1	1	2	1	1	1	1	2	2	2	1
CO3	2	2	3	2	2	2	2	2	1	2	1	3	3	2	2
CO4	3	3	3	3	2	2	2	2	2	2	2	3	3	3	3
CO5	3	2	2	2	2	3	1	1	1	1	1	1	3	3	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
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CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: MA204
Course title: **Numerical Methods Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 2 C:1
Class schedule per week: 2
Class: B. Tech
Semester / Level: III/II
Branch: All

Course Objectives
This course enables the students to understand

1.	derive appropriate numerical methods to solve algebraic, transcendental equations and linear system of equations
2.	approximate a function using various interpolation techniques, to find the numerical solution of initial value problems
3.	ncepts in probability theory, the properties of probability distributions
4.	estimation of mean, variance and proportion, the concepts of statistical hypothesis

Course Outcomes
After the completion of this course, students will be able to

1.	solve algebraic, transcendental equation and linear system of equations using an appropriate numerical method arising in various engineering problems
2.	evaluate derivative at a value using an appropriate numerical method in various research problems, solve differential equation numerically
3.	learn basic probability axioms, rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
4.	find the point and interval estimates, analyse data statistically and interpretation of the results

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Syllabus
List of Assignments

16. Find a simple root of $f(x)=0$ using bisection method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
17. Find a simple root of $f(x)=0$ using Regula-Falsi method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
18. Find a simple root of $f(x)=0$ using Newton Raphson method. Read any initial approximation x_0, maximum number of iterations n and error tolerance eps.
19. Solution of a system of $n\times n$ linear equations using Gauss elimination method with partial pivoting. The program is for 10×10 system or higher order system.
20. Matrix inversion and solution of $n\times n$ system of equations using Gauss-Jordan method. If the system of equations is larger than 15×15 change the dimensions of the float statement.
21. Program to solve a system of equation using Gauss-Seidel iteration method. Order of the matrix is n, maximum number of iterations $niter$, error tolerance is eps and the initial approximation to the solution vector is x_0. If the system of equations is larger than 10×10 change the dimension in float.
22. Program to find the largest Eigen value in magnitude and the corresponding Eigen vector of a square matrix A of order n using power method.
23. Program for Lagrange interpolation.
24. Program for Newton divided difference interpolation.
25. Program for Newton's forward and backward interpolation.
26. Program for Gauss's central difference interpolation (both backward and forward).
27. Program to evaluate the integral of $f(x)$ between the limits a to b using Trapezoidal rule of integration based on n subintervals or $n+1$ nodal points. The values of a,b and n are to be read. The program is tested for $f(x)=1/(1+x)$.
28. Program to evaluate the integral of $f(x)$ between the limits a to b using Simpson's rule of integration based on $2n$ subintervals or $2n+1$ nodal points. The values of a,b and n are to be read and the integrand is written as a function subprogram. The program is tested for $f(x)=1/(1+x)$.
29. Program to solve an IVP, $dy/dx=f(x),y(x_0)=y_0$ using Euler method. The initial value x_0,y_0 the final value x_f and the step size h are to be read. The program is tested for $f(x,y)=-2xy^2$.
30. Program to solve an IVP, $dy/dx=f(x),y(x_0)=y_0$ using the classical Runge-Kutta fourth order

    method with step size h, $h/2$ and also computes the estimate of the truncation error. Input parameters are: initial point, initial value, number of intervals and the step length h.

Solutions

with h, $h/2$ and the estimate of the truncation error are available as output. The right hand side The program is tested for $f(x,y)=-2xy^2$.

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Text Books:

1. S.S.Sastry-Introductory Methods of Numerical Analysis-PHI, Private Ltd., New Delhi.
2. N.Pal& S. Sarkar- Statistics: Concepts and Applications, PHI, New Delhi-2005.

Reference Books:

1 R.V.Hogg et.al- Probability and Statistical Inpane, 7th Edn, Pearson Education, New Delhi-2006.
2. R.L.Burden&J.D.Faires- Numerical Analysis, Thomson Learning-Brooks/Cole, Indian Reprint, 2005.

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
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CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	(60)
Attendance Marks	12
Lab file Marks	12
Viva Marks	24
Day-to-day performance Marks	12

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End SEM Evaluation	(40)
Lab quiz Marks	20
Lab performance Marks	20

Assessment Components	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation	√	√	√	√	√
End SEM Evaluation	√	√	√	√	√

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	2	1	1					1	2	2	3	2
CO2	2	2	3	2	1	1				2	1	2	2	3	2
CO3	2	2	3	2	1	1			1	2	2	2	2	3	2
CO4	3	3	3	2	1	1	2	2	1	2	2	3	3	3	3
CO5	3	3	3	2	1	1	2	2	1	2	2	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT202
Course title: **Basic IT Workshop**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 2
Class schedule per week: 2
Class: B. Tech
Semester / Level: IV/II
Branch: All

Course Objectives

This course enables the students:

1.	Understand and use the basic Matlab functions and understand its environment and variables
2.	Know about handling operations and advanced features like menus and toolbars
3.	Implement programs with the use of arrays, strings and graphical data representations
4.	Understand Python, Data Types, Operators, Arrays
5.	Implement Functions and loops, object oriented programming using Python

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Course Outcomes

After the completion of this course, students will be able:

1.	Apply features of Matlab and algorithms to solve problems
2.	Develop application programs with the help of various tool boxes available in Matlab.
3.	Apply data analysis through graphical data representations
4.	Implement programs with the use of arrays, strings in Matlab
5.	Implement Functions and loops, using Python

Syllabus

Module I

Introduction to MATLAB and Basics Part I:

Introduction, Advantage, Disadvantage of MATLAB, MATLAB Environment, Variables and Array, Built-in Functions of MATLAB, Subarrays, Multidimensional Arrays, Data Files.

Module II

MATLAB Basic Part II:

Scalar and Array Operations, Hierarchy of Operations, Introduction to Plotting, Polar Plots, Subplots, MATLAB profiler. String Functions, Complex Data, Three-Dimensional Plot

Module III

MATLAB Advanced Features:

Sparse Arrays, Cell Arrays,Structure Arrays, I/O Functions, Object Handles, Position and Units, Graphical User Interface: Dialog Boxes, Menus, Toolbars.

Module IV

Introduction to Python Basics

Basics, I Python, Data Types, Operators, Arrays, Plotting

Module V

Python Programming Part 2:

Functions and loops, object oriented programming, Numerical Formalism

Sample list of Assignments:

Sample Assignments on Python

Data Types, Input- Outputs, Variables

1. Write a program in Python to swap two variables.

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2. Write a program in Python to check the input character is an alphabet or not.

Loop

3. Write a program in python to shuffle a deck of card using the module random and draw 5 cards.

4. Write a program in python to find the factors of a number.

Array and Lists

5. Write a program in python to transpose a given matrix M = [[1, 2], [4, 5], [3, 6]].

6. Write a program in python to print the median of a set of numbers in a file.

Function

6. Write a function in Python to find the resolution of a JPEG image.

7. Write a program in python and use in-built functions to convert a decimal number to binary, octal and hexadecimal number.

8. Write a program in python to sort words in alphabetical order.

Plot

9. Use Matplotlib to draw histogram to represent average age of population given as Age [21, 54, 66, 44, 32,42, 54, 62, 93, 45, 32, 70]

10. Create a 3-D plot in Python for the function $\sqrt{y^2 - x^2}$ over the interval $-3 \leq x \leq 3$ and $-3 \leq x \leq 3$.

Sample Assignments on MATLAB

Assignment Statements:

1. Given two sides a= 3.2 and b=4.6 of a triangle and angle theta= 60^0 between these two sides. Find the length of the third side and the area of the triangle.

2. Write a MATLAB statement to calculate the sum of the series:

$S= 1- x^2/2! + x^4/4! – x^6/6! + x^8/8!$ for x= 1.5

Arrays

3. The array A is given below. Extend the 2-D array to 3-D array by including another 2-D array as second element in the third dimension.

$$A = 123; 543; 136;$$

4. Let a matrix A of size (3x4) is defined as, = 12356791011 4812 . Reshape the matrix A into matrix B of the size (6x2).

5. Let a column vector z be given as z = [2; 3; 4; 5].

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(i) Form a diagonal matrix A, using the elements of z as he main diagonal elements of A.

(ii) Form the matrix B, using the elements of vector z as elements of upper diagonal of B.

(iii) Form the matrix C, using the elements of vector z as elements of first lower diagonal of C.

Polynomials

6. Integrate the polynomial $y = 4x^3 + 12x^2 + 16x + 1$. Take the constant of integration as 3.

7. Find the polynomial of degree 2 to fit the following data:

x	0	1	2	4
y	1	6	20	100

Input-Output statement and files

8. Write a program in MATLAB to illustrate the use of 'pause' command.

9. Write a program in MATLAB to illustrate the use of fwrite function for writing binary data of different formats to a file named 'check.txt'.

Plots

10. Plot the curve given by the equation y = sin(x) where x varies from 0 to 2π. Also label the x-axis and y-axis and provide a suitable title for the plot

11. Plot a bar graph for the data given as x = [1 2 3 4 5 6] and y = [10 15 25 30 27 19]

12. Given $x = t^2$ and $y = 4t$ for $-4 < t < 4$. Using MATLAB obtain a 3-D plot showing the matrix in (x, y) space as a factors of time.

Control structures

13. Write a program in MATLAB to find the count of even values in the given n numbers.

Functions

14. Write a function in MATLAB to calculate the roots of the quadratic equation $ax^2 + bx + c = 0$, where a, b, c are constants.

Text Books:

3. MATLAB® Programming for Engineers:Stephen J. Chapman, Thomson Corporation, 4th Edition
4. Introduction to Python for Engineers and Scientists, Sandeep Nagar, Apress, 2018

Reference Books

2. Learn Python The Hard Way, Zed A. Shaw, Addison-Wesley, Third Edition

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Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

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CD9	Simulation

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Mapping between course outcomes and course delivery method

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CS205
Course title: **OOPDP Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV/II
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To introduce the student with fundamentals and features of Object Oriented programming.
2.	To be able to write a Java program to solve a well specified problem
3.	To be able to describe, recognize, apply and implement selected design patterns in Java
4.	To be familiar with common errors in Java and its associated libraries
5.	To understand a Java program written by someone else and be able to debug and test the same.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Work in any object oriented environment and program using those features.
CO2	Student will have hands on experience with all basic concepts of Java programming
CO3	Analyse the design pattern of the given problem and further solve with less complexity.
CO4	Use his/her programming skills to resolve the issues coming while programming for bigger problems.
CO5	Work in industry environment with good enough knowledge about Java and OOPs.

Syllabus

List of Programs as Assignments:

12. Lab Assignment No: 1

Objective: To understand and Implement basic java program concepts using Scanner class.

Q1. Take input from user a character variable in a program and if the value is alphabet then print "Alphabet" if it's a number then print "Digit" and for other characters print "Special Character"

Q2. Write a program to add all the values in a given number and check if the sum is prime number or not. Ex: 1234->10, not prime.

13. Lab Assignment No: 2

Objective: To Understand and Implement the concept of arrays in java

Q1. Write a program to find the largest 2 numbers and the smallest 2 numbers in the array initialized by the user.

Q2. Write a program to print the element of an array that has occurred the highest number of times Eg) Array -> 10,20,10,30,40,100,99 O/P:10

14. Lab Assignment No: 3

Objective: To Understand and Implement the concept of 2-D arrays in java.

Q1.Write a program to reverse the elements of a given 2*2 array. Four integer numbers needs to be passed as Command Line arguments

Eg: C:\>java Sample 1 2 3 4

O/P Expected :

The given array is : 1 2

3 4

The reverse of the array is : 4 3

2 1

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Q2. Write a program to find greatest number in a 3*3 array. The program is supposed to receive 9 integer numbers as command line arguments.

15. Lab Assignment No: 4

Objective: To Understand and Implement the concept of classes and Constructors

Q1. Create a class Box that uses a parameterized constructor to initialize the dimensions of a box.(dimensions are width, height, depth of double type). The class should have a method that calculates and returns the volume of the box . Obtain an object and print the corresponding volume in main() function.

Q2. Write a program in Java with class Rectangle with the data fields width, length, area and color. The length, width and area are of double type and color is of string type. The methods are set_length() , set_width() , set_color(), and find_area(). Create two object ofRectangle and compare their area and color. If area and color same for the objects then display “Matching Rectangles” otherwise display “Non Matching Rectangle”.

16. Lab Assignment No: 5

Objective: To Understand and Implement the concept of Inheritance

Q1.Create a class named ‘Animal’ which includes methods like eat() and sleep(). Create a child class of Animal named ‘Bird’ and override the parent class methods. Add a new method named fly(). Create an instance of Animal class and invoke the eat and sleep methods using this object.Create an instance of Bird class and invoke the eat, sleep and fly methods using this object.

Q2. A HighSchool application has two classes: the Person superclass and the Student subclass. Using inheritance, in this lab you will create two new classes, Teacher and CollegeStudent. A Teacher will be like Person but will have additional properties such as salary (the amount the teacher earns) and subject (e.g. “Computer Science”, “Chemistry”, “English”, “Other”). The CollegeStudent class will extend the Student class by adding a year (current level in college) and major (e.g. “Electrical Engineering”, “Communications”, “Undeclared”).

17. Lab Assignment No: 6

Objective: To Understand and Implement the concept of Overloading and Overriding

Q1.Create a class Account with two overloaded constructors. First constructor is used for initializing, name of account holder, account number and initial amount in account. Second constructor is used for initializing name of account holder, account number, address, type of account and current balance. Account class is having methods Deposit(), WithDraw(), and GetBalance().Make necessary assumption for data members and return types of the methods. Create objects of Account class and use them.

Q2. Create a base class Fruit which has name ,taste and size as its attributes. A method called eat() is created which describes the name of the fruit and its taste. Inherit the same in 2 other class Apple and Orange and override the eat() method to represent each fruit taste.

18. Lab Assignment No: 7

Objective: To Understand and Implement String class in Java

Q1. Reverse the string but not the words. Eg. I/P: Birla institute of technology

O/P: technology of institute birla.

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Q2. Find out and print the maximum possible palindrome in a given string. Eg:
I/P: nononsene O/P: nonon
Q3.Given a string and a non-empty word string, return a string made of each char just before and just after every appearance of the word in the string. Ignore cases where there is no char before or after the word, and a char may be included twice if it is between two words.
If inputs are "abcXY123XYijk" and "XY", output should be "c13i".
If inputs are "XY123XY" and "XY", output should be "13".

19. Lab Assignment No: 8

Objective: To Understand and Implement the concept of Abstract classes and Interfaces
Q1. Create an abstract class Compartment to represent a rail coach. Provide an abstract function notice in this class. Derive FirstClass, Ladies, General, Luggage classes from the compartment class. Override the notice function in each of them to print notice suitable to the type of the compartment. Create a class TestCompartment. Write main function to do the following: Declare an array of Compartment of size 10. Create a compartment of a type as decided by a randomly generated integer in the range 1 to 4. Check the polymorphic behavior of the notice method.
Q2.Write a program in java which implement interface Student which has two methods Display_Grade and Attendance for PG_Students and UG_Students (PG_Students and UG_Students are two different classes for Post Graduate and Under Graduate Students respectively).

20. Lab Assignment No: 9

Objective: To Understand and Implement Exception handling in java
Q1. Write a program in Java to display name and roll number of students. Initialize respective array variables for 10 students. Handle ArrayIndexOutOfBoundsException, so that any such problem does not cause illegal termination of program.
Q2. Write a program to accept name and age of a person from the command prompt(passed as arguments when you execute the class) and ensure that the age entered is >=18 and < 60. Display proper error messages. The program must exit gracefully after displaying the error message in case the arguments passed are not proper. (Hint : Create a user defined exception class for handling errors.)

21. Lab Assignment No: 10

Objective: To Understand and Implement File Handling and multithreading in java
Q1. Write a program to count the number of times a character appears in the Fileand also copy from one file to another. (Case insensitive... 'a' and 'A' are considered to be the same)
Q2. 1. Create class of SalesPersons as a thread that will display fives sales persons name. 2. Create a class as Days as other Thread that has array of seven days.
3. Call the instance of SalesPersons in Days and start both the threads 4. suspendSalesPersons on Sunday and resume on wednesday Note: use suspend, resume methods from thread
Q3. Create two threads, one thread to display all even numbers between 1 & 20, another to display odd numbers between 1 & 20. Note: Display all even numbers followed by odd numbers Hint: use join

22. Lab Assignment No: 11

Objective: To Understand and Implement Applets, AWT and Swings
Q1. Program to create a calculator with the help of AWT packages in Java.
Q2. Program to create a unit converter using Swings in Java.

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Q3. APPLETS
a) Working with Frames and various controls.
b) Working with Dialogs and Menus.
c) Working with Panel and Layout.
d) Incorporating Graphics.
e) Working with colors and fonts.

Books recommended:

TEXT BOOKS

4. Krishna P. R., Object Oriented Programming through JAVA, 1st Edition, Universities Press, 2008.
5. Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.
6. Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi.

REFERENCE BOOKS

3. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi.
4. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi.

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

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CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Head of Department

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
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CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO2	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO3	2	1	3	3	3	3	2	1	1	1	1	2	3	2	3
CO4	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3
CO5	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CS212
Course title: Operating System Lab
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Gain practical experience with designing and implementing concepts of operating systems such as system calls.
2.	Implement and develop CPU scheduling.
3.	Implement and understand process management, memory management.
4.	To provide a foundation in use of file systems and deadlock handling using C language in Linux environment.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand and implement basic services and functionalities of the operating system using system calls. .
CO2	Use modern operating system calls and synchronization libraries in software/ hardware interfaces.
CO3	Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.
CO4	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
CO5	Implement memory management schemes and page replacement schemes.

SYLLABUS

List of Programs as Assignments:

11. Lab Assignment No: 1

Objective: To Understand and Implement Directory Structure

Q1. WAP to create a File directory system.

12. Lab Assignment No: 2

Objective: To Understand and Implement Scheduling processes

Q1. WAP to schedule various processes

13. Lab Assignment No: 3

Objective: To Understand and Implement FCFS

Q1. WAP to implement FCFS CPU Scheduling

14. Lab Assignment No: 4

Objective: To Understand and Implement SJF

Q1. WAP to implement SJF CPU scheduling.

15. Lab Assignment No: 5

Objective: To Understand and Implement SRTF

Q1.WAP to implement SRTF CPU scheduling.

16. Lab Assignment No: 6

Objective: To Understand and Implement Scheduling algorithms

Q1. WAP to implement Round Robin Scheduling

17. Lab Assignment No: 7

Objective: To Understand and Implement Scheduling algorithms

Q1 WAP to implement SRTF scheduling .

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18. Lab Assignment No: 8

Objective: To Understand and Implement context switching

Q1. WAP to implement Round Robin Scheduling with context switching.

19. Lab Assignment No: 9

Objective: To Understand and Implement context switching.

Q1.WAP to implement SRTF with context switching.

20. Lab Assignment No: 10

Objective: To Understand and Implement Page Replacement Techniques

Q1. WAP to implement FCFS page replacement algorithm.

Q2. WAP to implement Optimal page replacement algorithm.

Books recommended:

TEXT BOOKS

OPERATING SYSTEM CONCEPTS(2012): ABRAHAM SILBERSCHATZ Yale University PETER BAER GALVIN Pluribus Networks GREG GAGNE Westminster College. **(T1)**

Operating Systems (2003) by Deitel, Deitel, and Choffnes. (**T2**)

REFERENCE BOOKS

OPERATING SYSTEM CONCEPTS(2012): ABRAHAM SILBERSCHATZ Yale University PETER BAER GALVIN Pluribus Networks GREG GAGNE Westminster College.**(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

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CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	**% Distribution**
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	**% Distribution**
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4
Progressive Evaluation	3	3	3	3
End SEM Evaluation	3	3	3	3

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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CO3	2	2	3	2	2	2	2	2	1	2	1	3	3	2	2
CO4	3	3	3	3	2	2	2	2	2	2	2	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD4
CO2	CD1, CD2,CD5
CO3	CD1, CD2
CO4	CD1, CD3,CD5
CO5	CD1,CD2

COURSE INFORMATION SHEET

Course code: CS207
Course title: **Design of Algorithm Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives
After the completion of this course, students will be able to:

1.	Able to implement various design strategies of algorithms
2.	Able to examine the efficiency of algorithm by changing the places of important steps.
3.	Able to compare approximate and exact solutions.
4.	Able to investigate effect randomness on correctness and efficiency of algorithms.
5.	Able to design approximate, random and parallel solution of different problems.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Able to know the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations.
CO2	Able to determine the practical implications of asymptotic notations.
CO3	Able to Implement, analyze, and compare algorithms.

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CO4	Able to Know the difference between the dynamic programming concept and a greedy approach.
CO5	Able to know and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.

Syllabus

List of Programs as Assignments:

9. **Lab Assignment No: 1**

   Programs on Polynomial vs logarithmic running times

   Lab Assignment No: 2

Programs on Divide-and-conquer algorithms

10. **Lab Assignment No: 3**

Programs on Greedy and dynamic-programming algorithms

11. **Lab Assignment No: 4**

    Programs on Binary trees

12. **Lab Assignment No: 5**

Programs on Heaps and priority queues

13. **Lab Assignment No: 7**

Programs on Binary search trees

14. **Lab Assignment No: 8**

Programs on Hash tables

15. **Lab Assignment No: 9**

    Programs on Graph traversal

16. **Lab Assignment No: 10**

Programs on Shortest paths in graphs.

Books recommended:

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001. **(T1)**
2. SanjoyDasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, Tata McGraw-Hill, 2008. **(T2)**
3. Jon Kleinberg and ÉvaTardos, Algorithm Design, Pearson, 2005. **(T3)**

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Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A
Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
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CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution

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Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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CO1	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO2	2	2	3	2	1	1	1	1	1	2	1	2	3	3	2
CO3	2	2	3	2	1	1	1	1	1	2	2	2	3	3	3
CO4	3	3	3	3	2	1	1	1	1	2	2	3	3	3	3
CO5	3	3	3	3	2	1	1	1	1	2	2	3	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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COURSE INFORMATION SHEET

Course code: IT301
Course title: **Data Communication & Computer Network(DCCN)**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Study the components of the data communication model and communications architecture.
2.	Understand the differences and similarities between the OSI model and the TCP model.
3.	Understand the fundamentals of the theory of signaling.
4.	Understand the basic principles of signal encoding techniques, error-detection, and error-correction techniques.
5.	Understand the characteristics of analog signaling and digital signaling and the strengths and weaknesses of each method.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify the elements of a communication network.
2.	Illustrate different data communications and networking standards.
3.	Design and implement a simple LAN and a WAN that meet a specific set of criteria.
4.	Identify the new trends and technologies, their potential applications.
5.	Examine the social impact of the networking technology particularly on issues related to security and privacy.

Syllabus

Module I

Data Communications and Networking Overview

A Communications Model, Data Communications, Data Communication Networking, The Need for Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture, Data Transmission Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity. (8L)

Module II

Transmission Media and Signal Encoding Techniques: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.Digital Data Digital Signals,

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Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals. (8L)

Module III

Digital Data Communication Techniques and Data Link Control: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing, Flow Control, Error Control, High-Level Data Link Control (HDLC). (8L)

Module IV

Multiplexing, Circuit Switching and Packet Switching Multiplexing

Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing, Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signaling, Soft switch Architecture, Packet-Switching Principles, X.25, and Frame Relay. (8L)

Module V

Asynchronous Transfer Model

Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.

Routing in Switched Networks

Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms. (8L)

Text Book:

Stallings W., Data and Computer Communications, 10thEdn., Pearson Education, PHI, New Delhi, 2014.(T1)

Reference Book:

Forouzan B. A., Data Communications and Networking, 5thEdn. TMH, New Delhi, 2017.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25

Head of Department

Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	2	2	2	2	1	1			2	2	3	3	3	3
CO2	3	2	2	2	2	1	1		2	2	2	3	3	3	3
CO3	3	3	2	2	2	2	1		2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS301
Course title: **Database Management System (DBMS)**
Pre-requisite(s): Data Structures.
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Understand the fundamental concepts, historical perspectives, current trends, structures, operations and functions of different components of databases.
2.	Recognize the importance of database analysis and design in the implementation of any database application.
3.	Describe the role of transaction processing in a database system.
4.	Understand various concurrency control mechanisms for a database system.
5.	Describe the roles of recovery and security in a database system.

Course Outcomes
After the completion of this course, students will be able to:

1.	Analyze data organization requirements and their inter relationships.
2.	Illustrate the features of data models and their application for storing data.

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3.	Design queries to maintain and retrieve useful information from the databases created.
4.	Analyze the physical database design with respect to their expected performance using normalization and query processing.
5.	Examine the best practices according to concepts of indexing, transaction control and concurrency maintenance

Syllabus

Module I

Database Design and Entity - Relational Model

Purpose of Database System; View of Data, Database Languages, Transaction Management, Database architecture, Database Users and Administrator, Types of database System, Overview of design process, E-R model, Constraints, E–R Diagram, E-R Diagram issues, Weak Entity Sets, Extended E – R Features, Reduction to E–R Schemas. (8L)

Module II

Relational Model

Structure of Relational Database, Codd's Rules, Fundamental Relational Algebra Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations, Data definition, Basic structure of SQL queries, Set Operations, Aggregate Functions, Null Values, Nested Sub Queries, complex queries, views, modification of database, Joined relations, SQL data types & schemas, Integrity constraints, authorization, Embedded SQL, Triggers. (8L)

Module III

Relational Database Design

Functional dependency, Decomposition, Normalization, First normal form, Second normal form, Third normal form, BCNF, Multivalued dependencies and Fourth normal form, Join dependencies and Fifth normal form, DKNF. (8L)

Module IV

Indexing & Hashing

Ordered Indices, B+ Tree index files, B-Tree index files, Multiple key access Static hashing, Dynamic Hashing, Comparison of ordered indexing and hashing, Index definition in SQL.

Query Processing

Measure of Query Cost, Selection Operation, Evaluation of Expressions. (8L)

Module V

Transaction & Concurrency Control

Transaction Concepts & ACID Properties, Transaction States, Implementation of Atomicity & Durability, Concurrent Executions, Serializability& Its Testing, Recoverability, Lock-Based protocols, Validation based protocol, Multiple Granularity, Multiversion Schemes, Deadlock Handling. (8L)

Text Book:

Silberschatz A. et.al, Database System Concepts, 6th Edition, Tata Mc-Graw Hill, New Delhi, 2011. (T1)

Reference Books:

Elmasri R., Fundamentals of Database Systems, 7thEdition, Pearson Education, New Delhi, 2016. (R1)

Ullman Jeffrey D et.al., A First course in Database Systems, 3rd Edition, Pearson Education, New Delhi- 2014.(R2)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects

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CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO2	3	1	2	2	3	3	2	1	1	1	1	2	3	2	2
CO3	3	1	3	3	3	3	2	1	1	2	1	2	3	2	3
CO4	3	1	3	3	3	3	2	1	1	2	2	3	3	2	3
CO5	2	1	3	3	3	3	2	1	1	1	2	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS310
Course title: **Formal language and Automata Theory**
Pre-requisite(s): Discrete Mathematics
Co- requisite(s): NIL
Credits: L:3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	Define a system and recognize the behavior of a system.
2.	Design finite state machines and the equivalent regular expressions.
3.	Construct pushdown automata and the equivalent context free grammars
4.	Design Turing machines and Post machines
5.	Learn about the issues in finite representations for languages and machines, as well as gain a more formal understanding of algorithms and procedures.

Course Outcomes

After the completion of this course, students will be able to:

1.	Relate formal languages and mathematical models of computation
2.	Analyze different types of languages and the corresponding machines
3.	Analyze the Pushdown machine and its role in compiler construction
4.	Find the capability of real computers and learn examples of unsolvable problems.
5.	Analyze classes of P, NP, NP-C and NP-Hard problems

Syllabus

Module I

Introduction to Automata: (mathematical model of digital devices, including real computer), State Transition Graph, Finite Automaton (FA) and its types, Deterministic Finite Automaton (DFA), Non-deterministic Finite Automaton (NDFA), Complement, Union, Intersection of FA's , Conversion Strategy from NDFA to DFA , Minimization of FA, Finite Automaton with Output, Applications of FA.
(10L)

Module II

Regular Expressions(RE): Introduction , R.E.'s and basic operations, Algebraic laws on Regular Expression, Finite and Infinite Languages, Equivalence of finite Automaton and regular expressions, Constructing NDFA from Regular Expression , Pumping Lemma for Regular Language, Closure properties of Regular Languages, Non-regular languages, Applications of Regular Expression.
(6L)

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Module III

Grammar: Introduction, Formal Definition of Grammar, The Chomsky Hierarchy of Grammar, Designing Regular grammar from DFA, Context Free Grammar, Closure properties of Context Free Languages, , CFG and Normal form: Chomsky Normal Form, Greibach Normal Form, Non-Context Free Language, Applications of CFGs. (8L)

Module IV

Push Down Automation (PDA): Introduction, Definition of PDA, Types of Pushdown Automata (DPDA and NPDA), Converting CFG to PDA, Derivation (Parsing), Parsing Techniques, Ambiguous and Unambiguous Grammar, Demerits of Ambiguous Grammar. (8L)

Module V

Turing Machine(TM): Single Tape TM, Variations of TM, Halting Problem, Turing Machine and Languages, Enumerable Languages, Decidable, Recognizable and Undecidable languages, Solvable and Unsolvable problems, Post Correspondence Problems(PCP), Classes of Problems: P, NP, NP-C and NP-Hard.
(8L)

Text Book:

Hopcroft J.E., Motwani R. and Ullman J.D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2008. (T1)

Reference Books:

Mishra K.L.P. andChandrasekaran N. , Theory of Computer Science: Automata, Languages and Computation, 3rd Edition, PHI.(R1)

Martin John C., Introduction to Languages and the Theory of Computation, 3rd Edition, TataMcGraw Hill Publishing Company, New Delhi, 2007. (R2)

Lewis Harry R. and Papadimitriou Christos H., Elements of the theory of Computation, 2nd Edition, Prentice-Hall of India Pvt. Ltd. (R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	3	1	2	1	1	2	1	1	1	3	3	2
2	3	3	1	3	1	2	2	1	1	1	2	1	2	2	1
3	3	3	3	3	3	1	1	1	2	2	1	2	2	3	1
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	1
5	2	2	1	2	3	1	1	1	1	3	2	3	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT303
Course title: Internet and web technology
Pre-requisite(s):
Co- requisite(s):
Credits: L: 3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV/III
Branch: IT

Course Objectives

This course enables the students:

A.	To provide students with a fundamental understanding as to how an XHTML-compliant web site is developed, implemented, and maintained. XHTML
B.	To provide students with a fundamental understanding as to how an Cascading Style Sheets- is developed and implemented.

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C.	To provide basic understanding of java script to help in designing of web pages.
D.	To understand the need of Dom model.
.E	To provide the role of xml in web design

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Describe the components of the Internet and Web technology
2.	Analyse common Internet applications such as marketing, collaboration, electronic commerce and document management
3.	Explain the basics of Internet technology, such as http and the World Wide Web, HTML, and JavaScripts;
4.	Create WWW pages to serve as front-end to client/server, Internet applications
5	Analyzing and designing Internet applications and testing and documenting the solutions developed.

Syllabus

Module	Contents	No of Lect
1	Web 2.0: search, content networks, user-generated content, blogging, social networking, social media, tagging, social bookmarking, rich Internet applications, web services, location-based services, Web 2.0 monetization and business models, future of the Web.	7
2	Extensible Hypertext Mark up Language (XHTML): XHTML syntax, headings, linking, images, special characters and horizontal rules, lists, tables, forms, internal linking, meta elements.	8
3	Cascading Style Sheets (CSS): separation of content and presentation, inline styles, embedded style sheets, conflicting styles, kinking external style sheets, positioning elements, backgrounds, element dimensions, box model and text flow, media types, building a CSS drop-down menu, user style sheets.	8
4	JavaScript: client side scripting, control statements, functions, arrays, objects, events. Document object model: objects and collections	8

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5	Extensible Mark up Language (XML) and RSS: Advantages and applications, structuring data, XML namespaces, Document Type Definitions (DTDs), XML vocabularies, RSS.	9

Text books:

1. Deitel H.M. and P. J. Deitel, Internet & World Wide Web. How to Program, 5/e, Prentice Hall, ISBN 0131752421, 2013.

Reference books:

1.Internet and Web Technologies by Raj kamal, McGraw Hill Education (1 July 2017)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	2	3	1				1		1	3	2	3
CO2	3	2	3	2	3	3	1	3		2	1	1	3	2	3
CO3	2	2	3	2	3	1						1	3	2	3
CO4	3	2	3	2	3	2	1	3		2	1	1	3	2	3
CO5	3	2	3	2	3	3	1	2		2	1	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT320
Course title**: User Interface Design**
Pre-requisite(s): CS204 OOPDP
Co- requisite(s):NIL
Credits: L: 3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students

1.	To impart the basic concepts of User Interface Design.
2.	To develop understanding about human computer interaction methods that utilize more general, widespread and easier-to-learn capabilities.
3.	The cognitive and perceptual constraints that affect interface design
4.	Techniques for evaluating the usability of an interface
5	How to communicate the results of a design process, both in oral and written form

Course Outcomes
After the completion of this course, students will be able to do the following:

1.	Identify the key terms related to user interfaces and user interface design and implementation
2.	Identify and describe various types of computer users and computer use contexts
3.	Identify and describe various types of user interfaces
4.	Describe and explain the user interface design process
5	Identify and describe common abstract user interface components, such as radio buttons and group boxes

Syllabus
Module I
Introduction: Importance of user interface – definition, importance of good design, brief history – Graphical User Interface – Web User Interface – Theories, Principles and Guidelines of User interface design.
(7L)
Module II
Design Process: Obstacles in development path deigning for people-Understanding Human Interaction with computers, Importance of Human Characteristics, Human consideration, Human Interaction speeds – Understanding Business function. (8L)

Module II
Screen Designing: Design goals - screen meaning and purpose, organizing screen elements ordering of screen data and content – screen navigation and flow –

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visually pleasing composition – amount of information – focus and emphasis – presenting information simply and meaningfully – information retrieval on web – Statistical graphics – Technological considerations in Interface Design.

(8L)

Module IV

Menus and navigation schemes: structures of menus-functions of menus- contents of menus - formatting of menus – phrasing the menu- selecting menu choices-navigating menus-kinds of graphical menus- Selection of windows-Window characteristics-components of windows-window presentation styles-types of windows-window management-organising window functions-window operations-Selection of device based and screen based controls - text and messages – icons and images – Multimedia – colours- uses, problems, choosing colours.

(8L)

Module V

Distributed and Collaborative Interaction: Device consistency-distribution of the user interface-event distribution-graphical package layer-programmable API-Model semantics distribution-data layer distribution-asynchronous collaboration-Software tools-specification methods- interface building tools –evaluation and critiquing tools-Interaction devices keyboard and function keys - pointing devices- speech recognition, digitization and generation – image and video displays – printers.

(9L)

Text books:

Wilbert O. Galitz,"The Essential Guide to User Interface Design", 3rd Edition, Wiley Dreamtech,Delhi, 2007.(T1)

Shneiderman Ben, "Designing the User Interface", 5th Edition, Pearson Education Asia, Delhi, 2014.(T2)

Reference books:

Olsen Dan R., "Human Computer Interaction",Cengage, New Delhi,2009.(R1)

Carroll John M.,"Human Computer Interaction", Pearson Education Asia, Delhi, 2002.(R2)

Cooper Alan, "The Essentials of User Interface Design ", Wiley Dreamtech, Delhi, 2002.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
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CD5	Industrial visits/in-plant training
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CD7	Simulation

Head of Department

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	2	3	1	1	2	1	2	1	2	3	2	3
CO2	2	3	3	3	2	3	2	2	2	3	2	3	3	2	3
CO3	3	3	3	3	3	3	1	2	2	3	2	3	3	3	3
CO4	3	3	3	3	3	1	1	1	2	2	2	3	3	2	3
CO5	3	3	3	2	3	2	2	1	2	2	1	2	3	3	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
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CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT321
Course title: **Bio Inspired Computing**
Pre-requisite(s): CS201 Data Structure
Co- requisite(s):
Credits: L: 3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic structure of cellular system.
2.	To understand the basic structure of Biological nervous systems.
3.	To know the basic structure of Biological immune system.
4.	To understand the artificial evolution of competing systems.

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Course Outcomes

After the completion of this course, students will be able to:

1.	Implement and apply evolutionary algorithms
2.	Explain cellular automata and artificial life
3.	Implement and apply neural systems
4.	Explain developmental and artificial immune systems
5.	Explain behavioral systems

Syllabus

Module I

EVOLUTIONARY AND CELLULAR SYSTEMS

Foundations of evolutionary theory – Genotype – artificial evolution – genetic representations – initial population – fitness functions – selection and reproduction – genetic operators – evolutionary measures – evolutionary algorithms – evolutionary electronics – evolutionary algorithm case study Cellular systems – cellular automata – modeling with cellular systems – other cellular systems – computation with cellular systems – artificial life – analysis and synthesis of cellular systems.

(8L)

Module II

NEURAL SYSTEMS

Biological nervous systems – artificial neural networks – neuron models – architecture – signal encoding – synaptic plasticity – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – case study. (8L)

Module III

DEVELOPMENTAL AND IMMUNE SYSTEMS

Rewriting systems – synthesis of developmental systems – evolutionary rewriting systems – evolutionary developmental programs Biological immune systems – lessons for artificial immune systems – algorithms and applications – shape space – negative selection algorithm – clonal selection algorithm – examples. (8L)

Module IV

BEHAVIORAL SYSTEMS

Behavior is cognitive science – behavior in AI – behavior based robotics – biological inspiration for robots – robots as biological models – robot learning – evolution of behavioral systems – learning in behavioral systems – co-evolution of body and control – towards self reproduction – simulation and reality. (8L)

Module V

COLLECTIVE SYSTEMS

Biological self-organization – Particle Swarm Optimization (PSO) – ant colony optimization (ACO) – swarm robotics – co-evolutionary dynamics – artificial evolution of competing systems – artificial evolution of cooperation – case study. (8L)

Head of Department

Text Books:

Floreano ,D. and Mattiussi ,C., "Bio-Inspired Artificial Intelligence", MIT Press, 2008.(T1)
Neumann ,F. and Witt ,C., "Bioinspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010.(T2)
Elben, A. E. and Smith ,J. E., "Introduction to Evolutionary Computing", Springer, 2010.(T3)
Goldberg, D. E., "Genetic algorithms in search, optimization, and machine learning", Addison- Wesley, 1989.(T4)
Haykin ,Simon O., "Neural Networks and Learning Machines", Third Edition, Prentice Hall,2008.(T5)

Reference Books

Dorigo ,M. and Stutzle ,T., "Ant Colony Optimization", A Bradford Book, 2004.(R1)
Ebelhart ,R. C. et al., "Swarm Intelligence", Morgan Kaufmann, 2001.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	3	2	1	1	2	1	2	3	3	2
CO2	3	3	2	3	3	3	2	1	1	1	1	2	3	2	2
CO3	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2
CO4	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3
CO5	3	3	3	3	3	3	3	1	1	2	1	2	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS320
Course title: **Optimization Technique**
Pre-requisite(s)::CS206Design and Analysis of Algorithm
Co- requisite(s):Nil
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the basic idea of Network Optimization Models.
2.	To introduce the basic concept of Dynamic Programming.
3.	To understand the idea of Nonlinear Programming.
4.	To know about the basic concepts of Heuristic Programming.
5.	Provide the students to practice on Linear Programming for Problem solving.

Course Outcomes
After the completion of this course, students will be able to :

1.	Prepare the operational models for the real-world applications using Linear Programming
2.	Apply the techniques to solve the Network Optimization models
3.	Analyse the computational feasibility of the solutions using the Deterministic and Probabilistic Dynamic Programming
4.	Model problems using Non-Linear Programming and evaluate the suitability of the available techniques for the problem at hand
5	Apply the meta-heuristic algorithms for real world optimization

Syllabus
Module I
Introduction to Linear Programming,Solving Linear Programming Problems –Graphical Method,The Simplex Method,The Revised Simplex Method, Duality Theory , Dual Simplex Method, Sensitivity Analysis.
(8L)
Module II
Integer Programming,Gomory's Cutting Plane Method, The Branch-and-Bound Technique for Binary and Mixed-Integer programming.Network Optimization Models, The Network Simplex Method.
(8L)

Head of Department

Module III

Dynamic Programming: Characteristics of Dynamic Programming Problem,Deterministic Dynamic Programming, Probabilistic Dynamic Programming. (8L)

Module IV

Nonlinear Programming: Graphical Illustration of Nonlinear Programming Problems, Types of Nonlinear Programming Problems, Unconstrained Optimization, The Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization, Quadratic Programming, Separable Programming, Convex Programming.
(8L)

Module V

Queueing Theory : Basic Structure of Queueing Models, Examples of Real Queueing Systems, Role of Exponential Distribution, The Birth-and-Death Process,Different Queuing Models.

Heuristic Programming and Metaheuristics: The Nature of Meta-Heuristics, Search, Simulated Annealing, Genetic Algorithms. (8L)

Text Book:

Hiller ,S. & Lieberman ,G.J.,"Operations Research", 9/e , TMH, New Delhi–2012.(T1)

Reference Books:

Taha ,H.A.,"Operations Research", 9/e , Pearson Education , New Delhi-2013.(R1)
Pai,P.P.,"Operations Research", 1/e, Oxford University Press 2012.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	3	2	1	1	2	2	1	2	3	2	3
CO2	3	3	3	3	3	2	1	1	2	2	1	2	3	3	3
CO3	3	3	2	3	3	3	1	1	2	2	1	2	3	2	3
CO4	3	3	3	3	3	2	1	1	2	2	1	2	3	3	3
CO5	3	3	3	3	3	2	1	1	3	3	1	2	3	3	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT321
Course title**: Soft Computing**
Pre-requisite(s): MA205Discrete Mathematics
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the concept of fuzzy logic and controllers
2.	To understand the various architectures of ANN and its learning methods
3.	To learn about basic concepts of genetic algorithm and its operators
4.	To understand the Artificial Neural Networks
5.	To understand the Genetic Algorithms

Course Outcomes

After the completion of this course, students will be able to:

1.	Solve numerical on Fuzzy sets and Fuzzy Reasoning.
2.	Develop Fuzzy Inference System (FIS).
3.	Solve problems on Genetic Algorithms
4.	Explain concepts of neural networks
5.	Develop neural networks models for various applications.

Head of Department

Syllabus

Module I

Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, Fuzzy types and levels, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement, Fuzzy Number,Fuzzy measure. (8L)

Module II

Fuzzy Logic: Fuzzy Rules and Fuzzy Reasoning:Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Defuzzification,FuzzyReasoning.Fuzzy Inference System: Introduction, Mamdani Fuzzy Models, Other Variants, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models. (8L)

Module III

Fundamentals of Genetic Algorithms: Basic Concepts, Creation of Offsprings, Encoding, Fitness Functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.
(8L)

Module IV

Introduction to Artificial Neural Networks: What is a Neural Network? Human Brain, Models of Neuron, Neural Network viewed as Directed Graphs, Feedback, Network Architecture, Knowledge Representation, Learning processes:(Error correction, Memory-Based, Hebbian ,Competitive,Boltzman ,Supervised,Unsupervised),Memory,Adaptation. (8L)

Module V

Perceptrons, Adaline, Back Propagation Algorithm, Methods of Speeding, Convolution Networks, Radical Basis Function Networks, Covers Theorem, Interpolation Learning, The Hopfield Network. (8L)

Text Books:

Jang J.S.R., Sun C.T. and Mizutani E., "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi 2004.(T1)
Rajasekaran S. & Vijayalakshmi G.A. Pai, PHI, New Delhi 2003.(T2)
Ross T. J., "Fuzzy Logic with Engineering Applications." TMH, New York, 1997.(T3)
HaykinsSimon ,"Neural Networks :A Comprehensive Foundation, Pearson Education,2002.(T4)

Reference Books:

Ray K.S. ,"Soft Computing and Its application", Vol 1, Apple Academic Press, 2015. (R1)
Lee K.H. ,"First Course on Fuzzy Theory and App.", Adv in Soft Computing Spinger, 2005.(R2)
Zimmermann H.Z. ,"Fuzzy Set Theory and its App " , 4th Edition, Spinger Science, 2001.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	1	1	2	2	1	2	2	3	2
CO2	3	3	3	3	3	3	3	1	3	3	1	2	3	3	3
CO3	3	3	3	3	2	2	1	1	2	2	1	2	3	3	2
CO4	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2
CO5	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS322
Course title: **Simulation and Modelling**
Pre-requisite(s): CS201 Data Structure
Co- requisite(s):
Credits: L: 3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To Characterise engineering systems in terms of their essential elements, purpose, parameters, constraints, performance requirements, sub-systems, interconnections and environmental context.
2.	To understand Engineering problem modelling and solving through the relationship between theoretical and mathematical
3.	To provide Mathematical modelling real world situations related to engineering systems development.
4.	To able Generate random numbers and random varieties using different techniques.
5.	To provide the knowledge of queuing theory to solve real life problem

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Define basic concepts in modeling and simulation (M&S)
2.	Classify various simulation models and give practical examples for each category
3.	Analyze the behavior of a dynamic system and create an analogous model for a dynamic system.
4.	Analyze and test random number variates and apply them to develop simulation models
5.	Develop a real-life model using queuing system

Syllabus

Module I

The concepts of a system, System Environment, Stochastic Activities, continuous and discrete systems, System Modeling, Types of models.System Studies: Subsystem, A Corporate Model, Environment segment, Production Segment, Management Segment, full Corporate Model, Types of System study, System Analysis, System Design, System Postulation. (7L)

Head of Department

Module II

The technique of simulation, the Monte Carlo method, comparison of simulation and analytical methods, experimental nature of simulation, types of system simulation, numerical computation technique for continuous & discrete models, distributed lag models, cobweb models. Continuous system models, differential equations, analog computers & methods, hybrid computers, CSSLs, CSMP-III, Feedback Systems, Simulation of an Autopilot. (8L)

Module III

Exponential Growth & decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamics diagrams, Simple system dynamics diagrams, multi–segment models, representation of time delays. (8L)

Module IV

Evaluation of continuous probability functions, continuous uniformly distributed random numbers, a uniform random number numbers, generating discrete distributions, non-uniform continuously distributed random numbers, the rejection method. Random numbers Generators: Techniques for generating random numbers. Test for random numbers. Random vitiate Generation: Inverse transform technique, exponential distribution, uniform distribution. (8L)

Module V

Queuing disciplines, measures of queues. Discrete events, representation of time, generation of arrival patterns, simulation of a telephone system, delayed calls, Simulation programming tasks, measuring utilization and occupancy. (9L)

Text books:

Gordon Geoffrey, System Simulation, 2nd Edition, Pearson Education, 2007. (T1)
Banks J., Carson J. S. , Nelson B.L., Nicol D.M., Discrete-Event System Simulation, 4thEdn, Pearson Education, 2007. (T2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	2	2	1	1	1	2	1	2	2	2	2
CO2	3	3	3	2	3	2	2	1	1	2	1	2	3	2	2
CO3	3	3	3	3	3	2	2	1	1	2	1	2	3	3	2
CO4	3	3	3	3	3	2	2	1	1	2	1	2	3	3	3
CO5	3	3	3	2	3	2	2	1	1	2	1	2	3	3	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS323
Course title: **Simulation and Modelling Lab**
Pre-requisite(s): CS322 Simulation Modelling
Co- requisite(s):NIL
Credits: L: 0 T:0 P:3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To Characterise engineering systems in terms of their essential elements, purpose, parameters, constraints, performance requirements, sub-systems, interconnections and environmental context.
2.	To understand Engineering problem modelling and solving through the relationship between theoretical and mathematical
3.	To provide Mathematical modelling real world situations related to engineering systems development.
4.	To able Generate random numbers and random varieties using different techniques.
5.	To provide the knowledge of queuing theory to solve real life problem

Course Outcomes
After the completion of this course, students will be able to do the following:

1.	Define basic concepts in modeling and simulation (M&S)
2.	Classify various simulation models and give practical examples for each category
3.	Analyze the behavior of a dynamic system and create an analogous model for a dynamic system.
4.	Analyze and test random number variates and apply them to develop simulation models
5.	Develop a real life model using queuing system

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Syllabus

1. Computer Generation of Random Numbers.
2. Chi-square goodness-of-fit test.
3. One-sample Kolmogorov-Smirnov test
4. Test for Standard Normal Distribution
5. Testing Random Number Generators.
6. Monte-Carlo Simulation.
7. Simulation of Single Server Queuing System.
8. Simulation of Two-Server Queuing System.
9. Simulate and control a conveyor belt system
10. Two-sample Kolmogorov-Smirnov test.

Text books:

Gordon Geoffrey, System Simulation, 2nd Edition, Pearson Education, 2007. (T1)
Banks J., Carson J. S. , Nelson B.L., Nicol D.M., Discrete-Event System Simulation, 4thEdn, Pearson Education, 2007. (T2)

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	2	2	2	2	1	1	1	2	1	2	2	2	2
CO2	3	3	3	2	3	2	2	1	1	2	1	2	3	2	2
CO3	3	3	3	3	3	2	2	1	1	2	1	2	3	3	2
CO4	3	3	3	3	3	2	2	1	1	2	1	2	3	3	3
CO5	3	3	3	2	3	2	2	1	1	2	1	2	3	3	3

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COURSE INFORMATION SHEET

Course code:IT322
Course title: **Cloud Computing**
Pre-requisites: IT201 Basics of Intelligent Computing
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Understand the elements of distributed computing and core aspects of cloud Computing.
2.	Understand the concepts and aspects of virtualization and application of virtualization technologies in cloud computing environment
3.	Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS and gain comprehensive knowledge of different types of clouds.
4.	Be familiar with application development and deployment using services of different cloud computing technologies provider: Google app Engine, Amazon Web Services (AWS) and Microsoft Azure.
5.	Understanding the key security, compliance, and confidentiality challenges in cloud computing.

Course Outcomes:

After the completion of this course, students will be able to:

1.	Recall the various aspects of cloud computing and distributed computing
2.	Understand the specifics of virtualization and cloud computing architectures.
3.	Develop and deploy cloud application using services of different cloud computing technologies provider: Google app Engine, Amazon Web Services (AWS) and Microsoft Azure.
4.	Evaluate the security and operational aspects in cloud system design, identify and deploy appropriate design choices when solving real-world cloud computing problems.
5.	Provide recommendations on cloud computing solutions for a Green enterprise.

Head of Department

Syllabus

Module I

Introduction: Essentials, Benefits and need for Cloud Computing - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics Cloud Adoption. (8L)

Module II

Principles of Parallel and Distributed Computing: Eras of computing, Parallel vs. Distributed computing, Elements of parallel computing, Elements of distributed computing, Technologies for distributed computing.

(8L)

Module III

Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples.

Storage virtualization:Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Centre.

(8L)

Module IV

Cloud computing architecture: Introduction, Cloud reference model, Types of clouds, Economics of the cloud, Open challenges.

(8L)

Module V

Cloud platforms in industry and Cloud applications : Amazon web services, Google app engine, Microsoft azure, Observations, Scientific applications, Scientific, Business and Consumer applications.

(8L)

Text Book:

Buyya Raj Kumar, Vecchiola Christian &Thamarai S. Selvi, "Mastering Cloud Computing", McGraw Hill Publication, New Delhi, 2013.(T1)

Reference Books:

Velte T., Velte A. and Elsenpeter R., "Cloud Computing: A Practical Approach", McGraw Hill, India.(R1)

Buyya R., Broberg J., "Cloud Computing: Principles and Paradigms", Wiley.(R2)

Hwang K., Fox G. and Dongarra J., "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann, 2012.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

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POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	3	2	2	1	2	2	2	3	3	3
CO2	3	3	3	3	3	3	2	2	1	2	2	2	3	2	3
CO3	3	3	3	2	3	3	2	2	1	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO5	3	3	3	3	3	3	2	2	2	2	2	2	2	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

Head of Department

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COURSE INFORMATION SHEET

Course code: IT323
Course title: **Software Project Management**
Pre-requisite(s): IT305 Software Engineering
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the fundamental principles of Software Project management
2.	Be familiar with the different methods and techniques used for project management.
3.	Have a good knowledge of responsibilities of project manager and how to handle these.
4.	To understand about different techniques for software management.
5.	Work in groups to analyze a project

Course Outcomes
After the completion of this course, students will be able to do the following:

1.	Create project plan for software projects effectively.
2.	Implement software project plans and handle real-world project management challenges.
3.	Develop skills for project scheduling, tracking and controlling software project.
4.	Analyze a project and implement a solution
5.	Handle activities necessary to successfully complete and close the software Projects.

Syllabus
Module I
Managing Software Project: Process & Project Management, Project Management and the CMM, Project Management at Infosys, Introduction to CMMI, PCMM.
The Project Planning Infrastructure: The process data base, The process capability Baseline, Process Assets and the Body of Knowledge System.

Head of Department

Process Planning: The Infosys Develelopment Process, Requirement Change Management. (8L)

Module II
Effort Estimation & Scheduling: Estimation and Scheduling Concepts, Effort – Estimation, Scheduling.
Quality Planning: Quality Concepts, Quantitative quality Management Planning, Defect Prevention Planning. (7L

Module III
Risk Management: Concepts of Risks and Risk Management, Risk Assessment, Risk Control, Examples.
Measurement and Tracking Planning: Concepts in measurement, Measurements, Project tracking.
(7L)
Module IV
Project Management Plan: Team Management, Customer Communication and Issue Resolution, Structure of the Project Management Plan.
Configuration Management: Concepts in Configuration Management, Configuration Management Process
Reviews: The Reviews, Review process Data Collection, Monitoring & Control, Introduction of Reviews &the NAH Syndrome.
(7L) **Module II**

Project Monitoring & Control: Project tracing, Milestone Analysis, Activity Level Analysis using SPC, Defect Analysis & Prevention Process Monitoring & audit.
Project Closure: Project closure Analysis.
(7L)

Text book:

Jalote Pankaj," Software Project Management in Practice", Pearson Education, New Delhi, 2002.(T1)

Reference books:

Huges B. And CotterellM.,"Software Project Management", 3rd Edition, Tata Mcgraw Hill, New Delhi, 2004.(R1)
Jalote Pankaj, "CMM in Practice", Pearson Education, New Delhi, 2002.(R2)
Grey W. Humph," Managing the Software Process", Addition – Wesley, 1989.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Head of Department

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Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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CO3	2	2	2	2	3	2	2	3	3	3	3	2	2	3	3
CO4	2	3	2	2	3	2	2	3	3	3	3	3	2	2	3
CO5	2	2	3	2	3	2	2	3	3	3	3	3	2	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS324
Course title: **SYSTEM PROGRAMMING**
Pre-requisite(s): Nil
Co- requisite(s):NIL
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Describe the utility of different system programs & system tools.
2.	Familiarize with the tradeoffs between run-time and compile-time processing (Linking & Loading techniques).
3.	To learn the concepts and techniques behind the designing of various system software.
4.	To organize the functionalities & components of system software & tools into different layers for efficient code generation.

Head of Department

Course Outcomes

After the completion of this course, students will be:

1.	Able to understand the evolution of various system software.
2.	Able to understand the various data structures that helps in the proper functioning of the system programs.
3.	Able to understand the basic design of various system software.
4.	Able to understand the designing of text editors, debuggers etc.
5.	Able to design Assemblers

Syllabus

Module I

Introduction: System Software & its Components, Evolution of System Softwares- Operating System, Loaders, Interpreters, Compilers, Linkers, Assemblers.

Assemblers: Elements of Assembly Language Programming, Assembly Process, Single Pass Assembler, Design of a 2-Pass assembler for In 8088. (8L)

Module II

Macros & Macro processors: Macros, Different forms of Macros, Macros using AIF, AGO, REPT. Etc, Design of a Macro Processor, Macro Assembler.
(8L)

Module III

Loaders: Basic Loader Functions, Absolute Loader, Compile & go Loader, Relocating Loader, Direct Linking Loader.
(8L)

Module IV

Linkage Editors: Linking and Relocation, Program Reliability, Linkage Editor and its Application in IBM-PC, Linking for Program Overlays.
(8L)

Module V

Software Tools: Spectrum of Software Tools, Text Editors, Interpreter and Program Generators, Debug Monitors, Programming Environments.
(8L)

Text Book:

Dhamdhere D.M., "System Programming and Operating Systems", 2nd Edition., TMH, New Delhi.(T1)

Reference Book:

Donovon J.J., " System Programming", TMH, New Delhi.(R1)
Beck Leland L., "System Software – An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2000. (R2)
Chattopadhyay Santanu, "System Software", Prentice-Hall India, 2007. (R3)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	3	3	1	1	2	2	1	3	3	2	1
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	2	3
CO4	3	2	3	2	3	3	1	2	2	3	3	1	3	3	3
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	1	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS325
Course title: **Database Modeling**
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objective

This course enables the students:

1.	Learn and practice data modeling using the entity-relationship and developing database designs.
2.	Understand the use of Structured Query Language (SQL) and learn SQL syntax.
3.	Understanding the basic principles of modeling of database using UML and apply normalization techniques to normalize the database system.
4.	Learn Multidimensional schemas suitable for data warehousing. And learn the Difference between OLTP (Online Transaction Processing) and OLAP (Online Analytical Processing).
5.	To demonstrate the principles behind the logical database design and Data Warehouse Modeling.

Course Outcomes

After the completion of this course, students will be to:

1.	Explain the features of database management systems and Relational database and design the ER-models to represent simple database application scenarios.
2.	ApplytheSQL-the standard language to relational tables, populate relational database and formulate SQL queries on data.
3.	Applying UML, it collects the requirements and prepare their scenarios and design. And understand the functional dependencies and design of the database.
4.	Design a data mart or data warehouse for any organization. And Develop a skill to write queries using DMQL.
5.	Analyze the existing design of a database and data warehouse and apply concepts of normalization to design an optimal database.

Head of Department

Syllabus

Module I

Database Design and Entity- Relational Model

Introduction to Data and Database Management, The Database Life Cycle, Conceptual Data Modeling, Fundamental ER Constructs, Mapping Cardinalities and Constraints, Relational Data model (Relational Algebra, Tuple and Domain Relational Calculus), Network Model, Hierarchical Model, Alternative Conceptual Data Modeling Notations, Advanced ER Construct, Summary.

(8L)

Module II

Requirement Analysis and Conceptual Data Modeling

Introduction, Requirements Analysis, Conceptual Data Modeling, View Integration, Entity Clustering for ER Models, Transforming Rules and SQL Constructs, Transformation Steps, Summary.

(8L)

Module III

The Unified Modeling Language (UML) and Normalization

Class Diagrams, Activity Diagrams, Rules of Thumb for UML Usage, Functional Dependencies, Fundamentals of Normalization, Design of Normalized Tables, Normalization of Candidate Tables Derived from ER Diagrams, 1NF, 2NF, 3NF, BCNF, Fourth and Fifth Normal Forms. Determining the Minimum set of 3NF Tables, Summary.

(8L)

Module IV

Business Intelligence

Overview of Data Warehousing, Logical Design, The Exponential Explosion of views, Decision Support system. Overview of Online Analytical Processing (OLAP), View Size Estimation, Selection of Materialized Views, View Maintenance, Query Optimization, Forecasting, Overview of Data mining and Text Mining, Summary.

(8L)

Module V

Logical Database Design

Requirements Specification, Logical Design, CASE Tools for Logical Database Design, generating a Database from a Design, Database Support, Collaborative Support, Distributed Development, Application Life Cycle tooling Integration, Design Compliance Checking, Reporting, Modeling a Data Warehouse, Semi-Structured Data, XML, Summary.

(8L)

Textbooks:

Teorey ,T. J., Lightstone,S., and Nadeau ,T.,"Database Modeling and Design: Logical Design", Fourth Edition, Morgan Kaufmann Publishers, 2006.(T1)

Reference books:

Elmasri,R., and Navathe ,S.B.,"Fundamentals of Database Systems,"Sixth Edition,Pearson,2015.(R1)

Silberschatz ,A., Korth ,H. F., and Sudarshan ,S.,"Database System Concepts," Sixth Edition,Mc Graw Hill Education,2010.(R2)

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	3	3	1	1	2	2	1	3	3	3	3
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	3	3
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	3	3
CO4	3	2	3	2	3	3	1	2	2	3	3	1	3	3	3
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	1	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS326
Course title: **Database Modeling Lab**
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Head of Department

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Course Objective

This course enables the students:

1.	Learn and practice data modeling using the entity-relationship and developing database designs.
2.	Understand the use of Structured Query Language (SQL) and learn SQL syntax.
3.	Understanding the basic principles of modeling of database using UML and apply normalization techniques to normalize the database system.
4.	Learn Multidimensional schemas suitable for data warehousing. And learn the Difference between OLTP (Online Transaction Processing) and OLAP (Online Analytical Processing).
5.	To demonstrate the principles behind the logical database design and Data Warehouse Modeling.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Describe the fundamental elements of relational database management systems.
CO2	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
CO3	Design ER-models to represent simple database application scenarios
CO4	Convert the ER-model to relational tables, populate relational database and formulate SQL.
CO5	Improve the database design by normalization.

SYLLABUS

List of Programs as Assignments:

Lab Assignment No: 1

Objective: Implementation of DDL commands of SQL with suitable examples

- Create table
- Alter table
- Drop Table

Lab Assignment No: 2

Objective: Implementation of DML commands of SQL with suitable examples

- Insert
- Update
- Delete

Lab Assignment No: 3

Objective: Implementation of different types of function with suitable examples

- Number function
- Aggregate Function

Head of Department

- Character Function
- Conversion Function
- Date Function

Lab Assignment No: 4

Objective: Study & Implementation of PL/SQL.

Lab Assignment No: 5

Objective Implementation of different types of operators in SQL

- Arithmetic Operators
- Logical Operators
- Comparison Operator
- Special Operator
- Set Operation

Lab Assignment No: 6

Objective: Implementation of different types of Joins

- Inner Join
- Outer Join
- Natural Join etc..

Lab Assignment No: 7

Objective: Study & Implementation of SQL Triggers.

Lab Assignment No: 8

Objective:

- Creating Database /Table Space
- Managing Users: Create User, Delete User
- Managing roles:-Grant, Revoke.

Lab Assignment No: 9

Objective: Study and Implementation of

- Group By & having clause
- Order by clause
- Indexing

Lab Assignment No: 10

Objective: Study & Implementation of

- Sub queries
- Views

Lab Assignment No: 11

Objective: Study & Implementation of different types of constraints.

TEXT BOOKS

1. A.Silberschatz et.al - Database System Concepts, 5thEd^{n}, Tata Mc-Graw Hill, New Delhi – 2000.

REFERENCE BOOKS

1. Date C.J. - An Introduction to Database System, Pearson Education, New Delhi, 2005.
2. R.Elmasri, Fundamentals of Database Systems, Pearson Education, New Delhi, 2005.

Head of Department

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Head of Department

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

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CO4	3	2	3	2	3	3	1	2	2	3	3	1	3	3	3
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	1	2

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COURSE INFORMATION SHEET

Course code: IT324
Course title: **Software Testing**
Pre-requisite(s): IT305 Software Engineering
Co- requisite(s):
Credits: L: 3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Objectives

1.	To understand the fundamental concepts of software testing
2.	To understand about product risks and risk based testing
3.	To learn the details about test planning, test case writing and defect management
4.	To identify various types of system and testing methodologies
5.	To describe about test metrics, test reports and qualitative and quantitative analysis

Outcomes

After the completion of this course, students will be able to:

1.	Comprehend the quality concepts that serve as the foundation for software testing
2.	Understand about the various risks related to product
3.	Conduct test planning, test case writing and defect management
4.	Enforce various techniques related to system and testing
5.	Elucidate about test metrics, test reports and qualitative and quantitative analysis

Syllabus

Module I

Introduction to Software Quality - Fundamentals of quality, financial aspect of quality, Total Quality Management, basic premises of quality management, quality approaches, quality and productivity relationship, variation in quality expectations, software quality management, processes related to software quality, quality management system structure.
(8L)

Head of Department

Module II

Fundamentals of Software Testing - Basic concepts of software testing, Comparison between TQM testing and Big Bang approaches, testing methodologies such as Black Box testing, White Box testing and Gray Box testing, test processes including test policy defining process, test strategy and test plan, overview of configuration management, SDLC work products, product risk management, potential risks of replacement of manual operation with automated systems, risk management processes, risk control mechanisms, software verification and validation during SDLC, V-Test model, defect management and life cycle.
(8L)

Module III

Testing Techniques and Tools- Levels of testing during SDLC, integration testing techniques, acceptance test plan and criteria, acceptance test process, acceptance testing methods such as alpha, beta and gamma testing, testing of specialised systems such as UI testing, compatibility testing, internationalisation testing, security testing, performance testing, recovery testing and installation testing, special testing such as OO testing, mobile testing, e-Commerce and e-Business testing, control testing, client testing, client server testing, web application testing and agile testing, testing tools and their procurement, advantages and disadvantages of tool usage in SDLC.
(8L)

Module IV

Testing Process - Test policy, test strategy, test planning, test scenario definition, test case definition, test data definition, test estimation techniques, variation in standards used at organisation level, national level, customer level and international level, roles and responsibilities of test team members, test metrics, test reports, quantitative and qualitative data collection and uses of qualitative and quantitative tools required for data analysis and decision making during and post testing. (8L)

Module V

Test Process Improvement - Introduction to test process improvement,Alteration in perception about testing, issues related to testing process, importance of test process improvement, test process maturity, test process improvement model, stages of test process improvement model, graphical representation of improvements.
(8L)

Text book:

Limaye M. G., “Software Testing: Principles, Techniques and Tools”, Tata McGraw-Hill Education Pvt Ltd, 2009.(T1)

Reference books:

Chauhan Naresh, “Software Testing: Principles and Practices”, Oxford University Press, 2012.(R1)
Sommerville, “Software Engineering’, 8th Edition, Pearson Education Ltd, 2009.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

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POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training

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CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	2	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT325
Course title: **Software Testing Lab**
Pre-requisite(s): IT324 Software Testing
Co- requisite(s):
Credits: L: 0 T:0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Familiarize the students with the fundamental concepts of Software Engineering
2.	Impart state-of-the-art knowledge on SRSand UML
3.	Explore case studies to demonstrate practical applications of different concepts
4.	Provide a platform where they can solve real life problems

Course Outcomes

After the completion of this course, students will be able to:

CO1	Comprehend the quality concepts that serve as the foundation for software testing
CO2	Understand about the various risks related to product
CO3	Conduct test planning, test case writing and defect management
CO4	Enforce various techniques related to system and testing
CO5	Elucidate about test metrics, test reports and qualitative and quantitative analysis

Head of Department

SYLLABUS

List of Programs as Assignments:

25. Lab Assignment No: 1

Objective: To Understand and Implement Identification of Requirements from Problem Statements

Q1. To consider the problem statement for a project to be developed and list out the ambiguities, inconsistencies and incompleteness of the problem statement.

Q2. To identify different functionaries to be obtained from a system and characteristics that a system should have, but not possessed by the system itself

26. Lab Assignment No: 2

Objective: To Understand and Implement Estimation ofProject Metrics

Q1. To estimate the minimum size of the team one would require to develop a project through application of intermediate COCOMO.

Q2. To use Halstead's metrics to estimate the effort required to recreate a program in JAVA from C.

27. Lab Assignment No: 3

Objective: To Understand and Implement Modeling UML Use Case Diagrams and Capturing Use Case Scenarios

Q1. To draw a use case diagram for the given case study.

Q2. To identify the primary and secondary actors for the system and generalization of use cases and «include» stereotypes to prevent redundancy in the coding phase.

28. Lab Assignment No: 4

Objective: To Understand and Implement E-R Modeling from the Problem Statements

Q1. To identify the possible entity sets, their attributes, and relationships for the given case study.

Q2. To draw an ER diagram for the given case study.

29. Lab Assignment No: 5

Objective: To Understand and Implement Identification of Domain Classes from the Problem Statements

Q1. To identify potential classes and their attributes for the given case study.

Q2. To utilize expert knowledge on the subject matter to identify other relevant classes.

30. Lab Assignment No: 6

Objective: To Understand and Implement Identification of Components from the Problem Statements

Q1. To identify potential components for the given case study.

Q2. To draw component diagram for the given case study

31. Lab Assignment No: 7

Objective: To Understand and Implement State Chart and Activity Modeling

Q1. To draw a statechart diagram to graphically represent the given case study.

Q2. To draw an activity diagram to graphically represent the workflow of the given case study.

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32. Lab Assignment No: 8

Objective: To Understand and Implement Modeling UML Class Diagrams and Sequence diagrams

Q1. To draw class diagram for the given case study.

Q2. To draw sequence diagram for the given case study.

33. Lab Assignment No: 9

Objective: To Understand and Implement Modeling Data Flow Diagrams

Q1. To draw data flow diagram (Level 0, 1 and 2) for the given case study.

34. Lab Assignment No: 10

Objective: To Understand and Implement Estimation of Test Coverage Metrics and Structural Complexity

Q1. To identify the basic blocks for a given program

Q2. To draw a CFG using the basic blocks

Q3. To determine McCabe's complexity from a CFG.

35. Lab Assignment No: 11

Objective: To Understand and Implement Designing Test Suites

Q1. To design a test suite for the given case study.

Q2. To verify implementation of functional requirements by writing test cases.

Q3. To analyze results of testing to ascertain the current state of the project.

36. Lab Assignment No: 12

Objective: To Understand and Implement Forward and Reverse Engineering

Q1. To obtain programs from UML diagrams.

Q2. To obtain UML diagrams from programs.

Books recommended:

TEXT BOOKS

5. Software Engineering, Ian Sommerville, Pearson, 10th Edition, 2016.**(T1)**
6. Software Engineering: A Practioner's Approach, Roger S. Pressman, McGraw Hills, 7th Edition, 2009.**(T2)**

REFERENCE BOOKS

3. Fundamentals of Software Engineering, Rajib Mall, Prentice-Hall of India, 3rd Edition, 2009.**(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO2, 5 & 6

Topics beyond syllabus/Advanced topics/Design:

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	3	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	2	3	1	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	2	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	3	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS270
Course title: **Fundamentals of Computer Science**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objective
This course enables the students:

1.	Use a variety of hardware and software on campus and do simple file editing.
2.	Discuss computer organization in simple terms, including major future directions.
3.	Describe how a computer actually performs instructions.
4.	Discuss the data organization concepts that apply to physical storage, data structures, files, and databases.
5.	Discuss the features of a programming language and the nature of the language translation process.

Course Outcomes:
After the completion of this course, students will be:

2.	Distinguish between program writing and algorithm development and apply various problem solving techniques.
2.	Describe the functions of an operating system and discuss the problems inherent in providing multiprogramming.
3.	Distinguish between good and bad programming design methods.
4.	Describe data organization concepts.
5.	Discuss methods of measuring algorithm performance and the limits of computability.

Syllabus:
Module I
History of Computing.Computer Generations, Significant Events of recent computing history, Using the terminal, Editing text files, System commands, Using electronic mail Data representation. Binary numbers, Integers - 2's complement, sign-magnitude, Fractions - binary, hexadecimal, Exponents - binary, hexadecimal, excess notation, Characters - ASCII, EBCDIC. (8L)

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Module II

Computer Architecture,CPU organization - registers, op codes, execution cycle, Memory organization - addresses, base &bound.Device operations - interrupts, parity, commands, physical actions. Modern architectures - pipelining, vector and array processors,Future architectures - data driven, demand driven and inference machines.
(8L)

Module III

Algorithm Development ,Top-down approach,Common tasks - searching, sorting, merging Techniques - repetition, recursion, divide-and-conquer Programming Languages. Language levels, Data types, Operators, Control statements and conditions, Input and output Specifications, Paradigms - procedural, functional, specification, declaration, object-oriented.
(8L)

Module IV

Software Engineering Modularization Documentation Design methodologies Software life cycle Systems Software (3 hrs)OperatingsystemsCompilers, interpreters and assemblers, Linkers and loaders.
(8L)

Module V

Data Organization,Data Structures: Consecutive storage - arrays, stacks, queues, trees Files - access and organization, Data base approaches - relational, network, distributed. Algorithm Analysis, Measuring time and space, Effects of data structures, Computability.
(8L)

Text Books:

Brookshear, J.G., Computer Science, An Overview, Benjamin/Cummings, 1994. (T1)

Reference Books:

Rajaraman V., Computer Fundamentals, 6th edition, Adabala N, PHI.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	1	1	1	1	1	1	1	1	2	3	1	1
CO2	2	2	2	1	2	1	1	1	2	2	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO4	2	3	3	2	2	1	1	1	2	2	2	2	2	2	1
CO5	3	3	3	3	2	1	1	2	2	2	3	3	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS271
Course title: **Fundamentals of Computer Science Lab**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L:0 T:0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

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Course Objective

This course enables the students:

1.	Use a variety of hardware and software on campus and do simple file editing.
2.	Discuss computer organization in simple terms, including major future directions.
3.	Describe how a computer actually performs instructions.
4.	Discuss the data organization concepts that apply to physical storage, data structures, files, and databases.
5.	Discuss the features of a programming language and the nature of the language translation process.

Course Outcomes:

After the completion of this course, students will be:

	Distinguish between program writing and algorithm development and apply various problem solving techniques.
2.	Analyze and discuss the problems and their solutions through programming
3.	Distinguish between good and bad programming design methods.
4.	Write algorithms to solve problems.
5.	Discuss methods of measuring algorithm performance and the limits of computability.

Syllabus

1. To find the sum of individual digits of a given number

2. To print the Fibonacci series for 1 to n value

3. To print a prime numbers up to 1 to n

4. To calculate the sum. Sum=1-x2/2!+ x4/4!- x6/6!+ x8/8!-

x10/10!

5. Programs that use recursive function to find the factorial of

a given integer.

6. Program that use non recursive function to find the factorial

of a given integer.

7. To find the GCD of two given integers by using the

recursive function

8. Two integer operands and one operator form user, performs

the operationand then prints the result.(Consider the

operators +,-,*, /, % and use Switch Statement)

Head of Department

9. To find both the largest and smallest number in a list of integers.

10. To perform the addition of two matrices

11. Functions to insert a sub string into given main string from a given position.

12. To generate Pascal's triangle

13. To convert the given binary number to 2's complement

14. To read the two complex numbers and perform the addition and multiplicationof these two numbers.

15. Program which copies one file to another

Text Books/ reference Book:

Rajaraman V., Computer Fundamentals, 6th edition, Adabala N, PHI.(R1)

E. Balaguruswamy, Programming in ANSI C, &th Edition, TMH.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	2	1	1	1	1	2	3	2	2
CO2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	2
CO3	3	3	3	3	3	2	1	1	1	1	2	2	3	3	3
CO4	2	2	2	1	1	1	1	1	1	1	1	2	2	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CA201
Course title: **Object Oriented Programming using Java**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T: 0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives
This course enables the students:

A.	Learn about Object oriented programming concepts
B.	Learn how to use the JDK
C.	Improve their programming skills in core Java
D.	Use the Java packages, applets for software development

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Course Outcomes

After the completion of this course, students will be able to:

1.	Use the knowledge of object oriented programming through Java
2.	Successfully use the JDK of various versions for programming
3.	Apply the knowledge gained for project work as well as Advanced Java
4.	Apply latest know-how related to the new developments in the field of Java
5.	develop GUI applications.

Syllabus

MODULE I

Procedure-Oriented Programming, Object-Oriented programming, Benefits of OOP, Applications of OOP, Basics, Evolution of Java, Structure of JAVA Program, Simple Java Program, Tokens, Comments, Identifiers, Operators, Literals, Control Structures. Java Environment Setup, Compiling a Java Program, Java Virtual Machine, Philosophy of Java and Benefits.
(6L)

MODULE II

Data types and program statements: Primitive and reference data types, variables and constants, enumerated constants, labelled statement, expression and null statements, compound statement, control statement – decision and loops, jump statement, declaration statement, try-throw-catch-finally statement, declaring and creating arrays, accessing array elements, assigning values to array elements, multidimensional arrays.
(9L)

MODULE III

Functions, Data Abstraction and classes: Declaration, definition and call, main method arguments, reference variables, method overloading, parameter passing by value for primitive types, object references and arrays, scope of variables, return from methods.

Class and object, class members and initialization, access rights of members – public, private and protected access modifiers, constructor and copy constructor, mutability, finalization, dynamic memory management, garbage collection, this keyword, static members, scope of variables, interface – declaration, implementation and extending, package and package visibility.
(9L)

MODULE IV

Inheritance and Collection classes: multi level and single inheritance, multiple inheritance of interfaces, Object class, access rights in subclasses and packages, constructor calling sequence, super keyword, dynamic binding of methods, abstract class, overriding, shadowing and hiding, finalize, association, aggregation and composition. String, StringBuffer, Date, Calendar, Math, Object, Class, Exception class.
(8L)

Head of Department

MODULE V

Input/Output and JAVA Applets: Stream clases – InputStream, OutputStream, Buffered Stream, file classes and handling, pushback streams, reader and writer classes, file reader and writer, serialization.Applet code example, HTML tags for applet, applet lifecycle, color, font and basic GUI handling, basic graphics, animation.
(8L)

Text books:
E. Balagurusamy - Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi.(T1)

Reference books:
Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.(R1)

Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	3	3	2	2	1	1	1	1	2	3	2	2
CO2	2	2	1	2	2	1	1	1	1	1	1	1	2	2	2
CO3	2	3	2	3	3	1	1	1	1	1	2	2	3	3	3
CO4	3	2	2	1	3	1	1	1	1	1	1	2	2	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CA202
Course title: **Object Oriented Programming using Java Lab**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 0 T: 0 P:3
Class schedule per week: 3
Class: B.Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To write programs using abstract classes.
2.	To write programs for solving real world problems using java collection frame work.
3.	To write multithreaded programs and impart hands on experience with java programming.
4.	To write GUI programs using swing controls in Java.
5.	To introduce java compiler and eclipse platform.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Impart hands on experience with java programming.
CO2	Write programs using abstract classes.
CO3	Write multithreaded programs.
CO4	Write GUI programs using swing controls in Java.
CO5	Simulate basic Engineering problems

Head of Department

Syllabus

1. Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
3.
    a. Develop an applet in Java that displays a simple message.
    b. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked.
4. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.
5. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
6. Write a Java program for the following:

    i. Create a doubly linked list of elements.
    ii. Delete a given element from the above list.
    iii. Display the contents of the list after deletion.

11. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially, there is no message shown.
12. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
13. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.
14. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).
15. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It

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takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).

16. Write a Java program that correctly implements the producer – consumer problem using the concept of interthread communication.
17. Write a Java program to list all the files in a directory including the files present in all its subdirectories.
18. Write a Java program that implements Quick sort algorithm for sorting a list of names in ascending order
19. Write a Java program that implements Bubble sort algorithm for sorting in descending order and also shows the number of interchanges occurred for the given set of integers.

REFERENCE BOOKS

1. Java for Programmers, P. J. Deitel and H. M. Deitel, 10th Edition Pearson education.
2. Thinking in Java, Bruce Eckel, Pearson Education.
3. Java Programming, D. S. Malik and P. S. Nair, Cengage Learning.
4. Core Java, Volume 1, 9th edition, Cay S. Horstmann and G Cornell, Pearson.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	3	3	2	2	1	1	1	1	2	3	2	2
CO2	2	2	1	2	2	1	1	1	1	1	1	1	2	2	2
CO3	2	3	2	3	3	1	1	1	1	1	2	2	3	3	3
CO4	3	2	2	1	3	1	1	1	1	1	1	2	2	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT302
Course title: DCCN Lab
Pre-requisite(s):
Co- requisite(s): None
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B.Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To familiarize the student in introducing and exploring various Network topologies and networking protocols
2.	To understand the use of client/server architecture in application
3.	To enable the student on how to approach for networking problems using networking simulation tools.
4.	To Design reliable servers using both TCP and UDP sockets
5.	Familiarwithnetworktoolsandnetworkprogramming.

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Course Outcomes
After the completion of this course, students will be able to:

CO1	Express programming & simulation for networking problems.
CO2	Understand of various aspects of networking devices
CO3	Design and implement simulation of a simple LAN and a WAN that meet a specific set of criteria
CO4	Identify the elements of a communication network
CO5	Simulate various OSI layer protocols using C/C++/ Java

Syllabus
List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Q1. To familiarize with the Lab Network Topology, Locating different interfaces, routers and switches. Studying different pools of IP addresses.
   Q2. Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.
   Q3. To learn and observe the usage of different networking commands e.g.PING, TRACEROUTE. Learning remote login using telnet session. Measuringtypical average delays between different locations of the network.
2. **Lab Assignment No: 2**

   Q1. What is the IP of the machine you are using? Compare it with the IP of your neighbors.Are the IPs of your neighbors same? Why or Why not?

   Q2. Ping" is a tool used to determine if a server is responding and to estimate the round triptime of a message sent to that server. Use the ping command for the following URLs andrecord the success or failure statistics along with the average round trip time.

   a) google.com
   b) facebook.com
   c) bitmesra.ac.in

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Q3. Trace the route that is taken when you try to access:
a) google.com
b) facebook.com
c) bitmesra.ac.in

Q4. Network Commands on Linux / Unix

3. Lab Assignment No: 3

Q1. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC 32.

Q2. Implementation of Sub-netting and Super-netting.

Q3. To study different types of transmission media, various topologies, and configure modem of computer HUB and Switches.

4. Lab Assignment No: 4

Q1. Write a C/C++ program to determine if the IP address is in Class A, B, C, D, or E.

Q2. Write a C/C++ program to determine if the IP address is in Class A, B, or C.

Q3. Write a C/C++ program to translate dotted decimal IP address into 32 bit address.

Q4. To implement a routing protocol and check its connectivity in a variable length subnet masked network

Q5. Write a C/C++ program to perform bit stuffing and de-stuffing.

5. Lab Assignment No: 5

Q1. Implement Dijkstra‘s algorithm to compute the Shortest path through a graph.

Q2. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

Q3. Take an example subnet of hosts. Obtain broadcast tree for it.

6. Lab Assignment No: 6

Q1. Build implementations of the Internet protocols
Q2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
Q3. Write a code simulating ARP /RARP protocols.

7. Lab Assignment No: 7

Q1. Create a socket for HTTP for web page upload and download

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Q2. Write a code simulating PING and TRACEROUTE commands.

8. **Lab Assignment No: 8**

   Q1. Study and implement model for Socket Programming and Client – Server model.

   Q2. Experiments with NS2(or any other simulator) to study behavior (especially performance of) link layer protocols such as Ethernet and802.11 wireless LAN..

9. **Lab Assignment No: 9**

   Q1. Experimental study of applicationprotocolssuch as HTTP, FTP,SMTP, using network packetsniffersandanalyzerssuchas**Wireshark**. Small exercisesinsocketprogramming in C/C++/Java..

10. **Lab Assignment No: 10**

    Q1. Take a 64 bit playing text and encrypt the same using DES algorithm.

    Q2. Write a program to break the above DES coding

    Q3. Using RSA algorithm encrypts a text data and Decrypt the samebjective: To Understand and Implement Data Interpolation

11. **Lab Assignment No: 11**

    Q1. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer

    Q2.Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS

    Q3.Echo client and echo server b. Chat c. File Transfer

Books recommended:

Text books

4. William Stallings, Data and Computer Communication, Prentice Hall of India. (T1)
5. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill. (T2)
6. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.(T3)

Reference books

3. W. Richard Stevens, TCP/IP Illustrated, Volume 1, Addison-Wesley.(R1)
4. Douglas Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India.(R2)

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

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Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	1			2	2	3	3	3	3
CO2	3	2	2	2	2	1	1		2	2	2	3	3	3	3
CO3	3	3	2	2	2	2	1		2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT220
Course title: **Shell and Kernel Programming**
Pre-requisite(s): Operating System, UNIX Programming
Co- requisite(s): NIL
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

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Course Objectives

This course enables the students:

1.	To understand the basic concepts of UNIX & shell programming.
2.	Understand the basic operations of an operating system.
3.	To explore the function of a kernel.
4.	To understand the basic function of a device driver.
5.	To understand the structure of a file system.

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain the design of Linux kernel components
2.	Experiencing the kernel by passive/active observation
3.	Extend the Linux kernel for understanding, self-satisfaction/falsification.
4.	Identify the current research trends in OS, Linux being the reference OS
5.	Illustrate the design of Linux kernel components

Syllabus

Module I

Introduction to UNIX, file system, system calls, AWK script, Bourne shell programming.
(8L)

Module II

Korn Shell Programming, C Shell Programming, Different tools & Debuggers.
(8L)

Module III

Introduction: OS concepts catch-up, Linux kernel overview, Extending the kernel: building a modified kernel, writing simple kernel modules, User-kernel interfacing: system calls, proc/sys, character devices, device memory maps, Kernel execution contexts: processes, threads, kernel threads, interrupts, bottom halves/soft IRQs.
(8L)

Module IV

Process management: Linux kernel scheduler, context switching, kernel synchronization
Memory management: Virtual memory, page cache, File systems: The VFS layer, Kernel-File system interfacing. (8L)

Module V

Generic block layer: Block I/O interfacing, kernel block I/O scheduler
Device drivers: Device probe and software / hardware configurations, event registration, communication.
(8L)

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Text Books:

HARWANI B.M., UNIX and Shell Programming, First Publication,Oxford University Press, 2013. (T1)
Love Robert, Linux Kernel Development, 3rd Edition.(T2)
Corbet Jonathan, Kroah-Hartman Greg, Rubini Alessandro, Linux Device Drivers, 3rd Edition. (T3)
Bovet Daniel P. , CesatiMarco,Understanding the Linux Kernel, Publisher: O'Reilly.(T4)
Nutt Gary, Kernel Projects for Linux, Addison Wesley, ISBN: 0-201-61243-7, July 2000.(T5)

References Books:

Sarwar Syed Mansoor, Koretsky Robert, & Sarwar Syed Aqeel ,Linux: The Textbook Addison Wesley, ISBN: 0-201-72595-9. (R1)
Gagné Marcel, Linux System Administration: A User's Guide, Addison Wesley, ISBN: 0-201-71934-7 Paperback, September 2001. (R2)
Rubini Alessandro & Corbet Jonathan ,Linux Device Drivers, O'Reilly & Associates, ISBN 0-596-00008-1Paperback, June 2001.(R3)
Bar Moshe, Linux File Systems, McGraw-Hill; ISBN: 0-07-212955-7 Paperback.(R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	2	3	3	1	1	1	3	2
2	2	3	1	2	2	2	2	2	2	3	2	1	1	2	1
3	2	3	3	3	3	1	1	1	2	3	1	2	2	3	1
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	1
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	1

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
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CO5	CD1,CD2,CD3,CD4,CD5,CD7

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	2	2	3	2	3	1				1		1	3	2	3
CO2	3	2	3	2	3	3	1	3		2	1	1	3	2	3
CO3	2	2	3	2	3	1						1	3	2	3
CO4	3	2	3	2	3	2	1	3		2	1	1	3	2	3
CO5	3	2	3	2	3	3	1	2		2	1	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT305
Course title: **Software Engineering**

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Phone : (EPBX) 0651 – 2275444/2275896, 2276002/2276006 FAX : 0651 – 2275401/2275351 Website : www.bitmesra.ac.in

Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Students are effective team members, aware of cultural diversity, who conduct themselves ethically and professionally
2.	Students use effective communication skills and technical skills to assure production of quality software, on time and within budget.
3.	Students build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks.
4.	Able to increase level of self-reliance, technical expertise, and leadership.

Course Outcomes

After the completion of this course, students will be:

1.	Explain the software engineering principles and techniques
2.	Apply Software Project Management Practices
3.	Apply the knowledge gained for their project work as well as to develop software following software engineering standards
4.	Develop self-reliance, technical expertise, and leadership.

Syllabus

Module I

Introduction

Some Definitions, FAQs about software engineering, the evolving role of software, Software process models, Waterfall model, the prototyping model, spiral model, RAD and Incremental model, Management activities, Project planning and Project Scheduling.
(8L)

Module II

Software Requirements

Functional and non-functional requirements, User requirements, System requirements, the software requirements document. IEEE standard of SRS, Quality of good SRS.

Requirement Engineering Process: Feasibility study, Requirements elicitation and analysis, Requirements validation, Requirement management.

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(8L)

Module III

Design Engineering

Design Process and Design Quality, Design Concepts, Design Models, Object oriented Design, UML: Class diagram, Sequence diagram, Collaboration diagram.
(8L)

Module IV

Verification and Validation

Verification and Validation Planning, S/W inspection, static analysis.

Software Testing

Testing functions, Test care design, White Box testing, Black box testing, Unit testing, Integration Testing, System testing, Reliability.
(8L)

Module V

Process metrics, Software Measurement, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Quality assurance and standards, Quality planning, Quality control, **S**/W Maintenance in detail.
(8L)

Text Book:

Sommerville, Software Engineering, 7th Edition, Pearson Education Publication. (T1)

Reference Books:

Pressman R. S.,Software Engineering: A Practiioners Approach, 5th Edition., TMA, New Delhi.(R1)

Mall Rajib, Fundamental of Software Engineering, 4th Edition, PHI Learning Private Limited.(R2)

Peters J. F. &Pedrycz W., Software Engineering, John Wiley & Sons, Inc. 2000.(R3)

Behforooz A. & Hudson F.J., Software Engineering Fundamentals, Oxford Univ. Press, New York, 2000.(R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	3	1	1	2	1	2	3	3	1	1	1	3	2
2	2	3	1	2	2	2	2	2	2	3	2	1	1	2	3
3	2	3	3	3	3	1	1	1	2	3	1	2	2	3	3
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	2
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT307
Course title: **Image Processing**
Pre-requisite(s): Discrete Mathematics,
Co- requisite(s): Data Structures
Credits: L: 3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level:
Branch: CSE/IT

Course Objectives

Head of Department

This course enables the students:

1.	Understand the basic concept of Digital Image Processing
2.	To Learn the Fourier Transform & its application
3.	Understand the basic components of filters
4.	Understand the basic concept of Image Compression Fundamentals
5.	Understand the basic concept of Image Segmentation.

Course Outcomes

After the completion of this course, students will be:

1.	Understand the concept of image formation, digitization, and role human visual system plays in perception of image data and spatial filtering techniques for enhancing the appearance of an image.
2.	Acquire an appreciation for various frequency based filtering techniques for enhancing the appearance of an image, duly applying them in different applications.
3.	Discern the difference between noise models, gain an insight into assessing the degradation function and realize different spatial and frequency based filtering techniques for reduction and removal of noise.
4.	Synthesize a solution to image compression using the concept of information theory and lossless and lossy compression techniques.
5.	Design and create practical solutions using morphological and image segmentation operators for common image processing problems and assess the results.

Syllabus

Module I [8 L]

Introduction to Digital Image Processing, Elements of Visual Perception, Image Sensing & Acquisition, Sampling and Quantization, Basic Relationships between Pixels, Intensity Transformations, Histogram Processing, Spatial Convolution & Correlation, Smoothing Spatial Filters, Sharpening Spatial Filters.

Module II 8 L]

Introduction to the Fourier Transform, Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Image Smoothing using Frequency Domain filters, Image Sharpening using Frequency Domain filters, Selective Filtering, Basics of Fast Fourier Transform, Basics of: Walsh- Hadamard Transform; K-L Transform; Discrete Cosine Transform.

Head of Department

Module III **[8 L]**

Model of Image Degradation/Restoration Process, Noise Probability Density Functions, Restoration in presence of Noise only, Periodic Noise Reduction using Frequency Domain filtering, Circulant Matrices, Block Circulant Matrices, Unconstrained Restoration, Constrained Restoration, Basics of Inverse Filtering

Module IV **[8 L]**

Image Compression Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria, Image Compression Models– Source Encoder and Decoder, Channel Encoder and Decoder, Elements of Information Theory, Error-Free Compression – Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.Color Fundamentals, Color Models, Basics of Full Color Image Processing

Module V **[8 L]**

Morphological Image Processing- Preliminaries, Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformation, Boundary Extraction, Hole Filling, Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning

Image Segmentation- Fundamentals, Point, Line and Edge Detection, Thresholding, Region Based Segmentation, Segmentation based on color.

Text books:

1. Rafael. C. Gonzalez & Richard E. Woods- Digital Image Processing, 3/e Pearson Education, New Delhi - 2009

Reference books:

1. W.K.Pratt-Digital Image Processing, 4/e, John Wiley & sons, Inc. 2006.
2. M. Sonka et al. Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007.
3. Jayaraman, Digital Image Processing, Tata McGraw-Hill Education, 2011

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2		1					2	3	3	2
CO2	3	3	3	2	2	1	1					2	3	3	2
CO3	3	3	3	3	2	1	1					2	3	3	2
CO4	3	3	3	3	2	1	1					2	3	3	2
CO5	3	3	3	3	3	2	1	1	1	1		2	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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COURSE INFORMATION SHEET

Course code: IT326
Course title: **Wireless Sensor Networks**
Pre-requisite(s): IT301 Data Communication and Computer Networks
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Familiarize with the principles of sensor nodes, network deployment and architectures.
2.	Know the data transmission and routing protocols. Know the differences among different networks.
3.	Analyze or compare the performance of different routing and MAC protocol
4.	Evaluate the performance of different MAC protocols and clustering algorithm
5.	Compute the throughput and channel utilization for different network scenarios.

Course Outcomes
After the completion of this course, students will be:

1.	Obtain a broad understanding about the network architecture of wireless sensor network.
2.	Understand all basic characteristics of wireless sensor networks and sensor nodes.
3.	Understand the principles of data transmission, clustering algorithm and routing protocols.
4.	Analyse and evaluate different constraint of wireless sensor network, e.g., coverage, powermanagement, security and data collisions.
5.	Design and development of new sensor network architecture.

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Syllabus

Module I

Introduction: Wireless channel and communication fundamentals, Features of Wireless sensor network, Design principles for WSNs, Service interfaces of WSNs and Gateways, Applications, Hardware components, Sensor deployment mechanism.
(6L)

Module II

Network and Component Technologies: Topologies and characteristics, Sensor network characteristics, energy consumption model, Power management, Localization, hierarchical and cluster based topology control.
(10L)

Module III

Data Transmission and Routing: Data processing and aggregation, Data storage, Network clustering protocols, Multi-hop communication protocols, Energy efficient routing, Data aggregation and data centric routing.
(8L)

Module IV

Protocols: MAC Protocols, Framing and error control in WSNs, Medium access control protocols, Congestion control and rate control protocols.
(8L)

Module V

QOS Issues:
Coverage and deployment, Reliable data transport, Single packet and block delivery, Congestion control and rate control, Collisions, Collision avoidance mechanism.
(8L)

Text books:

Karl Holger and Willig Andreas, "Protocols and Architectures for Wireless Sensor Networks".(T1)

Callaway Jr. Edgar H. and Callaway Edgar H., "Wireless Sensor Networks: Architectures and Protocols".(T2)

Reference books:

Zhang Yan, Jejunum, Hu Honglin, "Wireless Mesh Networking, Architecture, Protocols and Standards".(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	3	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	3

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT327
Course title: Wireless Sensor Networks Lab
Pre-requisite(s): IT326 Wireless Sensor Networks
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B.Tech
Semester / Level: III
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2.	Application of established engineering methods to complex engineering problem solving.
3.	Fluent application of engineering techniques, tools and resources
4.	High levels of technical competence in the field
5.	Be able to apply problem solving approaches to work challenges and make decisions using sound engineering methodologies

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply knowledge of wireless sensor networks(WSN) to various application areas.
CO2	Design and implement WSN and IoT.
CO3	Conduct performance analysis of WSN.

Syllabus

List of Programs as Assignments:

8. Wireless technology for distributed sensor networks in perspective of deployment mechanisms
9. Clustering techniques in WSN; multi-hop to single hop communication analysis
10. Analyzing Routing in WSN: AODV, DSR
11. Industrial WSN protocols: ZigBee, Bluetooth applications
12. WSN network design and implementation; in perspective of gateway-based communications
13. Employing of wireless technologies in IoT.
14. IoT Structure and Framework

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Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Assessment Components	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation	√	√	√	√	√
End SEM Evaluation	√	√	√	√	√

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Outcome	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	2	3	3	3	3	1	2	3	1	2	2	3	3	3
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	3	2	3	3	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	3

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COURSE INFORMATION SHEET

Course code: IT328
Course title: **Pattern Recognition**
Pre-requisite(s): IT307 Image Processing
Co- requisite(s): NIL
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Be familiar with both the theoretical and practical aspects Pattern Recognition.
2.	Have described the foundation of pattern formation, measurement, and analysis.
3.	Understand the mathematical and computer aspects of while extracting features of an object.
4.	Learn the techniques of clustering and classification for various applications.

Course Outcomes

After the completion of this course, students will be able to:

1.	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
2.	Solve Decision making model using Statistical and Mathematical Decision Theory.
3.	Design clusters for various Pattern using classical and Modern clustering techniques.
4.	Analyzing various Techniques for Pattern Classification and Clustering.
5.	Develop Model for Pattern classification through Probabilistic or fuzzy.

Syllabus

Module I

Introduction: Feature Vectors, Classifiers, Supervised, Unsupervised, MATLAB Tools. Classifiers Based on Bayesian Theory, Linear Classifiers, Nonlinear Classifiers. (10L)

Module II

Feature Selection, Feature Generation I: Data Transformation and Dimensionality Reduction, Feature Generation II.
(10L)

Module III

Template Matching, Context Dependent Classification, Supervised Learning.
(10L)

Module IV

Clustering: Basic Concepts, sequential Algorithms.
(5L)

Head of Department

Module V
Hierarchical algorithms, Fuzzy clustering, probabilistic clustering, Hard Clustering, Optimization.
(5L)

Text Books:

Theodoridis S., Koutroumbas K., Elsevier, "Pattern Recognition", 5th Edition 2015.(T1)
Murty N. Narshima "Pattern Recognition", Springer, University Press2nd edition,2015.(T2)

Reference Book:

DudaR.O.,Hart E. Peter,Stork G. David," Pattern Classification" 2nd Edition, John Wiley, New York, 2002.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	3	2	1	1	2	1	2	2	3	2	3
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	2	2	3	2	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	2

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT329
Course title: **Pattern Recognition Lab**
Pre-requisite(s): IT328 Pattern Recognition
Co- requisite(s): NIL
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
2.	Solve Decision making model using Statistical and Mathematical Decision Theory.
3.	Design clusters for various Pattern using classical and Modern clustering techniques.
4.	Analyzing various Techniques for Pattern Classification and Clustering.
5.	Develop Model for Pattern classification through Probabilistic or fuzzy.

Course Outcomes

After the completion of this course, students will be able to:

1.	formulate and describe various applications in pattern recognition
2.	understand the Bayesian approach to pattern recognition
3.	Be able to mathematically derive, construct, and utilize various classifiers both theoretically and practically.
4.	be able to identify the strengths and weaknesses of different types of classifiers
5.	validate and assess different clustering techniques

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Syllabus

1. Implement a function for extracting the colour histogram of an image.
2. Read all the images from the training set. For each image compute the colour histogram with general bin size *m* and save it as a row in the feature matrix ***X***. Save the corresponding class label in the label vector ***y*.**
3. Implement the k-NN classifier for an unknown image and for a general *K* value.
4. Evaluate the classifier on the test set by calculating the confusion matrix and the overall accuracy.
5. Try out different values for the number of bins for the histogram and the parameter *K* to see which feature attains the best performance.
6. Convert the input image into Luv or HSV colour-space before histogram calculation.

Text books:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer 2006.

Reference books:

1. Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2013.
2. Pattern Classification, 2nd Ed., Richard Duda, Peter Hart, David Stork, John Wiley & Sons, 2001.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	3	1	3	2	2	2	1	2	3	3	2
CO2	3	2	3	1	2	1	2	3	2	1	1	2	2	3	2
CO3	3	3	3	1	2	1	2	3	1	2	1	2	3	2	2
CO4	3	3	3	1	2	2	2	2	1	2	3	2	3	1	2
CO5	3	2	3	1	2	2	1	3	2	2	3	2	3	2	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CS327
Course title: **Computer Graphics**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To understand different hardware used for graphical requirement
2.	To perform visual computations for geometrical drawings.
3.	To display 3D objects in a 2D display devices using projection techniques
4.	To model 3D
5.	To create realistic images using color and shading techniques

Course Outcomes
After the completion of this course, students will be:

1.	Able to understand different hardware used for graphical requirement.
2.	Able to perform visual computations for geometrical drawings.
3.	Able to display 3D objects in a 2D display devices using projection techniques
4.	Able to model 3D objects
5.	Able to create realistic images using color and shading techniques

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Syllabus

Module I

Introduction and Overview of Graphics Systems

Use of Computer graphics, Video Display Devices, Raster and Random Scan Displays, Colour CRT Monitors, Flat Panel Displays, Three-Dimensional Viewing Devices, Stereoscopic & Virtual Reality, Graphics system architecture, Input Devices, Graphics Software.

Output Primitives

Points and Lines, Line Drawing Algorithms (DDA &Bresenham's), Circle and Ellipse Generating Algorithms, Conic Sections.Filling Polygons, Pattern Filling, Thick Primitives, Line Style and PenStyle, Generating Characters, Aliasing and Antialiasing.
(7L)

Module II

Geometric Transformations

Two dimensional transformations and their matrix representations, Translation, Rotation, Scaling, Reflection, Shears, Homogeneous Coordinates, Composite Transformations, transformations between Coordinate Systems, Affine transformations, 2-Dimensional viewing pipeline, Window-to-Viewport Coordinate transformation, Clipping-Point, Line clipping-Cohen Sutherland, Liang Bursky, Polygon clipping – Sutherland Hodgeman, weilerArtherton, Curve and Text Clipping, Three Dimensional Transformations, Translation, Rotation, Scaling, Reflection, Shears. (8L)

Module III

Three Dimensional Concepts and Object Representation

Three Dimensional Display Methods, Polygon Surfaces, Curved Lines & Surfaces, Quadric Surfaces, Spline Representations, Cubic Spline interpolation methods, Hermite Interpolation, Bezier Curves and Surfaces, Properties of B-splines, Fractal.

Three Dimensional Transformations and Viewing

Three dimensional viewing pipe line, Projections- Parallel and Perspective, Projection Transformations, Clipping. (7L)

Module IV

Color Model and Color application

Properties of light, Standard primaries and chromaticity diagram, XYZ Color model, RGB color model. YIQ color model, HSV color model, HLS color model

Illumination Model and Surface Rendering

Light sources, Basic Illumination Models, Ambient light, Defuse and specular reflection. Shadows, Transparency, Assigning intensity levels, Polygon Rendering Methods, Constant intensity shading, Gourad shading, Phong shading, Detail. (7L)

Module V

Visible Surface Detection Methods

Classification of Visible Surface Detection Algorithms, Back Face Detection, Depth Buffer Method, A-Buffer Method, Scan-Line Method, Depth Sorting Method, BSP-Tree Method & Area Subdivision Method. Octrees, Ray castiny method.

Graphical User Interfaces and Interactive Input Methods

The User Dialogues, Input of graphical data.

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Computer Animation

Design of animation sequences, General computer animation functions, Raster animation, Computer animation languages, Key frame systems. (7L)

Text books:

Hearn D. & Baker M.P. , Computer Graphics, 2/e , Pearson Education, New Delhi, 2005.(T1)

Reference books:

Foley J.D. et. Al, A Fundamental of Computer Graphics, Addition Wesley, London, 1993.(R1)

Krishnamurthy N, Introduction to Computer Graphics, 1st Edn., TMH, 2002.(R2)

Rogers B., Mathematical elements of Computer Graphics, McGraw Hill, 1989.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: N/A

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	3	2	1	1	2	1	1	2	3	2	2
CO2	3	2	2	3	3	2	1	1	2	2	2	1	3	2	2
CO3	3	2	2	3	2	3	3	2	2	2	2	1	3	1	2
CO4	3	2	3	2	3	2	1	2	2	3	3	1	3	3	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1	2	2	2

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS328
Course title: **Computer graphics lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

A.	Able to understand different hardware used for graphical requirement.
B.	Able to perform visual computations for geometrical drawings.
C.	Able to display 3D objects in a 2D display devices using projection techniques
D.	Able to create realistic images using color and shading techniques
E.	Able to model 3D objects

Course Outcomes

After the completion of this course, students will be able to:

1.	To list the basic concept used in Computer Graphics
2.	To describe the importance of viewing and projections.
3.	To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
4.	To design an application with the principles of Computer Graphics
5.	To define the fundamentals of animation, virtual reality and its related technologies.

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Syllabus

7. Study of basic graphics functions defined in "graphics.h".
8. Write a program to draw a line using Bresenham's Algorithm
9. Write a program to draw a line using DDA Algorithm.
10. Write a program to draw a line using Mid-Point Algorithm.
11. Write a program to draw a Circle using Mid-Point Algorithm.
12. Write a program to draw a Ellipse using Mid-Point Algorithm.
13. Programs using 2-D transformations in C.
14. Implement Polygon filling algorithms [Flood-Fill Algorithm] in C.
15. Program for Cohen Sutherland Line clipping algorithm in C.
16. Write a program to implement reflection of a point, Line.
17. Write a program to rotate a circle around any arbitrary point or around the boundary of another circle.
18. Write a program to implement polygon filling.
19. Programs to study 3-D transformations in C.

Text books:

2. D. Hearn & M.P. Baker - Computer Graphics, 2/e , Pearson Education, New Delhi, 2005.

3. Prabat K Andleigh and KiranThakrar, "Multimedia Systems and Design", PHI, 2005.

Reference books:

3. W.M. Newman. et. al.- Principle of Interactive Computer Graphics, McGraw Hill Publication, New Delhi, 1995.
4. S. Harrington -Computer Graphics- A Programming Approach, McGraw Hill Publication, New Delhi, 1994.
5. J.D. Foley et. al- A Fundamental of Computer Graphics Addition Wesley, London, 1993.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	3	2	1	2	1	2	2	1	2	3	3	2
CO2	3	3	3	2	2	1	2	1	1	1	2	2	2	3	3
CO3	3	2	2	2	3	2	2	2	2	2	3	2	3	3	3
CO4	3	3	3	2	3	2	2	1	2	1	1	1	2	2	1
CO5	2	3	3	2	3	3	3	3	3	2	3	3	3	3	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT330
Course title: **Cryptography and Network Security**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

1.	To Learn Basic Concepts of Cryptography and Network Security and Apply them in various Real life Application.
2.	To understand the basic concepts of Network Security
3.	To acquire knowledge on standard algorithms used to provide confidentiality, integrity

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	and authenticity.
4.	To understand how to deploy encryption techniques to secure data in transit across data networks
5.	To design security applications in the field of Information technology

Course Outcomes

After the completion of this course, students will be:

1.	Understand the basic concept of Cryptography and Network Security and their mathematical models, and to be familiar with different types of threats
2.	Learning and applying various Ciphering Techniques.
3.	Apply Symmetric and Asymmetric Cryptographic Algorithms and Standards in Networks.
4.	Examine the issues and structure of Authentication Service and Electronic Mail Security
5.	To explain and classify different malicious programs, worms and viruses, and to learn the working and design principles of Firewalls

Syllabus

Module I

Introduction to Cryptography: ComputerSecurity concepts, The OSI Security Architecture, Security Attacks, Security Services, A model for Network Security, Classical Encryption Techniques.

(8L)

Module II

Mathematical Foundations of Cryptography: Modular Arithmetic, Euclidean Algorithm, Groups, Rings, Fields, Finite Fields of the Form GF(p), Polynomial Arithmetic, Finite Fields of the Form GF(2^n), Prime Numbers, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Quadratic Congruence, Discrete Logarithms.

(8L)

Module III

Symmetric and Asymmetric Cryptography: Difference Between Symmetric and Asymmetric Cryptography, DES, Triple DES, AES, RSA Cryptosystem, Symmetric and Asymmetric Key Cryptography Together, Elgamal Cryptosystem, Elliptic Curve Cryptosystems, , Diffie-Hellman Key Exchange , Cryptographic Hash Functions, Message Authentication Codes, Digital Signature.

(8L)

Module IV

Internet Security Protocols : Basic Concepts, Security Socket Layer (SSL), Secure Hyper Text Transfer Protocol (SHTTP), Time stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol(WAP) Security, Security in GSM.

(8L)

Module V

Network Security: Users, Trusts and Trusted Systems, Buffer Overflow and Malicious Software, Malicious Programs, Worms, Viruses, Intrusion Detection Systems (IDS), Firewalls: Definitions, Constructions and Working Principles.

(8L)

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Text Book:

Forouzan B. A., Mukhopadhyay D., "Cryptography and Network Security", 3rd Edition, Mcgraw Higher Education, 2016. (T1)

Reference Books:

Stallings W., "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson, 2017.(R1)
Kahate A., "Crptography and Network Security", 3rd Edition, McGraw Hill Education, New Delhi, 2013.(R2)
Schneier B., "Applied Cryptogaphy: Protocols, Algorithms And Source Code In C", 2nd Edition, Wiley, 2007. (R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5

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Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	3	3	2	2	1	2	2	2	3	1
CO2	3	3	3	3	3	3	3	2	2	2	1	2	1	2	3
CO3	3	2	3	3	3	2	2	2	2	2	2	2	2	3	3
CO4	3	2	3	3	2	2	1	2	2	2	2	2	1	2	3
CO5	3	2	3	3	1	2	2	2	2	1	1	2	2	1	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS391
Course title: **Introduction to Distributed System**
Pre-requisite(s): NIL
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Identifying trends in distributed systems
2.	Introducing peer to peer services and distributed file systems
3.	Understanding the issues in process and resource management
4.	Understanding the requirements for designing and supporting distributed systems

Course Outcomes
After the completion of this course, students will be able to:

1.	Define distributed systems and their architecture.
2.	outline peer to peer services and distributed file systems
3.	Elaborate on concepts of process and resource management
4.	Analyze the requirements for designing and supporting distributed systems
5.	Discuss and design the working of distributed systems

Syllabus
Module I
Introduction: Introduction to "Large-Scale"distributed systems, Consequences of "large-scale" Some large-scale distributed systems, Architectures of large scale distributed systems.
(8L)

Module II
Design principles of Distributed system: Introduction to peer-to-peer systems, The peer-to-peer paradigms, Services on structured overlays, Building trust in P2P systems.
(8L)

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Module III

Communication in Distributed system: System Model – Inter Process Communication – the API for internet protocols – External data representation and Multicast communication.

Peer to Peer Services: Peer-to-peer Systems - Introduction - Napster and its legacy - Peer-to-peer - Middleware - Routing overlays.

File System: Features-File model -File accessing models- File sharing semantics

Naming: Identifiers, Addresses, Name Resolution - Name Space Implementation - Name Caches - LDAP.

(8L)

Module IV

Remote Method Invocation and Objects: Remote Invocation - Introduction - Request-reply protocols - Remote procedure call - Remote method invocation.

Case study: Java RMI – Group communication - Publish-subscribe systems - Message queues - Shared memory approaches -Distributed objects - Case study: Enterprise Java Beans -from objects to components.

(8L)

Module V

Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation.

Resource Management: Introduction- Features of Scheduling Algorithms -Task Assignment Approach - Load Balancing Approach - Load Sharing Approach.

(8L)

Text Books:

Coulouris G., Dollimore J., and Kindberg T., "Distributed Systems Concepts and Design", 5th Edition, Pearson Education, 2012.(T1)

Distributed Systems: Design and Algorithms, Editors(s):SergeHaddadFabriceKordonLaurentPautetLaure Petrucci, Wiley online Library.(T2)

Reference Books:

A. S. Tanenbaum, M. Van Steen, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.(R1)

P. K. Sinha, "Distributed Systems: Concepts and Design", Prentice Hall, 2007.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

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POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
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CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	2	1	1	2	1	3	3	2	2
CO2	3	2	2	2	2	1	2	1	2	2	1	3	3	2	2
CO3	3	2	3	3	2	2	2	2	2	2	3	3	3	3	3
CO4	3	2	3	2	3	2	2	2	2	3	2	3	3	2	3
CO5	3	2	3	3	3	1	2	2	2	3	3	3	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS275
Course title: **Bio Informatics**
Pre-requisite(s): Programming for Problem Solving
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: II
Branch: CSE/IT

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Course Objective

This course enables the students to:

1.	To enable the students to understand the tools used in Bioinformatics & how to use them.
2.	Understand the basic features of databases.
3.	Analyze the importance of sequence similarity.
4.	Understand the basic features of Phylogenetic Analysis.

Course Outcomes

After the completion of this course, students will be:

1.	Identify the scope of Bioinformatics.
2.	Utilize the biological databases to retrieve various biological information
3.	Apply the tools to do biological analysis.
4.	Identify and solving various biological challenges.
5.	Analyze Phylogenetic tree to find a relation in between proteins.

Syllabus

Module I

Introduction to Bioinformatics- Historical overview, Bioinformatics Applications, Molecular Biology and Bioinformatics, Central Dogma of Molecular Biology.

Biological Databases and Information Retrieval- Major Databases in Bioinformatics, Tools for Web Search, Data Retrieval Tools, Data Mining in Bioinformatics.

(8L)

Module II

Genome Analysis and Gene Mapping- Introduction, The Sequence Assembly Problem, Physical Maps, Cloning, Genome Sequencing, Application of Genetic Maps, Sequence Assembly Tool, The Human Genome Project.

(8L)

Module III

Alignment of Pair of Sequences- Motivation, Methods of Sequence Alignment, Measuring Sequence Detection Efficiency

Alignment of Multiple Sequences- Methods of Multiple Sequence Alignment, Evaluating Multiple Alignments, Applications.

(8L)

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Module IV

Phylogenetic Analysis- Introduction, Terminologies, Tree Topologies, Gene Trees, Methods of Phylogenetic Analysis, Tree Evaluation, Problems in Phylogenetic Analysis, Tools. (8L)

Module V

Tools for Similarity Search and Sequence Alignment- FASTA, BLAST, Comparison, Other Programs

Gene Identification and Prediction- Introduction, Basis of Gene Prediction, Pattern Recognition, Gene Prediction Methods, Other Gene Prediction Tools. (8L)

Text Books:

Rastogi S. C., Namita Mendiratta, Parag Rastogi, "Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery", Fourth Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.(T1)

An Introduction to Bioinformatics algorithms: Neil C Jones, Pavel A Pevzner, MIT Press, 2004.(T2)

Reference Books:

Bryan Bergeron, "Bioinformatics Computing", PHI Learning, New Delhi, 2010.(R1)

Arthur M. Lesk, "Introduction to Bioinformatics", Third Edition, OxfordUniversity Press, Chennai, 2010.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	1
CO2	3	3	3	1	3	1	1	1				2	2	2	1
CO3	3	3	3	3	3	1	1	1		1	1	2	3	2	1
CO4	3	3	3	1	3		1	1		1	1	2	3	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1	2	3	2	1

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code:IT270
Course title**: Introduction to R**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To develop problem solving skills
2.	To learn programming and to solve problems using computers
3.	To learn Data Manipulation, Analysis and Visualization using Computers
4.	To introduce students to the key concepts and ideas of a statistical computing environment
	To introduce students to fundamental concepts in (scientific) programming in general.

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Course Outcomes

After the completion of this course, students will be to do the following:

1.	Design programs with Interactive Input and Output, utilizing arithmetic expression, repetitions and decision making
2.	Design programs using the fundamental data structures in R
3.	Develop programs in R interfacing files and URLs
4.	Solve Mathematical problems using R
5.	Design graphs and simulations in R

Syllabus

Module I

Introduction- R reserved words, Variables and Constants, Operators, Operator Precedence

Getting Data In and Out of R –Accessing the Keyboard and Monitor, Reading in Larger Datasets.

(6L)

Module II

Control Statements- if ..else, for loop, while loop, repeat loop, break and next

Data Structures- Vectors, Arrays, Matrices, Lists, Data Frames, Factors, Operations on Dates and Times.

(7L)

Module III

Strings: Overview of String Manipulation Functions

Functions: Function Syntax, Environment and Scope, Recursive Function

Interfaces to the Outside World: File Connections, Reading Lines of a Text File Reading From a URL Connection.

(7L)

Module IV

Maths in R- Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations, Set Operations.

Simulation -Generating Random Numbers, Simulating a Linear Model, Random Sampling. (8L)

Module V

Graphics-Creating Graphs, Customising Graphs

Introduction to Object Oriented Features- Concept of Class and Object, S3 Classes, S4 Classes.

(7L)

Text books:

Peng Roger D., R Programming for Data Science.(T1)

Matloff Norman, The Art of R Programming – A Tour of Statistical Software Design. (T2)

Head of Department

Reference books:

Grolemund Garret, Hands-On Programming with R. (R1)
Gardener Mark, Beginning R: The Statistical Programming Language.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars

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CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				1	3	2	1
CO2	3	3	3	2	3	1	1	1				1	3	2	1
CO3	3	3	3	2	3	1	1	1		1	1	1	3	2	1
CO4	3	3	3	2	3		1	1		1	1	1	3	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1		3	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT271
Course title: **Introduction to Python**
Pre-requisite(s):
Co- requisite(s):NIL
Credits: L: 3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To facilitate skills required to Install and run the Python interpreter
2.	To facilitate skills required to Create and execute Python programs
3.	To introduce the Understanding the concepts of file I/O
4.	To provide skills to read data from a text file using Python
5.	To discover the interesting patterns using appropriate Python visualization libraries

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Show how to convert the problems into algorithms
2.	Analyze and develop the algorithms to Python programs.
3.	Design programs with Interactive Input and Output, utilizing arithmetic expression repetitions, decision making, arrays.
4.	Develop modular Python programs using functions.
5.	Design programs using file Input and Output.

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Syllabus

Module I **[6 L]**

Problem Analysis-Formal Definition of a Problem, Algorithms, Flowcharts, Examples for Algorithms and Flowcharts

Introduction to Python- Variables, Operators, Expressions, Evaluation of Expressions, String Operations, Input and Output functions

Module II **[7 L]**

Control Statements- Decision making statements, Iterative Statements, Loop Control Statements

Strings and Lists- String Operations, Tuples and Dictionaries-Operations and Examples

Module III **[7 L]**

Functions- Function Definition and Call, Mathematical functions, User defined Functions, Parameters and Arguments, Type Conversion and Coercion

Module IV **[8 L]**

Files – Different File Operations, File Object Attributes, Directories

Exceptions- Except clause, Exception with arguments, Raising an Exception, User Defined Exceptions

Module V **[7 L]**

Introduction to Classes and Objects- Object Oriented Features, Attributes, Instances, Garbage Collection

Text book:

1. Downey A., How to think like a computer scientist: Learning with Python.

Reference books:

1. Jose Jeeva, Taming Python by Programming, Khanna Publishing House.
2. Jose J. Introduction to Computing and Problem Solving with Python, (ISBN: 978-93-82609-810).

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				1	2	2	1
CO2	3	3	3	1	3	1	1	1				1	2	2	1
CO3	3	3	3	1	3	1	1	1		1	1	1	2	2	1
CO4	3	3	3	1	3		1	1		1	1	1	2	2	1
CO5	3	3	3	1	3	1	1	1	1	1	1		2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS271
Course title: **Cyber Law and Security**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the necessity of cyber laws.
2.	To explore the Constitutional & Human Rights Issues in Cyberspace
3.	To understand the criteria for Cyber Stalking/Harassment
4.	To understand the different aspects of cyber crimes

Course Outcomes

After the completion of this course, students will be able to:

1.	Construct a strategy to Safeguard the society from cybercrime.
2.	Organize the evidence in terms of court terminology.
3.	Define the legal issues and its applications.
4.	Apply Computer forensics and digital detective and various processes, policies and procedures.
5.	Compose the techniques to produce data from computer and hand held devices.

Syllabus

Module I

Introduction

Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level.

Cyber Law - International Perspectives

UN & International Telecommunication Union (ITU) Initiatives, Council of Europe - Budapest Convention on Cybercrime, Asia-Pacific Economic Cooperation (APEC), Organization for Economic Co-operation and Development (OECD), World Bank, Commonwealth of Nations, Indian Context of Jurisdiction and IT Act, 2000, International Law and Jurisdictional Issues in Cyberspace.

(8L)

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Module II

Constitutional & Human Rights Issues in Cyberspace

Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection

Cyber Crimes & Legal Framework

Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under Indian IT Act, 2000.

(8L)

Module III

Cyber Torts

Cyber Defamation, Different Types of Civil Wrongs under the IT Act, 2000

Intellectual Property Issues in Cyber Space

Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

(8L)

Module IV

Introduction to Cybercrime, Classifications of Cyber Crimes, Local and Global perspectives on Cybercrime, Cyber offences, Cyberstalking, Cybercrime and cloud computing, cybercrimes through hand held devices., Tools and Methods used in Cybercrime, phishing, steganography, attacks on wireless network.

(8L)

Module V

Understanding Digital forensic, Forensics science, computer forensics, and digital forensics. Criminalistics, Analysis of cyber-criminalistics area, Holistic approach to cyber-forensics, Computer forensic tools, Forensics of Hand held devices, tools for hand held device forensics., intellectual property in the cyberspace, The ethical dimension of Cybercrimes.

(8L)

Text Books:

9. Reed Chris & Angel John, *Computer Law*, OUP, New York, 2007. (T1)
10. Singh Justice Yatindra, *Cyber Laws*, Universal Law Publishing Co, New Delhi, 2012. (T2)
11. Verma S, K, Mittal Raman, *Legal Dimensions of Cyber Space*, Indian Law Institute, New Delhi, 2004. (T3)
12. JonthanRosenoer, *Cyber Law*, Springer, New York, 1997. (T4)
13. Naib Sudhir, The Information Technology Act, 2005: A Handbook, OUP, New York, 2011.(T5)
14. Godbole Nina, BelapureSunit, Cyber Security, Wiley Indian Print, 2014.(T6)
15. Sammons John, The Basics of Digital Forensics, Elsevier.(T7)
16. Hyaes D.R., A Practical Guide to Computer Forensics Investigations , Person IT education 2014.(T8)

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Reference Books:

1. Bhansali S. R., *Information Technology Act, 2000*, University Book House Pvt. Ltd.,Jaipur, 2003. (R1)
2. Deva Vasu, *Cyber Crimes and Law Enforcement*, Commonwealth Publishers, New Delhi, 2003. (R2)
3. Nelson Bil, Philips A, Stuarts Christopher, Guide to Computer Forensics and Investigations: Processing Digital evidence , Cengage Learning, 5th Edition 2015.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	2	2	2				2	2	2	1
CO2	3	3	3	3	2	2	2	2				2	2	2	1
CO3	3	3	3	3	2	1	2	2		1	1	2	2	2	1
CO4	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO5	3	3	3	3	3	1	2	2	1	1	1	2	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: MT123
Course title: **Business Communications**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: I
Branch: CSE/IT

Course Objectives

This course enables the students:

A.	To analyze and demonstrate writing and speaking processes through invention, organization, drafting, revision, editing, and presentation.
B.	To understand the importance of specifying audience and purpose and to select appropriate communication choices.
C.	To interpret and appropriately apply modes of expression, i.e., descriptive, expositive, Narrative, scientific, and self-expressive, in written, visual, and oral communication
D.	To participate effectively in groups with emphasis on listening, critical and reflective thinking, and responding.
.E	To develop the ability to research and write a documented paper and/or to give an oral presentation.

Course Outcomes

After the completion of this course, students will be able to:

1.	Apply business communication strategies and principles to prepare effective communication for domestic and international business situations.
2.	Utilize analytical and problem-solving skills appropriate to business communication.
3.	Participate in team activities that lead to the development of collaborative work skills.
4.	Select appropriate organizational formats and channels used in developing and presenting business messages
5.	Communicate via electronic mail, Internet, and other technologies and deliver an effective oral business presentation.

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Syllabus

MT123: Business Communication

Module I(4 lectures)

Introduction to Business Communication:
Importance and Objectives of Business communication, Process of communication, Barriers to effective communication, Techniques of effective communication. Forms of communication (Written, Oral, audio-visual communication).

Module II(5 lectures)

Managing Business Communication:
Formal and Informal communication, Non- verbal communication (Body language, Gestures, Postures, Facial expressions). The cross cultural dimensions of business communication. Techniques to effective listening, methods and styles of reading.

Module III (5 lectures)

Other aspects of communication:
Vocabulary:
Single word substitution, Idioms and phrases, Precis writing, Comprehension.

Group Discussions, Extempore, Principles of effective speech and presentations, Role playing.

Module IV: (6 lectures)

Introduction to managerial writing:

Business letters: Inquiries, Circulars, Quotations, Orders, Acknowledgement, Claims & adjustments, Collection letters, Sales letters, Drafting of different resumes, Covering letters Applying for a job, Social correspondence, Invitation to speak.

Official Correspondence: Memorandum, Notice, Agenda, Minutes, Circular letters.

Module V: (3 lectures)

Report writing and Technical Proposals:
Business reports, Types, Characteristics, Importance, Elements of structure, Process of writing, Order of writing, the final draft, check lists for reports.

Technical proposals, Definitions, types and format.

Head of Department

Text Books:

T1. Communication Skills, Sanjay Kumar &PushpLata, Oxford University Press
T2. Business Correspondence and Report Writing,R.C.Sharma, Krishna Mohan.Mcgraw Hill
T3. Communication for Business,Shirley Taylor, V.Chandra, Pearson

Reference Books:

R1. Business Communication- HorySankar Mukherjee, Oxford University Press
R2. Basic Business Communication- .Lesikar I Flatley, McGraw Hill.
R3. Business Communication Today ,Bovee, Thill and Chaterjee, Pearson

Gaps in the syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design
POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Quiz(I,II)	20
Mid Term Examination Marks	25
Attendance	5
End Term Examination Marks	50

AssessmentComponents	CO1	CO2	CO3	CO4	CO5
Quiz(I,II)	√	√	√		
End Sem Examination Marks	√	√	√	√	√
Mid Term Examination Marks			√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	1	1	1	1	2	3	3	3	3	3	3	2	2	1	1
CO2	1	2	1	1	1	3	3	2	3	3	2	2	1	1	2
CO3	1	2	2	1	1	1	3	3	3	3	2	2	1	1	3
CO4	1	2	2	1	3	3	2	2	3	3	1	2	1	1	2
CO5	2	1	1	2	2	3	3	3	3	3	2	1	1	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1,CD2,CD3
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD3
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini projects/Projects	CO4	CD1,CD2,CD3,CO4 CD5
CD5	Laboratory experiments/teaching aids	CO5	CD1,CD2,CO5
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

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COURSE INFORMATION SHEET

Course code: MT204
Course title: **Constitution of India**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 2 T: 0 P: 0
Class schedule per week: 2
Class: B. Tech
Semester / Level: II
Branch: CSE/IT

Course Objectives:
This course enables the students:

A.	To describe the importance and role of Constitution of India
B.	To resolve the social problems and issues.
C.	To maintain and bolster the unity and integrity in the society.
D.	To formulate and design policies in accordance with the constitutional provisions.

Course Outcomes

After the completion of this course, students will be:

1.	Outlinethe need and importance of the Indian constitution.
2.	Explain the fundamental rights and duties of the citizens of India.
3.	Relate appropriate constitutional provisions with relevant social issues
4.	Describe the role of different departments of government.
5.	Crique the Government policies and programmes designed for the society at large.

Syllabus

Module 1: Introduction to the Constitution of India, Salient Features of the Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Module 2: Union and State Executives: President and Prime Minister, Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.Governor: Role and Position, Chief Ministers and Council of ministers.

Module 3: The Indian Judicial System – The Supreme Court and The High Court's – composition, Jurisdiction and functions, The Role of the Judiciary.

Module 4: Local Government- District's Administration: Role and Importance, The Panchayatas – Gram Sabha, Constitution and Composition of Panchayatas ,Constitution and Composition of Municipalities

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Module 5: Miscellaneous- Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Readings

6. The Constitution of India by " Ministry of Law India" Kindle Edition
7. Constitutional History of India by Prof.M.V.PYLEE-S.Chand Publishing
8. Indian Administration by Avasti and Avasti-Lakshmi Narain Agarwal Educational Publishers.2017 edition.
9. Introduction to the Constitution of India by D DBasu by Lexis Nexis : 20th edition.
10. Constitution of India V.N.Shukla's EBC Explorer Edition 13th ,2017

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
1.Lecture by use of boards/LCD projectors/OHP projectors
2. Tutorials/Assignments
3. Seminars
4. Mini projects/Projects
5.Laboratory experiments/teaching aids
6.Industrial/guest lectures
7.Industrial visits/in-plant training
8.Self- learning such as use of NPTEL materials and internets
9.Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	**% Contribution during CO Assessment**
Mid Sem Examination Marks	25
End SemExamination Marks	60
Assignment / Quiz (s)	15

AssessmentCompoents	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Mid Sem Examination Marks	√	√			
End Sem Examination Marks	√	√	√	√	√
Assignment	√	√	√		

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Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1						3	3	3	3	3		2	1	1	1
CO2						3	3	2	3	3		2	1	1	2
CO3						1	3	3	3	3		2	1	1	1
CO4						3	2	2	3	3		2	1	1	1
CO5						3	3	3	3	3		1	1	1	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1
CD2	Tutorials/Assignments	CO2	CD1
CD3	Seminars	CO3	CD1, CD2
CD4	Mini projects/Projects	CO4,	CD1, CD2
CD5	Laboratory experiments/teaching aids	CO5	CD1, CD3, CD6
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

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COURSE INFORMATION SHEET

Course code: IT306
Course title: **Software Engineering Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T:0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Familiarize the students with the fundamental concepts of Software Engineering
2.	Impart state-of-the-art knowledge on SRSand UML
3.	Explore case studies to demonstrate practical applications of different concepts
4.	Provide a platform where they can solve real life problems

Course Outcomes

After the completion of this course, students will be able to:

CO1	Prepare efficient models for development of software for various projects
CO2	Collect the requirements the client wants for the software being produced
CO3	Design the UML diagrams necessary for the software being developed
CO4	Create and specify feasible software designs based on the requirements/specifications
CO5	Assess the extent and costs of a project with the help of several different assessment methods

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SYLLABUS

List of Programs as Assignments:

37. Lab Assignment No: 1

Objective: To Understand and Implement Identification of Requirements from Problem Statements

Q1. To consider the problem statement for a project to be developed and list out the ambiguities, inconsistencies and incompleteness of the problem statement.

Q2. To identify different functionaries to be obtained from a system and characteristics that a system should have, but not possessed by the system itself

38. Lab Assignment No: 2

Objective: To Understand and Implement Estimation ofProject Metrics

Q1. To estimate the minimum size of the team one would require to develop a project through application of intermediate COCOMO.

Q2. To use Halstead's metrics to estimate the effort required to recreate a program in JAVA from C.

39. Lab Assignment No: 3

Objective: To Understand and Implement Modeling UML Use Case Diagrams and Capturing Use Case Scenarios

Q1. To draw a use case diagram for the given case study.

Q2. To identify the primary and secondary actors for the system and generalization of use cases and «include» stereotypes to prevent redundancy in the coding phase.

40. Lab Assignment No: 4

Objective: To Understand and Implement E-R Modeling from the Problem Statements

Q1. To identify the possible entity sets, their attributes, and relationships for the given case study.

Q2. To draw an ER diagram for the given case study.

41. Lab Assignment No: 5

Objective: To Understand and Implement Identification of Domain Classes from the Problem Statements

Q1. To identify potential classes and their attributes for the given case study.

Q2. To utilize expert knowledge on the subject matter to identify other relevant classes.

42. Lab Assignment No: 6

Objective: To Understand and Implement Identification of Components from the Problem Statements

Q1. To identify potential components for the given case study.

Q2. To draw component diagram for the given case study

43. Lab Assignment No: 7

Objective: To Understand and Implement State Chart and Activity Modeling

Q1. To draw a statechart diagram to graphically represent the given case study.

Q2. To draw an activity diagram to graphically represent the workflow of the given case study.

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44. Lab Assignment No: 8

Objective: To Understand and Implement Modeling UML Class Diagrams and Sequence diagrams

Q1. To draw class diagram for the given case study.

Q2. To draw sequence diagram for the given case study.

45. Lab Assignment No: 9

Objective: To Understand and Implement Modeling Data Flow Diagrams

Q1. To draw data flow diagram (Level 0, 1 and 2) for the given case study.

46. Lab Assignment No: 10

Objective: To Understand and Implement Estimation of Test Coverage Metrics and Structural Complexity

Q1. To identify the basic blocks for a given program

Q2. To draw a CFG using the basic blocks

Q3. To determine McCabe's complexity from a CFG.

47. Lab Assignment No: 11

Objective: To Understand and Implement Designing Test Suites

Q1. To design a test suite for the given case study.

Q2. To verify implementation of functional requirements by writing test cases.

Q3. To analyze results of testing to ascertain the current state of the project.

48. Lab Assignment No: 12

Objective: To Understand and Implement Forward and Reverse Engineering

Q1. To obtain programs from UML diagrams.

Q2. To obtain UML diagrams from programs.

Books recommended:

TEXT BOOKS

7. Software Engineering, Ian Sommerville, Pearson, 10th Edition, 2016.**(T1)**
8. Software Engineering: A Practioner's Approach, Roger S. Pressman, McGraw Hills, 7th Edition, 2009.**(T2)**

REFERENCE BOOKS

4. Fundamentals of Software Engineering, Rajib Mall, Prentice-Hall of India, 3rd Edition, 2009.**(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

Head of Department

POs met through Gaps in the Syllabus: PO2, 5 & 6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	2	2	1	1	1	1	3	1	3	3
CO2	3	2	1	1	2	1	1	1	2	1	3	3	3	2	3
CO3	3	3	2	1	3	2	2	1	3	3	1	3	3	3	3
CO4	2	3	2	2	3	3	2	3	3	2	3	3	3	3	2
CO5	3	1	1	3	2	2	3	1	2	1	2	2	1	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3,CD6
CO5	CD1,CD2, CD3, CD6, CD7

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

COURSE INFORMATION SHEET

Course code: CS308
Course title: **Mobile Interface Lab**
Pre-requisite(s):
Co- requisite(s): NIL
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To introduce Android platform and its Architecture.
2.	To learn activity creation and Android UI designing.
3.	To be familiarized with Intent, Broadcast receivers and Internet services.
4.	To integrate multimedia, camera and Location based services in Android Application.
5.	To explore Mobile security issues.

Course Outcomes

After the completion of this course, students will be able to:

1.	Describe Android platform, Architecture and features.
2.	Design User Interface and develop activity for Android App.
3.	Design and implement Database Application and Content providers.
4.	Use multimedia, camera and Location based services in Android App.
5.	Discuss various security issues in Android platform.

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Syllabus

20. Develop an application that uses GUI components, Font and Colors.
21. Develop an application that uses Layout Managers and event listeners.
22. Write an application that draws basic graphical primitives on the screen.
23. Develop an application that makes use of database.
24. Develop a native calculator application.
25. Implement an application that implements Multi-threading.
26. Develop a native application that uses GPS location information.
27. Implement an application that writes data to the SD card.
28. Implement an application that creates an alert upon receiving a message.
29. Write a mobile application that creates alarm clock.

Text books:

4. Pattern Recognition and Machine Learning, Christopher Bishop, Springer 2006.

Reference books:

6. Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2013.
7. Pattern Classification, 2nd Ed., Richard Duda, Peter Hart, David Stork, John Wiley & Sons, 2001.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	3	2	3	1	2	1	2	1	1	2	1	2
CO2	3	2	3	3	2	1	2	3	2	1	3	2	2	3	2
CO3	3	3	1	3	2	1	3	3	3	2	1	2	3	2	2
CO4	2	3	3	2	2	2	2	2	2	2	2	1	3	2	2
CO5	3	3	3	1	2	3	1	1	2	3	2	2	3	2	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT308
Course title: **Image Processing**
Pre-requisite(s): Discrete Mathematics,
Co- requisite(s): Data Structures
Credits: L: 3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level:
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Understand the basic concept of Digital Image Processing
2.	To Learn the Fourier Transform & its application
3.	Understand the basic components of filters
4.	Understand the basic concept of Image Compression Fundamentals
5.	Understand the basic concept of Image Segmentation.

Course Outcomes
After the completion of this course, students will be:

1.	Understand the concept of image formation, digitization, and role human visual system plays in perception of image data and spatial filtering techniques for enhancing the appearance of an image.
2.	Acquire an appreciation for various frequency based filtering techniques for enhancing the appearance of an image, duly applying them in different applications.
3.	Discern the difference between noise models, gain an insight into assessing the degradation function and realize different spatial and frequency based filtering techniques for reduction and removal of noise.

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4.	Synthesize a solution to image compression using the concept of information theory and lossless and lossy compression techniques.
5.	Design and create practical solutions using morphological and image segmentation operators for common image processing problems and assess the results.

Syllabus

1. Write a C Program to display header information of 16 color .bmp image.
2. Program to enhance image using image arithmetic and logical operations.
3. Program for an image enhancement using pixel operation.
4. Program for gray level slicing with and without background.
5. Program for image enhancement using histogram equalization.
6. Program to filter an image using averaging low pass filter in spatial domain.
7. And median filter.
8. Program to sharpen an image using 2-D laplacian high pass filter in spatial
9. domain.
10. Program for detecting edges in an image using Roberts cross gradient
11. operator and sobel operator.
12. Program for smooth an image using low pass filter in frequency domain . (Butterworth lpf)
13. Program for smooth an image using high pass filter in frequency domain . (Butterworth hpf)
14. Program for morphological image operations-erosion, dilation, opening & closing.
15. Program for illustrating color image processing.
16. Program for image Watermarking .

Text books:

2. Rafael. C. Gonzalez & Richard E. Woods- Digital Image Processing, 3/e Pearson Education, New Delhi - 2009

Reference books:

4. W.K.Pratt-Digital Image Processing, 4/e, John Wiley & sons, Inc. 2006.
5. M. Sonka et al. Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007.
6. Jayaraman, Digital Image Processing, Tata McGraw-Hill Education, 2011

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

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POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2			2	1	2	2	3	3	2
CO2	3	3	3	2	2	1			2	1	2	2	3	3	2
CO3	3	3	3	3	2	1			2	1	2	2	3	3	2
CO4	3	3	3	3	2	1			2	1	2	2	3	3	2
CO5	3	3	3	3	3	2	1	1	2	1	2	2	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT404
Course title: **Intellectual Property Rights and Cyber Laws**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 2 T:0 P: 0
Class schedule per week: 2
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

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Course Outcomes

After the completion of this course, students will be:

1.	Understand the importance of Intellectual property, their implications and their types.
2.	Identify the process for registration and use of copyrights and patents and the rights involved with them.
3.	Discover the functioning of trademarks and domain names, the rights of the holders and process of dispute resolution.
4.	Assess the importance and procedure for registration of Designs and Geographical Indications, the rights of the owner and arbitration process.
5.	Develop an understanding of the Cyber Laws, trends in Cyber crimes and procedures to tackle them.

Syllabus

Module I

Introduction to Intellectual Property, Justifications for protection of IP, Major forms of IP- Copyright; Patent; Trade Marks; Designs; Geographic indication; Semi conductors; Plant varieties, Berne Convention, Paris Convention, TRIPS

Module II

Copyrights- Historical development of copyright, Original literary, dramatic, musical, artistic works, Cinematograph films, Sound recordings, Ownership of copyright, Term of copyright, Infringement of copyright, Exceptions of infringement, Remedies, Registration

Patents- Historical development of patents, Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Revocation, Infringement of patents, Remedies

Module III

Trade Marks and Domain Names - Historical development of trademarks, Functions of marks, Concept of distinctiveness, Absolute grounds of refusal, Procedure for registration, Term of mark, Rights of holder, Assignment and licensing of marks, Infringement, Passing Off, Domain Name Protection, Domain Name Disputes, Cyber squatting, Arbitration

Module IV

Designs- meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indications- meaning and its evolution, Difference between GI and Trade Marks, Registration, Rights, Authorised user

Module V

Cyber Law- Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Cyber Crime and IT Act 2000, Nature of cyber criminality, Strategies to tackle cyber crime and Trends, Defamation, Harassment and Email abuse, Law of Digital Contracts, The System of Digital Signatures

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Text books:

3. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, Delmar Cengage Learning, 4th Edition, 2013.
4. Vivek Sood, Cyber Law Simplified, Tata McGraw-Hill Publishing, Fourth Reprint, 2008.

Reference books:

4. Miller and Davis' Intellectual Property, Patents, Trademarks, and Copyright in a nutshell, West Publishing, 5th edition, 2012.
5. William Rodolph Cornish, David Llewelyn, Tanya Frances Aplin, Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights, Sweet & Maxwell, 7th Edition, 2010.
6. Henri J. A. Charmasson, John Buchaca, Patents, Copyrights and Trademarks For Dummies, Wiley, 2nd Edition, 2008.

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1			1	1	1	3	3	3	1	3	2	2	1	1	2
CO2				1	1	3	3	2	1	3	2	2	1	1	2
CO3				1	1	1	3	3	1	3	2	2	1	1	2
CO4		2	2	1	1	3	2	2	1	3	2	2	1	1	2
CO5		2	2	1	1	3	3	3	1	3	2	1	1	1	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT331
Course title: **Biometric Security**
Pre-requisite(s): CS201 Data Structure
Co- requisite(s): CS206 Design and Analysis of Algorithm
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To understand the brief functioning of biometric system.
2.	To know the different types of biometric and their accuracy.
3.	To increase the likelihood that biometric technologies, when deployed, will be as protective of personal and informational privacy as possible.
4.	To raise awareness of privacy issues for end users and for students.
5.	To increase security of the system as well as data.

Course Outcomes

After the completion of this course, students will be able to:

1.	Determine knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2.	Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
3.	Develop new advanced authentication algorithms.
4.	Analyze the accurate discrimination between individuals.
5.	Illustrate the two factor authentication system.

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Syllabus

Module I

Biometrics- Introduction- benefits of biometrics over traditional authentication systems -benefits of biometrics in identification systems-selecting a biometric for a system –Applications - Key biometric terms and processes - biometric matching methods -Accuracy in biometric systems. (8L)

Module II

Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern. (8L)

Module III

Technical description – characteristics - strengths – weaknesses – deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.
(8L)

Module IV

signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.
(8L)

Module V

Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation plan. (8L)

Text Books :

Nanavathi Samir, Thieme Michel, and Nanavathi Raj, Biometrics -Identity Verification in a Network, 1st Edition, Wiley Eastern, 2002. (T1)

Chirillo John and Blaul Scott, Implementing Biometric Security, 1st Edition, Wiley Eastern Publication, 2005. (T2)

Reference Book :

Berger John, Biometrics for Network Security, 1st Edition, Prentice Hall, 2004.(R1)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	1	2	2				2	2	2	1
CO2	3	3	3	2	2	1	2	2				2	2	2	1
CO3	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO4	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO5	3	3	3	3	3	1	2	2	1	1	1	2	2	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS370
Course title: **Cyber Crime and Investigation**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the importance of the cyber law for crime investigation.
2.	To understand the web based criminal activity
3.	To understand the different methods for hacking.
4.	To understand the criminal activities over the web.

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Course Outcomes

After the completion of this course, students will be able to:

1.	Identifythecomputer-based crime.
2.	Analyze Technical and legal aspects of computer crime investigations
3.	Identify the limitations of law and its enforcement agencies.
4.	Utilize the procedures of recovering computer evidence and seize process.
5.	Apply techniques for finding, preserving, presenting, and extracting information from the digital devices.

Syllabus

Module I

Introduction: Cyberspace and Criminal Behavior, Traditional problems associated with computer-based crime, e cash problems, Computer Technology and History: Computer Language, Hardware, software, operating system, Internet, Network language.
(8L)

Module II

Early Hackers and Theft Components: Phreakers, Hacking, Commodities, Intellectual property. Contempory computer crime: web based criminal activity, money laundering.
(8L)

Module III

Identity theft and identity fraud: Typologies of internet theft, virtual identity, credit identity. Prevalence and victimology, physical methods, of identity theft, phishing, spyware, trojans, insurance and loan fraud, immigration fraud. Terrorism and organized crime:Terror online, criminal activities, organized crime as cyber gangs., technology used in organized crime. Data piracy.
(8L)

Module IV

Avenues for Prosecution and Government efforts: Act, Law enforcement agencies, International efforts, Cyber law and its amendments of current state, other legal considerations.
(8L)

Module V

Forensic Terminologies and Developing forensic capabilities, Searching and seizing computer related evidence, Processing of evidence and report preparation.
(8L)

Head of Department

Text Books:

3. Britz M.T., Computer Forensics and Cyber Crime, First Impression, Pearson Education, 2012.(T1)
4. Casey E., Computer Crime and investigations, First Edition, Springer, 2001.(T2)

Reference Book:

2. Easttom C. & Taylor D.J., Computer Crime Investigations and Law, Carenage Learning.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	2	2	2				2	2	2	1
CO2	3	3	3	3	2	2	2	2				2	2	2	1
CO3	3	3	3	3	2	1	2	2		1	1	2	2	2	1
CO4	3	3	3	3	3	1	2	2		1	1	2	2	2	1
CO5	3	3	3	3	3	1	2	2	1	1	1	2	2	2	1

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS371
Course title: **Genetic Algorithm**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Able to understand the basic concepts of GA
2.	Able to find the application areas of GA
3.	Able to understand the importance of optimization using GA
4.	Able to know about the traditional GA model

Course Outcomes
After the completion of this course, students will be able to:

1.	Define Traditional GA model.
2.	Build code for GA.
3.	Apply different techniques of GA.
4.	Design schema for various problems of optimization using GA.
5.	Develop Classifier system using GA.

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Syllabus

Module I

Introduction to Genetic Algorithm, Genetic Algorithms, Traditional and Search Methods and their Differences, A Simple Genetic Algorithm. The Fundamental Theorem, Schema Processing.

(8L)

Module II

Two & k-Armed Bandit Problem, Hypothesis, Schemata and Revisited., Computer Implementation of A Genetic Algorithm**:** Data Structures, Reproduction, Crossover and Mutation, A Time to Reproduce, A Time to Cross, How Well Does It Work, Mapping Objective Functions to Fitness Form, Fitness Scaling.
(8L)

Module IV

Coding, A Multiparameter Mapped, Fixed-Point Coding, Discretization, Constraints.Applications of Genetic Algorithms **:**The Rise of Genetic Algorithms, Genetic Algorithm Applications of Historical Interest, De Jong and Function Optimization.
(8L)

Module V

Improvements in Basic Technique, Current Applications of Genetic Algorithms.Genetics-Based Machine Learning, Whence It Came, What is Classifier System, Rule and Message, Genetic Algorithm.

(8L)

Text Book :

Goldberg D. E., Genetic Algorithms in Search Optimization and Machine Learning, Pearson Education, New Delhi, 2005.(T1)

Reference Book :

Vose M. D., The Simple Genetic Algorithm, PHI, New Delhi, 2004.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	1	1	1	1				2	2	2	1
CO2	3	3	3	1	2	1	1	1				2	2	2	1
CO3	3	3	3	3	3	1	1	1		1	1	2	3	2	1
CO4	3	3	3	2	3	1	1	1		1	1	2	3	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1	2	3	2	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT402
Course title: **Dot NET Programming**
Pre-requisite(s): Nil
Co- requisite(s):
Credits:L:0 T:0 P:1.5
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV

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Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To study basic and advanced features of the C# language
2.	To create form based and web based applications
3.	To study the internals of the .NET framework
4.	To know and study about the Common Language Runtime (CLR) and Common Language Infrastructure (CLI)

Course Outcomes

After the completion of this course, students will be able to:

1.	Install and configure Dot Net application development tools.
2.	develop, implement and creating Applications with C#
3	develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web
4.	explain Security in the .NET framework and Deployment in the .NET.
5.	develop Assemblies and Deployment in .NET, Mobile Application Development.

Syllabus

Module I

C# basics

C# and the .NET framework – C# basics – Objects and types – Inheritance –Arrays – Operators and casts – Indexers. (8L)

Module II

Advanced C# features

Delegates and events – Strings and regular expressions – Generics – Collections–Memory management and pointers – Errors and exceptions. (8L)

Module III

I/O and network programming

Tracing and events - threading and synchronization - .Net security – localization –Manipulating XML - Managing the file system – basic network programming. (8L)

Module IV

Window and web applications

Window based applications – Data access with .NET – basics of ASP .NET -Introduction to web services. (8L)

Module V

.NET Features

Architecture – Assemblies – shared assemblies – CLR hosting – Appdomains –Reflection. (8L)

Head of Department

Text Books:

Nagel,C. , Evjen,B. , Glynn,J. , Watson,K. , and Skinner,M.,"Professional C# 4 with .NET 4," Wiley India, 2010.(T1)
Liberty ,J., and MacDonald ,B., "Learning C# 3.0," First Edition ,O'Reilly, 2008.(T2)

References Book:

Troelson ,A., "Pro C# 5.0 and the.NET 4.5 Framework," Sixth Edition, Apress,2012.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	1	1	3	1	2	2	1	1	1	2	2	1	2
CO2	3	3	3	3	3	2	2	2	2	2	2	2	3	2	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO4	2	3	3	1	3	2	2	2	3	3	3	3	2	2	3
CO5	3	3	3	3	3	1	1	2	2	2	3	3	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT429
Course title: **Machine Learning**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co- requisite(s):NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic concept of machine learning.
2.	To explore the application of machine learning.
3.	To understand the concept of supervised learning.
4.	To learn the advantage of neural network.
5.	To learn the utility of clustering techniques.

Course Outcomes

After the completion of this course, students will be able to:

1.	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity
2.	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses
3.	Implement machine learning solutions to classification, regression, and clustering problems
4.	Design and implement various machine learning algorithms in a range of real-world applications
5.	Evaluate and analyse the performance of machine learning algorithm or a system based on machine learning algorithm.

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Syllabus

Module I

Introduction to Machine learning

Machine Learning – what and why? Basics of Linear Algebra and Statistics, Overview of target function representations; Linear Regression.

(8L)

Module II

Supervised Learning

Basics of Feature Selection and Evaluation, Decision Tree, Overfitting and Pruning, Logistic regression, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts. (10L)

Module III

Neural Networks

Perceptions: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

(8L)

Module IV

Unsupervised and Semi Supervised Learning

Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labelled and unlabeled data.

(8L)

Module V

Ensemble

Committees of multiple hypotheses, bagging, boosting, active learning with ensembles, (6L)

Text book:

1. Mitchell Tom, Machine Learning, Latest Edition, Mc-Graw Hill.(T1)

Reference books:

3. Shalev-Shwartz Shai and Ben-David Shai, Understanding Machine Learning, Cambridge University Press. 2017.(R1)
4. Bishop Christopher, Pattern Recognition and Machine Learning, Springer, 2006.(R2)

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	2	1	1	1	1	1	1	1	2	3	1	1
CO2	3	3	2	2	1	1	1	1	1	1	1	2	3	3	1
CO3	3	3	3	3	3	3	2	2	2	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	2	2	3	3	2
CO5	2	3	2	3	3	2	1	1	2	2	1	2	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT490
Course title: **Natural Language Processing**
Pre-requisite(s): CS305 Compiler Design
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Head of Department

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Course Objectives

This course enables the students:

1.	To understand the basic component of Natural Language Processing.
2.	To explore the application areas of Natural Language Processing.
3.	To understand the idea of Language Modelling.
4.	To explore the basic concepts of Parts-of-speech Tagging.
5.	To understand the concepts of language modelling.

Course Outcomes

After the completion of this course, students will be able to:

1.	Describe the typical NLP problem, their importance & difficulty; and concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
2.	Demonstrate understanding of the relationship between NLP and statistics& machine learning.
3.	Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.
4.	Analyse NLP problems to decompose them into appropriate components.
5.	Evaluate a NLP system, identify shortcomings and suggest solutions for these shortcomings.

Syllabus

Module I

Introduction to NLP :introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

(8L)

Module II

Language Modelling: N-gram and NeuralLanguageModelsLanguage Modelling with N-gram, Simple N-gram models, Smoothing(basic techniques), Evaluating language models;Neural Network basics, Training;Neural Language Model, Case study: application of neural language model in NLP system development**.**

(8L)

Module III

Parts-of-speech Tagging**: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, POS Tagging using Maximum Entropy Model.** (8L)

Head of Department

Module IV

ParsingBasic concepts: top down and bottom up parsing, Treebank; Syntactic parsing: CKY parsing; Statistical parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

(8L)

Module V

Semantics: Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WorldNet.

(8L)

Text books:

Jurafsky Dan and Martin James H., Speech and Language Processing **(3rd ed.)***To be published in 2018*. Available at: https://web.stanford.edu/~jurafsky/slp3/. (T1)

Reference books:

Jurafsky D. and Martin J. H., Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.(R1)

Goldberg Yoav, A Primer on Neural Network Models for Natural Language Processing.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Head of Department

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	1	1	1	2	1	3	1	1	3	2	1
CO2	3	3	3	1	3	1	1	1	3	1	2	2	3	2	1
CO3	3	3	3	3	3	1	2	2	2	1	1	2	3	3	2
CO4	3	3	3	1	3	2	1	1	2	1	1	2	3	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	3	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT420
Course title: **Artificial Intelligence**
Pre-requisite(s): IT201 Basics of Intelligent Computing
Credits: L:3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/ IT

Program Outcome

This course enables the students to:

1.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
2.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
3.	An ability to design a system, component or process to meet desired needs within realistic constraints.
4.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
5.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Head of Department

Course Outcomes

After the completion of this course, students will be to:

1.	Analyze the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
2.	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
3.	Analyze the various concepts of knowledge representations and demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.
4.	Develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
5.	Explain various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

Syllabus

Module I

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature Of Environment, Structure Of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining The Problem As State Space Search, Production System, Problem Characteristics, Issues In The Design Of Search Programs.

(9L)

Module II

Search Techniques: Solving Problems By Searching, Problem Solving Agents, Searching For Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search For Constraint Satisfaction Problems.

Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Mini Max Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

(9L)

Module III

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, and Natural Deduction.

Representing Knowledge Using Rules: Procedural Verses Declarative Knowledge, Logic Programming, Forward Verses Backward Reasoning, Matching, Control Knowledge. (7L)

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Module IV

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster-Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning.

Learning: Forms Of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning. (8L)

Module V

Natural Language Processing: Brief introduction to Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planning uncertain movements, robotic software architecture, application domains.
(6L)

Text Books:

Russel S. and Norvig P., Artificial Intelligence a Modern Approach, 3rd edition, Pearson Education.(T1)

Rich E. & Knight K., Artificial Intelligence, 3rd edition, TMH, New Delhi.(T2)

Reference books:

Patterson Dan W., Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.(R1)

Rolston D.W., Principles of AI & Expert System Development, TMH, New Delhi.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	3	2	1	1	1	2	1	3	2	3	2
CO2	3	2	2	3	3	2	1	1	3	3	2	3	2	2	1
CO3	3	2	2	2	3	2	2	2	3	3	1	3	2	3	2
CO4	2	3	2	2	2	3	2	1	3	3	1	3	2	2	3
CO5	3	3	2	3	2	3	2	2	2	1	2	2	2	2	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS470
Course title: **Wireless Communication**
Pre-requisite(s): IT301 Data Communication and Computer Network
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week:
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Understand the basic concept ofwireless communication
2.	Know the state of art architecture for wireless LANs and PANs
3.	Learn about the Propagation Models for Wireless Networks, Multipath Effects in Mobile Communication in Cellular Mobile Wireless Networks
4.	Understand the basics of Coding and Error Control,
5.	Classify MAC Protocols, Transport Layer Protocols,Routing Protocols

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Course Outcomes

After the completion of this course, students will be:

1.	DefineTransmission fundamentals and Modulation Techniques
2.	Elaborate Wireless LAN Standards, Bluetooth, Mobile IP characteristics
3.	Analyse Frequency Reuse, Co-channel and Adjacent channel interference in cellular networks.
4.	Compare QoS constraints in wireless networks and their security.
5.	Summarize features of MAC Protocols, Transport Layer Protocols,Routing Protocols.

Syllabus

Module -I

Introduction: Fundamentals of Wireless Communication - Transmission fundamentals –- Antennas and Propagation, ModulationTechniques

Module -II

Wireless Networking, Wireless LANS & PANS: Wireless Networking – Satellite Communication, Wireless LANs -Wireless LAN Technology, IEEE 802.11 Wireless LAN Standards, Bluetooth, Mobile IP and Wireless Access Protocol ,HIPERLAN Standard.

Module -III

Cellular Mobile Wireless Networks: Systems and Design Fundamentals, Propagation Models Description of cellular system, Frequency Reuse, Co-channel and Adjacent channel interference, Propagation Models for Wireless Networks, Multipath Effects in Mobile Communication, Models for Multipath Reception.

Module -IV

Error-control&Security : Coding and Error Control,Introduction - Issues in Ad Hoc Wireless Networks -– Wired Equivalent Privacy(WEP), WPA – The Extensible Authentication Protocol - Security in Ad Hoc Wireless Networks.

Module –V

Protocols in Wireless Networks: Classifications of MAC Protocols, Classifications of Transport Layer Protocols, Classifications of Routing Protocols, QoS in wireless networks.

Text Books:

Stallings William, Wireless Communications and Networking, 2nd Edition, Pearson Education, 2005.(T1)

Rappaport Theodore S., Wireless Communication: Principles and Practice, 2nd Edition. Prentice Hall of India, 2005. (T2)

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Reference Books:

Siva Ram Murthy C, Manoj B.S, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall, 2004.(R1)

William C.Y.Lec, Mobile Cellular Telecommunication, Analog and Digital Systems, McGrawHill Inc.(R2)

Pahlavan Kaveh and Krishnamurthy Prashant, Principles of Wireless Networks, 1st Edn., Pearson Education Asia, 2002.(R3)

Rappaport T.S, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall. (R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	3	3	3	2	3	1	2	2	3	3	1	3	2
2	3	3	2	2	3	1	3	1	3	3	3	2	1	3	1
3	2	3	1	3	1	3	3	3	3	1	3	2	2	3	3
4	3	3	1	3	1	1	1	1	2	2	3	2	1	3	1
5	1	3	3	1	3	1	1	3	2	1	3	3	1	2	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS471
Course title: **Medical Image Processing**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the basic concepts of image pre processing.
2.	To explore the importance of image processing in medical domain.
3.	To understand the basic classification of image processing.
4.	To explore the different image presentation techniques.

Course Outcomes

After the completion of this course, students will be able to:

1.	Apply image processing concepts for medical images.
2.	Analyze Morphology, Segmentation techniques and implement these in images.
3.	Analysis and visualize of medical images of numerous modalities.
4.	Find the clear domain knowledge in the various Medical Imaging techniques and its diagnostic applications.
5.	Apply the image processing techniques for problem solving related to medical domain.

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Syllabus

Module I

Image Fundamentals and Pre-Processing

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two-dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms. Image enhancement – point operation, Histogram modeling, spatial operations, Transform operations.
(10L)

Module II

Basics of Medical Image Sources

Radiology- The electromagnetic spectrum-Computed Tomography-Magnetic Resonance Tomography –ultrasound-nuclear medicine and molecular imaging-other imaging techniques-radiation protection and dosimetry.
(5L)

Module III

Medical Image Representation

Pixels and voxels – algebraic image operations - gray scale and color representation- depth-color and look up tables - image file formats- DICOM- other formats- Analyze 7.5, NifTI and Interfile, Image quality and the signal to noise ratio- MATLAB based simple operations. (5L)

Module IV

Medical Image Analysis and Classification

Image segmentation- pixel based, edge based, region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification – Statistical, Rule based, Neural Network approaches (10L)

Module V

Image Registrations and Visualization

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.
(10L)

Text Books:

Birkfellner Wolfgang, Applied Medical Image Processing – A Basic course, CRC Press, 2011.(T1)

Dhawan Atam P., edical Image Analysis, Wiley Interscience Publication, NJ, USA 2003.(T2)

Gonzalez R.C. and Woods R.E., Digital Image Processing, 2nd Edition, Pearson Education, 2002.(T3)

Jain Anil. K., Fundamentals of Digital Image Processing, Pearson Education, Indian Reprint 2003. (T4)

Horowitz Alfred, MRI Physics for Radiologists – A Visual Approach, 2nd edition Springer Verlag Network, 1991.(T5)

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Reference Books:

NajarianKavyan and Splerstor Robert, Biomedical signals and Image processing, CRC – Taylor and Francis, New York, 2006.(R1)

Semmlow John L., Biosignal and Biomedical Image Processing Matlab Based applications, Marcel Dekker Inc., New York, 2004.(R2)

Prince Jerry L. and Links Jnathan M., Medical Imaging Signals and Systems, Pearson Education Inc., 2002.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments

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CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	3	3	1	1	2	1	1	2	1	2	
2	2	3	2	2	1	1	2	2	1	1	1	
3	3	3	2	3	3	1	1	1	1	1	2	
4	3	1	2	1	2	2	2	2	1	1	1	
5	2	2	1	2	3	1	2	1	2	3	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS472
Course title: **Programming for Bio Informatics**
Pre-requisite(s): Nil
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Head of Department

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Course Objectives

This course enables the students:

1.	To know the basic components of Bio informatics.
2.	To understand how programming can apply for biology.
3.	To learn the basic concepts of pattern matching.
4.	To understand different databases of Bio informatics.

Course Outcomes

After the completion of this course, students will be able to:

1.	Convert the Bio problems into computer compatible problems.
2.	Apply the computer programming for Bio data storage and retrieval.
3.	Solve complex problems using programming approach.
4.	Learn the limitations of machine while handling the Bio image and data files.
5.	Integrate the techniques to apply on various bio informatics problem.

Syllabus

Module I

Primitives, Names Function and Modules, Collections and Control statements**.** (8L)

Module II

Classes, Utilities, Pattern Matching, Structured Text, Web Programming, Relational Database, Structured Graphics. (8L)

Module III

Introduction to pearl, Scalars, Arrays, Using Standard Peral Modules, Pearl Regular Expressions.

(8L)

Module IV

Perl Debugger, Advanced Array Operations, Perl Regular Expression II, Perl Control Statements (8L)

Module V

File I/O in Python and Perl, Subroutines and functions in Python and Perl.
(8L)

Text Books:

Model Michell L., Bioinformatics Programming using Python, O'Reilly publication, 2010.(T1)
Bal H. P., Perl Programming for Bioinformatics, Tata Mc Graw Hill, 2006.(T2)

Reference Books:

Thareja Reema, Python Programming, Oxford University Press, 2017.(R1)
Modern Perl, Chromatic, Pragmatic Bookshelf, 2015.(R2)

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	2	1	1	1	1	2	1	1	1	2	
2	3	3	3	2	1	2	1	1	2	1	1	
3	2	3	3	3	1	1	1	2	1	1	2	
4	3	2	2	3	3	1	1	1	1	2	1	
5	2	2	2	3	3	1	1	1	1	1	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT470
Course title: **Genomic Data Science**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Able to understand the basic elements of data science
2.	Able to understand the use of data science in biological data.
3.	Able to know the use of regression model.
4.	Able to understand the basic structure of DNA, RNA & protein databases.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain how data is collected, managed and stored for data science;
2.	Define key concepts in data science, including their real-world applications and the toolkit used by data scientists;
3.	Apply statistical knowledge on Biological data.
4.	Integrate concept and techniques to apply on genomic data.
5.	Design ode for the biological data.

Syllabus

Module I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. (8L)

Module II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources. (8L)

Module III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes. (8L)

Module IV

Analyzing DNA, RNA, and Protein Sequences Introduction, Access to Sequence Data and Related Information, Pairwise Sequence Alignment, Basic Local Alignment Search Tool (BLAST), Advanced Database Searching,Multiple Sequence Alignment.
(8L)

Module V

Genomewide Analysis of DNA, RNA, and Protein DNA: The Eukaryotic Chromosome, Analysis of Next-Generation Sequence Data, Bioinformatic Approaches to Ribonucleic Acid (RNA), Gene Expression: Microarray and RNA-seq Data Analysis, Protein Analysis and Proteomics, Protein Structure, Functional Genomics. (8L)

Text Books:

Neil Cathy O. and Schutt Rachel, Doing Data Science, Straight Talk from the Frontline. O'Reilly.(T1)
Leskovek Jure, Rajaraman Anand and Ullman Jeffrey, Mining of Massive Datasets, v2.1, Cambridge University Press. (T2)
Pevsner Jonathan, Bioinformatics and functional Genomics, 3rd edition, ISBN:978-1-118-58178-0.(T3)

Reference Book:

Azuaje Francisco, Dopazo Joaquín, Data Analysis and Visualization in Genomics and Proteomics,First published:15 June 2005.(R1)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	2	1	1	1	1	2	1	1	1	1	
2	3	3	2	2	2	2	1	1	2	1	1	
3	2	3	3	3	1	1	1	2	1	1	2	
4	3	2	2	3	3	1	2	1	2	2	1	
5	2	2	2	3	3	2	1	1	1	1	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS473
Course title: **Deep Learning**
Pre-requisite(s): IT429 Machine Learning
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

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Course Objectives

This course enables the students:

1.	To understand the basic component of Machine Learning.
2.	To explore the application areas of Neural Networks.
3.	To understand the idea of Recurrent Neural Networks.
4.	To explore the basic concepts of Feed forward Neural Networks.
5.	To understand the concepts of mathematical modelling.

Course Outcomes

After the completion of this course, students will be:

1.	Able to differentiate between machine learning and deep learning
2.	Identify problems suitable for application of deep learning.
3.	Illustrate the working of FF Neural Networks and their modifications.
4.	Apply Convolutional & Recurrent Neural Networks to solve problems
5.	Analyse the efficiency of deep learning systems.

Syllabus

Module I

Introduction and Basics of Machine Learning

Beginnings of ANN, XOR Problem, From Cognitive Science to Deep Learning, NNs and their importance. Elementary classification problem, evaluating classification results, Simple Classifier – Naïve Bayesian Classifier, Simple NN: Logistic Regression, Learning without Labels, Learning alternative representation of data – PCA. (8L)

Module II

Feed forward Neural Networks:

Basic concept and terminology, Representing networks, Perceptron rule, Delta rule, From logistic regression to Backpropagation, Backpropagation, Complete Feedforward NNs. (8L)

Module III

Modifications & Extensions of FF Neural Nets

Regularization, L1 & L2 regularization, Learning Rate, Momentum and Dropout, Stochastic Gradient Descent and Online Learning, Problems with multiple hidden layers, Vanishing and exploding gradients.
(4L)

Module IV

Convolution & Recurrent Neural Networks

Introduction, Feature maps and Pooling, Building a complete convolutional neural network. Recurrent Neural Networks – Sequences of unequal length, Settings for learning with recurrent neural networks, Adding feedback loops and Unfolding neural networks, Elman Networks, LSTM. (12L)

Head of Department

Module V
Auto encoders
Learning Representations, Different Autoencoder Architectures, Stacking Autoencoders. (8L)

Text book:

Skansi S., Introduction to Deep Learning - From Logical Calculus to Artificial Intelligence, 1st Edition, Springer International Publishing, 2018.(T1)

Reference book:

Buduma N., Fundamentals of Deep Learning, 1st Edition, O Reilly Media, 2016.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcome onto Program Outcome

Course Outcome	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	
1	3	2	3	2	1	2	2	1	2	2	2	
2	2	3	2	1	1	1	1	1	1	1	1	
3	3	3	1	3	H	3	2	1	1	1	1	
4	3	1	2	1	M	2	1	2	1	1	2	
5	2	2	1	2	3	1	1	1	2	3	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT426
Course title: **Data Mining Concepts and Technique**
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L:3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Examine the types of the data to be mined and apply pre-processing methods on raw data.
2.	To introduce the basic concepts of Data Warehouse and Data Mining techniques
3.	Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data
4.	Prepare students for research in the area of data mining and related applications and Enhance students communication and problem solving skills
5.	Provide the students with practice on applying data mining solutions using common data mining software tool /programming languages.

Course Outcomes

After the completion of this course, students will be able to:

1.	Illustrate the fundamentals of data mining systems as well as issues related to access and retrieval of data at scale.
2.	Explain the various data mining functionalities and data warehousing techniques.
3.	Apply the various data mining techniques to solve classification, clustering and association rule mining problems.
4.	Analyze and choose among different approaches of a data mining task.
5.	Design and evaluate data mining models to be used in solving real life problems, keeping in view social impacts of data mining.

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Syllabus

Module I

Data Mining: Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

(6L)

ModuleII

Data Warehouse: Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining.Data Cube Computation and Data Generalization. (8L)

Module III

Mining Association Rules in Large Databases: Association Rule Mining, Single – Dimensional Boolean Association Rules, Multilevel Association Rules from Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis, Constraint – Based Association Mining.

(10L)

Module IV

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule Analysis, Other Classification Methods, Prediction, Classification Accuracy.

(8L)

Module V

Cluster Analysis: Introduction , Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Method - k- Medoids Algorithm, CLARANS, Hierarchical Methods - BIRCH, ROCK Density-Based Methods - DBSCAN, Grid-Based Methods – STING, WaveCluster. Outlier Analysis.

(8L)

Text book:

Han Jiawei &Kamber Micheline - Data Mining Concepts & Techniques, 2nd Edition, Publisher Harcout India. Private Limited.(T1)

Reference books:

Gupta G.K., Introduction to Data Mining with case Studies, PHI, New Delhi, 2006.(R1)
Berson A. & Smith S. J., Data Warehousing Data Mining, COLAP, TMH, New Delhi, 2004.(R2)
Dunham H.M. & Sridhar S., Data Mining, Pearson Education, New Delhi, 2006.(R3)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	2	2	2	1	2	2	1	1	3	3	1
CO2	2	3	2	3	2	2	1	2	2	2	2	1	2	2	2
CO3	2	3	3	3	3	3	3	2	3	2	3	1	2	2	3
CO4	3	2	2	3	3	2	2	1	3	2	2	2	3	3	2
CO5	3	3	3	3	2	2	2	1	3	3	3	2	3	3	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT427
Course title: **Data Mining Concepts and Technique Lab**
Pre-requisite(s): IT426 Data Mining Concepts and technique
Co- requisite(s):
Credits: L:3 T:0 P:
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

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SYLLABUS

List of Programs as Assignments:

Q1. Build a Data Warehouse and Explore WEKA tool.

Q2. Demonstration of preprocessingon various datasets.

Q3.Demonstration of Association rule process on dataset using apriori algorithm.

Q4.Demonstrate performance of classification on various data sets.

Q5. Demonstrate performance of clustering on various data sets.

Q6. Demonstrate performance of Regression on various data sets

Q7. Implement following algorithms for various datasets

D. Apriori Algorithm.
E. FP-Growth Algorithm.
F. K-means clustering.

Q8. Implement Bayesian Classification for various datasets

Q9 Implement Decision Tree for various datasets.

Q10. Implement Support Vector Machines.

Q11 Applications of classification for web mining.

Q12. Case Study on Text Mining or any commercial application

Books recommended:

Text Books :

2. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques Publisher Harcout India. Private Limited.

Reference Books :

4. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.
5. A. Berson& S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004.
6. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.

Head of Department

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	3	2	2	2	1	2	3	3	3	3	3	1
CO2	2	3	2	3	2	2	1	2	2	3	3	3	2	2	2
CO3	2	3	3	3	3	3	3	2	3	3	3	3	2	2	3
CO4	3	2	2	3	3	2	2	1	3	3	3	3	3	3	2
CO5	3	3	3	3	2	2	2	1	3	3	3	3	3	3	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT401
Course title: **Data Analysis and Interpretation**
Pre-requisite(s): Nil
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: III
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Examine the different types of the data and its interpretation and analysis.
2.	To introduce the basic Statistics Probability Distributions.
3.	Apply the techniques of hypothesis tests, supervised and unsupervised learning, feature selection and visualization to real world data.
4.	Prepare students for latest research in the area of data analysis such as deep learning and related applications and Enhance student's communication and problem solving skills.
5.	Provide the students to practice on different datasets for data analysis and interpretation using common statistical software tool /programming languages.

Course Outcomes
After the completion of this course, students will be:

1.	Analyze data to convert information to useful knowledge.
2.	Develop an appreciation for what is involved in learning from data.
3.	Understand a wide variety of learning algorithms and also understand how to apply a variety of learning algorithms to data.
4.	understand the fundamental principles, theory and approaches for Neural Network and learning with deep neural networks

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Syllabus:

Module I

Descriptive Statistics- Introduction to the course Descriptive Statistics Probability Distributions **Inferential Statistics-**Inferential Statistics through hypothesis tests Permutation &Randomization Test. (6L)

Module II

Machine Learning: Introduction and Concepts Differentiating algorithmic and model based frameworks **Regression**: Regression & ANOVA Regression ANOVA (Analysis of Variance) Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification.
(10L)

Module III

Supervised Learning with Regression and Classification techniques - Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines

(10L)

Module IV

Ensemble Methods- Random Forest, Neural Networks, Deep learning.
(8L)

Module V

Unsupervised Learning and Challenges for Big Data Analytics- K-Means and Hierarchical Clustering, Associative Rule Mining, Challenges for big data analytics
Prescriptive analytics- Creating data for analytics through designed experiments, Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning.
(6L)

Text books:

Hastie, Trevor,**Tibshirani,** Robert, **Friedman**, Jerome, "The Elements of Statistical Learning". Vol. 2. No. 1. Springer, New York, 2009.(T1)
Montgomery, Douglas C., and Runger George C., "Applied statistics and probability for
Engineers" . John Wiley & Sons, 2010. (T2)

Reference Books:

DeGroot, Morris H., and Schervish Mark J., "Probability and Statistics", 3rd Edition, Boston, MA: Addison-Wesley., 2002. (R1)
Box, G.E.P., Hunter, J.S and Hunter, W.G, "Statistics for Experimenters - Design, Innovation and Discovery, 2nd Edition, Wiley, 2005. (R2)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	2	1	1	1	1	1	1	1	1	3	1	1	1
2	3	2	1	1	1	1	1	1	1	1	1	2	1	2	1
3	3	2	2	1	1	1	1	1	1	1	1	2	2	2	2
4	2	3	2	2	1	1	1	1	1	1	1	1	1	2	1
5	2	2	2	3	3	2	1	1	1	1	1	1	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT421
Course title: **Artificial Intelligence Lab**
Pre-requisite(s): IT420 Artificial Intelligence, Data Structure And Database Management System
Credits: L:3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing AI Problems
2.	Develop mathematical thinking and problem-solving skill using AI
3.	To enable the student on how to approach for solving Engineering problems using simulation tools.
4.	To provide a foundation so as to use AI techniques in real world puzzle solving

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply AI techniques to different complex problems using programs.
CO2	Create knowledge base and serve their applications in different fields.
CO3	Implement perfect and better heuristics for different applications.
CO4	Analyze and Implement real world complex problems.
CO5	Create Expert systems

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SYLLABUS

List of Programs as Assignments:

PUZZLE SOLVING:

12. **Lab Assignment No: 1**
    Objective: To understand and solve simple AI problems.
    To solve Tic-Tac-Toe problem such that computer always win.
    (Min-Max Search)
13. **Lab Assignment No: 2**
    Objective: To understand and solve simple AI problems.
    To solve Monkey-Banana Problem

14. **Lab Assignment No: 3**
    Objective: To understand and solve simple AI problems.
    To solve Missionaries and Cannabal Problem.

15. **Lab Assignment No: 4**
    Objective: To understand and solve simple AI problems.
    To solve Water-Jug problem.

SEARCHING PROBLEM: 8-PUZZLE OR 8-QUEEN

16. **Lab Assignment No: 5**
    Objective: To Understand blind search algorithms.
    Q1.Toimplement Depth First Search (DFS)
    Q2. To implement Breadth First Search (BFS)
17. **Lab Assignment No: 6**
    Objective: To apply DFS in problems.
    To solve Hill Climbing
18. **Lab Assignment No: 7**
    Objective: To apply BFS in problems.
    To solve Best First Search
19. **Lab Assignment No: 8**
    Objective: To understand and implement informed search algorithms.
    To solve A*.
20. **Lab Assignment No: 9**
    Objective: To understand and implement informed search algorithms.
    To solve AO*.

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OTHER PROBLEMS:

21. **Lab Assignment No: 10**
    Objective: To implement real world Games.
    Chess Playing (Computer vs Human)
22. **Lab Assignment No: 11**
    Objective: To implement real-world Games.
    Sudoku Puzzle

Books recommended:

TEXT BOOKS

2. Prolog Programming by Bratko, PHI publishing.
3. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	3	2	1	1	1	2	1	3	2	3	2
CO2	3	2	2	3	3	2	1	1	3	3	2	3	2	2	1
CO3	3	2	2	2	3	2	2	2	3	3	1	3	2	3	2
CO4	2	3	2	2	2	3	2	1	3	3	1	3	2	2	3
CO5	3	3	2	3	2	3	2	2	2	1	2	2	2	2	3

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COURSE INFORMATION SHEET

Course code: IT422
Course title: **Principles of Multimedia**
Pre-requisite(s): NIL
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Program Objectives:

1	Formulate a working definition of interactive multimedia.
2	Demonstrate competence in using the authoring programs.
3	Demonstrate the use of animation, digitized sound, video control, and scanned images
4	Study the concepts related to compression standards available in the current scenario
5	Use basic instructional design principles in the development of multimedia applications

Program Outcomes:

1	Understand of the standards for representing audio files
2	Compare the standards and issues concerned in representing static/dynamic visual input/output
3	Analysing audio and video aspects of multimedia design
4	Applying the tools available for multimedia production and image/audio processing
5	Assess multimedia applications by using concepts of multimedia

Module I
Introduction to Multimedia
Multimedia Definition, Properties of a Multimedia System, Multimedia Building Blocks, Modes of data transmission, Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous, Transmission Mode.Multimedia Information Representation: Analog Signal, Waves, General properties of Analog Signals, Digital Representation, Need for digital representation, Analog to digital conversion, Nyquist's Sampling Theorem, Encoder Design, Digital to Analog conversion, Decoder design and its principles, Encoder – Decoder, Relation between sampling rate and bit depth. (8L)

Head of Department

Module II

Discrete Media: Types of Media, Time Independent Media, Time dependent Media, Text, Unformatted Text, Formatted Text, Hyper Text, Essential Features of HTML, Graphics and Images, Creation of Computer Graphics, Digitised documents, Digitised Pictures, Digitised Cameras, Raster Scan Principles, Image Analysis, Image Transmission

Continuous Media: Audio, Speech Signals, Analog Signals, PCM Speech, CD- Quality audio, Synthesised audio, Types of Synthesizers, Characteristics of Synthesizers, Streaming Video, File Formats, Streaming Methods, Sound Fundamentals, Music, MIDI Basic concepts, MIDI Devices, MIDI Messages, Video, Broadcast Television, Digital Video – Format, 0 Format, HDTV Format, SIF, CIF, QCIF, PC Video and Video Content. (8L)

Module III

Text Representation and Compression: Compression Principles, Source Encoders and destination decoders, Lossless and Lossy Compression, Entropy Encoding, Source Encoding, Text Compression, Static Huffman coding, Arithmetic Coding,.

Image Storage and Compression: Digital image representation, Vector Graphics and Bitmapped images, Captured Image Format, Stored Image Format, Graphics Interchange Format (GIF), GIF Coding Standard, Tagged Image File Format (TIFF), Joint Photographic Experts Group (JPEG), Image/Block Preparation, Forward DCT, Quantization, Entropy Encoding, Frame building, JPEG decoding. (8L)

Module IV

Audio Representation and Compression: Introduction to Audio Compression, Differential pulse code modulation, Adaptive differential PCM, Adaptive Predictive Coding, Linear Predictive Coding, Code- excited LPG, Perceptual Coding, Sensitivity of the ear, Frequency marking, Temporal marking, G series Voice coding standards, MPEG audio Coders. (8L)

Module V

Video Representation and Compression: Video Compression Principles, Frame types, Motion estimation and Compression, Implementation Issues, Performance, Characteristics of Digital Video, Streaming Video, Combining sound and Pictures, H.261 Video Compression Standard, H.263, Digitisation Formats, Motion Pictures Experts Group (MPEG), MPEG-1, MPEG-2, MPEG-4, Audio and Video Compression. (8L)

Text Books:

Andleigh&Thakrar, "Multimedia", PHI, New Delhi, 2004.(T1)
Buford J. K. , "Multimedia Systems" , Pearson Education, New Delhi, 2001.(T2)

Reference Book:

Chapman Nigel & Chapman Jenny, "Digital Multimedia", Third edition, 2009, or Second edition, John Wiley & Sons. 2004.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

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POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	2	2	3	3	2	2	3	2	2	1	1	2	2
CO2	2	3	2	2	2	3	2	1	3	2	2	1	2	2	2
CO3	3	2	3	2	3	2	2	1	2	1	2	2	1	2	2
CO4	2	3	2	2	2	3	1	1	2	1	1	1	1	1	1
CO5	2	2	2	2	1	2	2	1	1	1	1	1	1	1	1

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT423
Course title: **Internet of Things(IoT)**
Pre-requisite(s): IT201 Basics of Intelligent Computing
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

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Course Outcomes

After the completion of this course, students will be:

1.	Identify the IoT Components and its capabilities
2.	Explain the architectural view of IoT under real world constraints
3.	Analyse the different Network and link layer protocols
4.	Evaluate and choose among the transport layer protocols
5.	Design an IoT application

Syllabus

Module I

Introduction to IOT

The definition of the Internet of Things, main assumptions and perspectives. Platform for IoT devices Device architectures. Conventional and renewable power sources for resource-constrained devices. Operating systems for resource-constrained devices.
(8L)

Module II

Architecture of IOT

Node structure: Sensing, Processing, Communication, Powering IOT networking: Topologies, Layer/Stack architecture, The data link layer for IoT- Wireless communication technologies. Wire communication technologies. Manet Networks.

(8L)

Module III

Communication Technologies

Introduction to ZigBee, BLE, WiFi, LTE, IEEE 802.11ah, Discuss data rate, range, power, computations/bandwidth, QoS, Service oriented protocols (COAP). Communication protocols based on the exchange of messages (MQTT). Service discovery protocols.
(8L)

Module IV

M2M and IoT Technology Fundamentals

Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management. (8L)

Module V

The data processing for IoT

Organization of data processing for the Internet of things. Cloud computing. Fog computing. Application case studies: Smart Grid. Home Automation. Smart City.
(8L)

Text books:

Madisetti Vijay and BahgaArshdeep, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.(T1)

Raj Pethuru and Raman Anupama C., The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.(T2)

Head of Department

Reference books:

Vermesan Dr. Ovidiu, Friess Dr. Peter, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers.(R1)

Holler Jan, TsiatsisVlasios, Mulligan Catherine, Avesand Stefan, Karnouskos Stamatis, Boyle David, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	1	2	1	2	1	1	2	2	2	2
CO2	2	3	3	3	2	2	1	1	1	1	1	2	2	3	2
CO3	2	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO4	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2
CO5	2	3	3	3	2	1	1	2	1	1	1	3	3	2	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT424
Course title: **Internet of Things(IoT) Lab**
Pre-requisite(s): IT423 Internet of Things(IoT)
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes

After the completion of this course, students will be:

1.	Identify the IoT Components and its capabilities
2.	Explain the architectural view of IoT under real world constraints
3.	Analyse the different Network and link layer protocols
4.	Evaluate and choose among the transport layer protocols
5.	Design an IoT application

List of Programs as Assignments:

12. **Lab Assignment No: 1**
    Glowing LEDs.
    Toggling LED's.
13. **Lab Assignment No: 2**
    Transmitting a string through UART
    Controlling LEDs blinking pattern through UART.
14. **Lab Assignment No: 3**
    Echo each character typed on HyperTerminal
    Digital IO configuration.
    Timer based LED Toggle.

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15. **Lab Assignment No: 4**
    Scanning the available SSID's in the range of Wi-FI Mote.
    Connect to the SSID of choice
16. **Lab Assignment No: 5**
    Demonstration of a peer to peer network topology.
    check the connectivity to any device in the same network.
17. **Lab Assignment No: 6**
    Send hello world to TCP server existing in the same network
    Reading of atmospheric pressure value from pressure sensor.
18. **Lab Assignment No: 7**
    I2C protocol study
    Reading Temperature and Relative Humidity value from the sensor.
    Reading Light intensity value from light sensor.
19. **Lab Assignment No: 8**
    Proximity detection with IR LED.
    Generation of alarm through Buzzer.
20. **Lab Assignment No: 9**
    Timestamp with RTC
    IO Expander.
    Relay control.
21. **Lab Assignment No: 10**
    I2C based 12-channel ADC
    EEPROM read and write
22. **Lab Assignment No: 11**
    Transmitting the measured physical value from the UbiSense Over the Air.

Text books:

Madisetti Vijay and BahgaArshdeep, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.(T1)

Raj Pethuru and Raman Anupama C., The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.(T2)

Reference books:

Vermesan Dr. Ovidiu, Friess Dr. Peter, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers.(R1)

Holler Jan, TsiatsisVlasios, Mulligan Catherine, Avesand Stefan, Karnouskos Stamatis, Boyle David, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.(R2)

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Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	1	2	1	2	1	1	2	2	2	2
CO2	2	3	3	3	2	2	1	1	1	1	1	2	2	3	2
CO3	2	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO4	2	2	2	3	2	2	1	1	1	1	1	3	2	2	2
CO5	2	3	3	3	2	1	1	2	1	1	1	3	3	2	2

COURSE INFORMATION SHEET

Course code: CS420
Course title: Advanced Data Structures
Pre-requisite(s): CS201 Data structure
Co-requisite(s):
Credits: L:3 T:1 P:0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	To understand the concepts of advanced data structure.
2.	To explore the different applications of advanced data structure.
3.	To understand the concept of Amortized Analysis.
4.	To explore the idea of Adaptive Data Structures.
5.	To understand the concepts of advanced tree structures.

Head of Department

Course Outcomes
After the completion of this course, students are expected to

1.	Develop programs that effectively used various advanced data structures.
2.	Apply mathematical foundations in the modelling of computer-based systems in a Way that demonstrates comprehension of the trade-offs involved in design.
3.	Develop programs using priority queues and other variations of queues.
4.	Demonstrate the usage of advanced optimal trees and heaps.
5.	Develop programs using advanced algorithms in graph theory.

Syllabus

Module I
List, Iterator ADTs and Maps: The Lists ADT, Array Lists, Positional Lists, Iterators, Sorting a Positional List. Maps, Sorted Maps, Hash Tables and Skip Lists, Sets, Multisets and Multi Maps. (8L)

Module II
Balanced Search Trees: Height-Balanced Trees, Weight-Balanced Trees, (a-b) and B-Trees, Red-Black Trees and Trees of Almost Optimal Height, Trees with Partial Rebuilding: Amortized Analysis, Splay Trees: Adaptive Data Structures. (9L)

Module III
Heaps: Balanced Search Trees as Heaps ,Array-Based Heaps, Heap-Ordered Trees and Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps, Heap-Related Structures with Constant-Time Updates. (9L)

Module IV
Priority Queues: Priority Queue Abstract Data Type, Implementing a Priority Queue, Sorting with a Priority Queue, Adaptable Priority Queue.
(7L)

Module V **Graph**
Algorithms: Graphs, Data Structures for graphs, Graph Traversals, Directed Acyclic

Graphs, Shortest Paths, Minimum Spanning Trees. (7L)

Text books:

Brass Peter,"Advanced Data Structures", 1st Edition,Cambridge University Press, 2008. (T1)
Goodrich Michael T., TamassiaRoberto, GoldwasserMichaelH.,"Data Structures and Algorithms in Java".6th Edition, Wiley Publication, 2014. (T2)

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Reference books:

Horwitz, Sahni, Anderson-Freed, "Fundamentals of Data Structures in C", University Press, 2008. (R1)

Cormen T. H.,Lieserson C. E., Rivest R. L., and Stein C., "Introduction to Algorithms", 3rdEdition, MIT Press, 2009. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	2	1	3	2	3	1	1	1	2	3	1	
2	3	3	2	3	3	1	1	2	2	3	1	
3	2	2	2	2	3	1	1	1	1	3	1	
4	3	2	1	1	1	3	3	3	1	1	1	
5	2	1	3	1	2	1	1	1	2	3	1	

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS421
Course title: **Parallel Computing**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Learn different types of parallelisms achieved over different computer models
2.	Write parallel algorithms (and programs) for computer problems
3.	Map parallel algorithms from architecture to architecture
4.	Identify the issues in concurrency control

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the need of concurrent execution of problems
2.	Reduce the issues of concurrency control
3.	Map the parallel algorithm from organization to organization
4.	Make familiar with a range of parallel algorithms on different architectures.
5.	Apply the concept parallelism in solving the problems of different domains

Head of Department

Module I
Introduction: Parallel Processing Environment- Pipelining and Data Parallelism, Flynn's Taxonomy, Speedup, Scaled Speedup, Analysing parallel algorithms, P-RAM Algorithms. (8L)

Module II
Processor Array, MIMD: Multiprocessors (shared) and Multi-computers (distributed), Networks(Processor organizations):Static and dynamic Interconnection Networks, Message Transferring procedures.
(8L)

Module III
Mapping and Scheduling, Dynamic Load Balancing on Multi-computers, Static Scheduling on UMA Multiprocessors, Parallel Programming model using process and thread, Deadlock and Synchronization issues. (8L)

Module IV
Elementary Parallel Algorithm: Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors, Algorithms for Multi-computers. (8L)

Module V
Solving set of linear equations: Gaussian Elimination, The Jacobi Algorithm, Finding roots of non-linear equations, Sorting algorithms: Enumeration Sort, ODD-EVEN Transposition sort, BITONIC Merge, Quicksort Based Algorithms, Graph Algorithms. (8L)

Text books:

Quin M. J., "Parallel Computing: Theory and Practice", McGraw Hill, New York, 1994.(T1)

Reference books:

Akl Selim G., "The Design and Analysis of Parallel Algorithms", Prentice Hall International. (R1)
Sasikumar M., Shikhare D. and Prakash P. Ravi, "Introduction to Parallel Processing", PHI, 2006. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	1	1	3	2	2	3	2	1	2	3	2	2	3	3	2
CO2	3	2	3	3	2	1	1	1	2	3	2	2	3	3	2
CO3	1	1	2	3	1	2	2	1	3	3	2	3	2	1	3
CO4	2	2	2	3	3	2	3	1	3	2	2	1	2	3	2
CO5	3	2	2	2	2	1	2	1	3	2	2	1	1	1	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS422
Course title: **Parallel Computing Lab**
Pre-requisite(s): Cs421 Parallel Computing
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	To describe benefits and applications of parallel computing.
2.	Explain architectures of multicore CPU, GPUs and HPC clusters, including the key concepts in parallel computer architectures, e.g. shared memory system, distributed system, NUMA and cache coherence, interconnection
3.	Understand principles for parallel and concurrent program design, e.g. decomposition of works, task and data parallelism, processor mapping, mutual exclusion, locks.
4.	write programs that effectively use parallel collections to achieve performance.
5.	To use large scale parallel machines to solve problems as well as discuss the issues related to their construction and use.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Reason about task and data parallel programs.
CO2	Express common algorithms in a functional style and solve them in parallel.
CO3	To analyse a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
CO4	Write parallel program using OpenMP, CUDA, MPI programming models.
CO5	Perform analysis and optimization of parallel program.

SYLLABUS

List of Programs as Assignments:

23. Lab Assignment No: 1

Objective: To understand and Implement basic MPI program.

Q1. Write a program that uses MPI and has each MPI process print 'Hello world from process i of n' using the rank in MPI_COMM_WORLD for i and the size of MPI_COMM_WORLD for n.

Q2. Write a parallel program to print any input message supplied by user.

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24. Lab Assignment No: 2

Objective: To Understand and Implement MPI program.

Q1. Write a parallel program to add two one dimensional arrays of size 'n'.

Q2. Write a parallel program to add two matrices of order n * n.

25. Lab Assignment No: 3

Objective: To Understand and Implement MPI program.

Q1.Write a parallel program to multiply two matrices.

Q2. Write a parallel program to multiply a matrix of order n x n by a vector of size n.

26. Lab Assignment No: 4

Objective: To Understand and Implement MPI program.

Q1. Write a parallel Program to count the no. of vowels in a text.

Q2. Write a parallel program to find the largest element of n elements.

27. Lab Assignment No: 5

Objective: To Understand and Implement MPI program.

Q1.Write a parallel program to count no. of characters, words and lines in a file.

Q2. Write a parallel program to find factorial value of an integer.

28. Lab Assignment No: 6

Objective: To Understand and ImplementMPI program.

Q1.Write a parallel program to find the transpose of a given Matrix.

Q2. Write a parallel program to implement ring topology.

29. Lab Assignment No: 7

Objective: To Understand and Implement MPI program.

Q1.Write a parallel program to find the largest and the second largest from a list of elements considering minimum no. of comparisons.

Q2. Write a parallel program to sort n elements, using any sorting technique.

30. Lab Assignment No: 8

Objective: To Understand and Implement MPI program.

Q1. Write a parallel program to solve a set of linear equations using gauss elimination method.

Q2. Write a parallel program to find the inverse of a given matrix of n*n order.

31. Lab Assignment No: 9

Objective: To Understand and Implement MPI program.

Q1. Write a parallel program to find minimal path (minimal cost) in an undirected graph.

Q2. Write a parallel program to find roots of an equation using N-R method.

Head of Department

Books recommended:

TEXT BOOKS

3. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Introduction to Parallel Computing (2nd Edition).
4. Edition), PDF, Amazon, cover theory, MPI and OpenMP introduction Recommended: John Cheng, Max Grossman, and Ty McKercher, Professional CUDA C Programming, 1st Edition 2014.

REFERENCE BOOKS

2. Barbara Chapman, Gabriele Jost, and Ruud van der Pas, Using OpenMP: Portable Shared Memory Parallel Programming, 2007

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	1	1	1	2	3	1	2	3	2	2
CO2	3	2	2	2	2	1	1	3	2	1	1	1	3	3	2
CO3	2	2	3	3	3	2	1	1	3	3	1	2	2	2	3
CO4	2	2	3	3	3	3	2	1	2	2	1	1	2	2	2
CO5	2	2	1	1	3	3	2	1	3	3	3	1	2	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

COURSE INFORMATION SHEET

Course code: IT425
Course title: **Image Analysis**
Pre-requisite(s): IT307 Image Processing
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: IV
Branch: B Tech/IT

Course Objectives

This course enables the students:

1.	To understand the basic concepts for representation of an image mathematically.
2.	To know the application areas of Image analysis.
3.	To understand the basic concepts of clustering and its importance.
4.	To know the performances of different clustering algorithms.

Course Outcomes

After the completion of this course, students will be:

1.	Identify the characteristics if images, and their mathematical formulation
2.	Analyze an image on the basis of Algorithms like clustering
3.	Applying entropy and mutual information for alignment, segmentation and Classification
4.	Evaluate hierarchical, k-means, spectral Applications for grouping in images
	Implement algorithms for analysis of images

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Syllabus

Module I

Introduction to Image Analysis, Mathematical Theory for Image Representation, Subspace (Manifold) learning Theory: PCA Applications: Eigen faces, Active Shape & Active Appearance Models, kernel PCA, LLE, Basic theory of Gaussian Processes for Image analysis.
(8L)

Module II

Boundary Detection Theory: Calculus of variations Applications: Mumford-Shah functional, snakes, level sets,EM Theory: EM algorithm Applications: segmentation, tracking. Building classical shape models.
(8L)

Module III

Graph algorithms Theory: Graph cut algorithms Applications: segmentation, stereo etc Graphical Models Theory: MRFs, inference in graphical models Applications: regularization, part/layer models, time series Analysis.
(8L)

Module IV

Clustering Theory: hierarchical, k-means, spectral Applications: grouping in images Shape Descriptors Shape context, SIFT Medial axis, skeletons Transformations and their manipulation Theory: diffeomorphisms, splines Applications: shape representation, registration.
(8L)

Module V

Information Theoretic Methods Theory: entropy and mutual information Application: alignment, segmentation Classification Theory: nearest neighbor, perceptron, Fisher Linear Discriminant, SVMs, Ada Boosting Applications, fitting statistical shape models to surfaces. Can be Module Heading as: Data Analysis, Structure Analysis, EXIF Analysis, Quantization Table Analysis, Pixel Level Analysis, Global Analysis, Compression Level Analysis, Color Filter Array, DCT Analysis, Local Analysis Blocking Artifacts Analysis.
(8L)

Text Book:

Umabaugh,S.E.,"Computer Imaging: Digital Image Analysis,"FirstEdison,CRC Press,2005.(T1)
Russ ,J. C.,"Introduction to Image Analysis," CRC Press,2008.(T2)
Basics of Image Processing and Anlysis by Kota Miura.(T3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

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POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	2	2	2	2	2	1	3	2	1	2	3	3	2
CO2	2	2	3	3	2	3	2	2	3	2	1	2	2	2	3
CO3	3	2	2	2	3	3	1	1	2	2	2	1	2	2	3
CO4	2	3	3	2	2	2	2	2	2	3	1	1	2	2	2
CO5	2	2	1	1	3	3	2	1	3	3	3	1	2	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course Code: CS423
Course title: **Advanced Algorithm**
Pre-requisite(s): CS206 Design and Analysis of Algorithms
Co- requisite(s): None
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

After the completion of this course, students will be able to:

1.	Understand different notions of asymptotic complexity
2.	Find about and infer the practical implications of asymptotic notations
3.	know and use basic and advanced graph algorithms
4.	Analyse the difference between the dynamic programming concept and a greedy approach.
5.	Implement, analyze, and compare algorithm.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations
2.	Determine the practical implications of asymptotic notations.
3.	Apply, analyze, and compare algorithms.
4.	Describe and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.
5.	Analyse the difference between the dynamic programming concept and a greedy approach

Syllabus

Module I

Design Paradigms

Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.
(8L)

Module II

Theory of NP- Hard and NP-Complete Problems

P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes. (8L)

Head of Department

Module III
Approximation Algorithms
Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms. (8L)

Module IV
Parallel Algorithms
Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity. (8L)

Module V
Probabilistic Algorithms & Randomized Algorithms
Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems. (8L)

Text Books:

Cormen ,T.H. Leiserson ,C. E., Rivest ,R. L., and Stein,C.,"Introduction to Algorithms,"Third Edison, MIT Press,2009. (T1)
Brassard,G.,and Bratley ,P.,"Fundamentals of Algorithmics,"First Edison,Pearson,2015.(T2)
Vazirani ,V. V., "Approximation Algorithms," First Edison,Springer,2003.(T3)

Reference Books:

David ,H.,Feldman, and Yishai, "Algorithmics: The spirit of computing,"ThirdEdison,Addison Wesley,2004.(R1)
Motwani ,R., and Raghavan ,P., "Randomized Algorithms," Cambridge University Press, 1995.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	2	2	2	2	2	1	3	3	3
CO2	3	2	3	2	1	1	1	1	2	1	2	2	2	3	2
CO3	2	3	3	3	3	1	1	1	2	3	2	2	2	3	3
CO4	2	3	3	2	3	2	2	1	2	2	2	1	3	3	2
CO5	3	2	2	3	2	2	1	1	3	2	2	1	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code:CS425
Course title: **Advanced Operating System**
Pre-requisite(s): CS303 Operating System
Co- requisite(s): None
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students to:

1.	Introducing the advance concepts of modern operating systems
2.	Understand the advance concepts of modern operating systems
3.	Evaluating design choices with performance analysis
4.	Identifying thrust areas in research in operating systems

Course Outcomes
After the completion of this course, students will be able to:

1.	Illustrating various design issues in different environments
2.	Analyze various design issues in different environments
3.	Compare design choices with performance analysis
4.	Identify thrust areas in research in operating systems

Syllabus
Module I
Introduction: History, Hardware Review, Types of Operating Systems, Operating System Concepts, System Calls, Operating System Structure, Research on Operating systems. (8L)
Module II
Virtualization and Clouds: Requirements, Hypervisors, Techniques, Memory Virtualization, I/O Virtualization, Multicore CPUs, Clouds. (8L)
Module III
Multiple Processor Systems: Multiprocessors, Multicomputers, Distributed Systems, Research on Multiple Processor Systems. (8L)
Module IV
Security: Security Problems, /controlling Access to Resources, Formal Models, Cryptography, Authentication, Exploiting Software, Attacks, Malwares, Defenses. (8L)

Head of Department

Module V

Operating system Design: Design Problem, Interface Design, Implementation, Performance, Trends. (8L)

Text Books:

Tanenbaum ,A. S., "Modern Operating Systems", 4th Edition, Pearson Education, 2014.(T1)

Reference Books

Stalling ,W.," Operating System: Internal and Design Principles,"8th Edition, Pearson International, 2014.(R1)

Galvin ,S., and Gagne," Operating System Concepts,"10th Edition, Wiley, 2017.(R2)

Dhamdhare, D. M.," Operating Systems," Third Edison,Tata McGraw Hill India,2012.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	3	2	1	2	2	2	1	2	3	2
CO2	2	3	3	2	3	3	3	2	2	2	2	2	3	3	2
CO3	2	3	3	3	3	2	3	1	2	2	2	1	2	3	3
CO4	3	3	2	2	2	3	2	2	3	3	3	2	2	2	3
CO5	3	3	2	2	2	3	2	2	3	3	3	2	2	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT428
Course title: **Information Retrieval**
Pre-requisite(s): Design of Algorithms
Co- requisite(s): NIL
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To understand the basic component of data retrieval.
2.	To explore the application areas of information retrieval.
3.	To understand the idea of indexing and pre-processing of data.
4.	To explore the different IR evolution techniques.
5.	To understand the concepts of Query Expansion techniques.

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain the working of a search engine and details of the individual components.
2.	Apply efficient techniques for the indexing of documents
3.	Implement various indexing, scoring, ranking and relevance feedback models and techniques for information retrieval
4.	Develop a complete IR system from scratch
5.	Evaluate and analyse the performance of a retrieval systems using a suitable test collection

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Syllabus

Module I

Introduction

Introduction; Search Engine Architecture; An overview of crawling, text transformation, index creation, user interaction, ranking, link analysis, evaluation and deep web.

(8L)

Module II

Pre-processing and Indexing

Pre-processing: tokenization, stop word, normalization, stemming, wildcard queries, spelling correction – edit distance and k-gram; Indexing: Index construction; Index compression. (12L)

Module III

Scoring

Parametric and zone indexes; term frequency and weighting; vector space model; efficient scoring and ranking; vector space scoring.

(8L)

Module IV

IR Evaluation

Evaluation; Standard test collection; Evaluation of unranked and ranked retrieval; Assessing relevance; System quality and user utility. (6L)

Module V

Relevance Feedback and Query Expansion

Relevance feedback and pseudo relevance feedback; query reformulation. (6L)

Text book:

Manning, Christopher D., Raghavan Prabhakar, and SchützeHinrich, "Introduction to Information Retrieval", Cambridge: Cambridge University Press, 2008.(T1)

Reference books:

Grossman David A., Frieder Ophir "Information Retrieval: Algorithms and Heuristics", Springer.(R1)

Croft Bruce, Metzler Donald, and Strohman Trevor "Search Engines: Information Retrieval in Practice", Pearson Education, 2009.(R2)

Ricardo Baeza-Yates and Neto Berthier Ribeiro "Modern Information Retrieval", 2nd Edition, Addison-Wesley, 2011.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	3	2	2	1	1	2	2	1	1	3	3	2
CO2	3	3	2	3	3	2	2	1	3	2	1	1	2	3	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	3
CO4	3	3	3	2	2	3	3	1	2	2	2	2	3	3	2
CO5	2	3	3	3	3	3	2	1	2	2	2	1	2	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
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CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS429
Course title: **Information and Coding Theory**
Pre-requisite(s): MA303 Discrete Mathematics
Co- requisite(s): NIL
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	To understand the role of information theory for an efficient, error-free and secure delivery of information using binary data streams.
2.	To have a complete understanding of error-control coding.
3.	To understand encoding and decoding of digital data streams.
4.	To introduce methods for the generation of these codes and their decoding techniques.
5.	To have a detailed knowledge of compression and decompression techniques.
6	To evaluate the performance of various coding techniques over noisy communication channels

Course Outcomes

After the completion of this course, students will be:

1.	To be able to understand the principles behind an efficient, correct and secure transmission of digital data stream.
2.	To be familiar with the basics of error-coding techniques.
3.	To have knowledge about the encoding and decoding of digital data streams.
4.	Generation of codes and knowledge about compression and decompression techniques.
5.	To be able to understand the performance requirements of various coding techniques.
6	To produce professionals who will be able to conduct research in information theory.

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Syllabus

Module I

Source Coding-Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measure for Continuous Random Variables, Source coding theorem, Huffman Coding, Shannon- Fano -Elias Coding, Arithmetic Coding , The Lempel-Ziv ,Algorithm , Run Length Encoding.
And the PCX Format, Rate Distribution Function, Optimum Quantizer Design, Entropy Rate of a Stochastic Process, Introduction to Image Compression, The JPEG Standard for Lossless Compression, The JPEG Standard for Lossy Compression. (8L)

Module II

Channel Capacity and Coding- Introduction, Channel Model, Channel Capacity, Channel Coding, Information Capacity Theorem, the Shannon Limit, Channel Capacity for MIMO System, Random Selection of Code. Error Control Coding (Channel Coding). (8L)

Module III

Linear Block Codes for Error Correction- Introduction to Error Correction Codes, Basic Definitions, Matrix Description of Linear Block Codes , Equivalent Codes , Parity Check Matrix, Decoding of Linear Block Code ,Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check (LDPC) Codes , Optimal Linear Codes, Maximum Distance Separable (MDS) Codes, Bound on Minimum Distance, Space Time Block Codes.

(10L)

Module IV

Cyclic Codes- Introduction to the Cyclic Codes, Polynomials, The Division Algorithm for Polynomials ,A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Burst Error Correction , Fire Codes, Golay Codes, Cyclic Redundancy Check(CRC) Codes, Circuit Implementation of Cyclic Codes. (6L)

Module V

Bose –Chaudhuri Hocquenghem(BCH)Codes- introduction to the Codes , Primitive Elements, Minimal Polynomials, Generator Polynomials , in Terms of Minimal Polynomials, Some Examples if BCH Codes, Reed –Solomon Codes, Implementation of Reed –Solomon Encoders and Decoders, Performance of RS Codes Over Real Channels, Nested Codes.

Module VI

Convolution Codes-Introduction to the Convolution Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolution Codes(Analytical Representation), Distance Notions for Convolution Codes, The Generating Function, Matrix Description of Convolution Codes, Viterbi Decoding and Convolution Codes , Distance Bounds for Convolution Codes , Turbo Codes.

Trellis Coded ModulatioN- Introduction to TCM , The concept of Coded Modulation , Mapping by Set partitioning.

(8L)

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Text book:

Bose R., "Information theory Coding and Cryptography", 2nd Edition, McGraw-Hill, 2008. (T1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	2	1	1	1	1	1	1	1	1	3	1	1	1
2	3	2	1	1	1	1	1	1	1	1	1	2	1	2	1
3	3	2	2	1	1	1	1	1	1	1	1	2	2	2	2
4	2	3	2	2	1	1	1	1	1	1	1	1	1	2	1
5	2	2	2	3	3	2	1	1	1	1	1	1	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS430
Course title: **Information and Coding Theory Lab**
Pre-requisite(s): MA303 Discrete Mathematics
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives:

This course enables the students:

1.	To understand the role of information theory for an efficient, error-free and secure delivery of information using binary data streams.
2.	To have a complete understanding of error-control coding.
3.	To understand encoding and decoding of digital data streams.
4.	To introduce methods for the generation of these codes and their decoding techniques.
5.	To have a detailed knowledge of compression and decompression techniques.
6	To evaluate the performance of various coding techniques over noisy communication channels

Course Outcomes:

After the completion of this course, students will be:

1.	To be able to understand the principles behind an efficient, correct and secure transmission of digital data stream.
2.	To be familiar with the basics of error-coding techniques.
3.	To have knowledge about the encoding and decoding of digital data streams.
4.	Generation of codes and knowledge about compression and decompression techniques.
5.	To be able to understand the performance requirements of various coding techniques.
6	To produce professionals who will be able to conduct research in information theory.

Syllabus:

1. Write a program for determination of various entropies and mutual information of a given channel.
Test various types of channel such as
a) Noise free channel.
b) Error free channel
c) Binary symmetric channel
d) Noisy channel Compare channel capacity of above channels.

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2. Write a program for generation and evaluation of variable length source coding using C/MATLAB (Any 2) a) Shannon – Fano coding and decoding b) Huffman Coding and decoding c) Lempel Ziv Coding and decoding
3. Write a Program for coding & decoding of linear block codes.
4. Write a Program for coding & decoding of cyclic codes.
5. Write a program for coding and decoding of convolutional codes.
6. Write a program for coding and decoding of BCH and RS codes.
7. Write a program to study performance of a coded and encoded communication system (Calculate the error probability).
8. Write a simulation program to implement source coding and channel coding for transmitting a text file.
9. Write a program to implement of any compression algorithm for either audio, image or video data

Text Book:

1. Ranjan Bose, “Information Theory coding and Cryptography”, McGraw-Hill Publication, 2ndEdition
2. J C Moreira, P G Farrell, “Essentials of Error-Control Coding”, Wiley Student Edition

References:

1. BernadSklar, “Digital Communication Fundamentals & applications”, 2ndEd. Pearson Education.
2. Shulin and Daniel j, Cistellojr., “Error control Coding” Pearson, 2nd Edition.
3. Todd Moon, “Error Correction Coding: Mathematical Methods and Algorithms”, Wiley Publication
4. Khalid Sayood, “Introduction to data compression”, Morgan Kaufmann Publishers International Institute of Information Technology, Hinjawadi, Pune.Page 3

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	2	2	1	1	2	2	2	2	3	3	2
CO2	3	3	3	1	2	1	2	1	2	1	2	2	3	3	2
CO3	3	3	3	3	3	1	2	1	2	1	1	2	3	3	2
CO4	3	3	3	2	3	1	1	1	2	2	1	2	3	3	2
CO5	3	3	3	2	3	1	2	1	2	2	1	2	3	3	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS431
Course title: **Computational Network Analysis**
Pre-requisite(s): IT301 Data Communication and Computer Network
Co- requisite(s):
Credits: L:3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Knowledge of basics of **Graph Theory** and their appropriate application
2.	Knowledge of basic concepts about **Regular Networks**
3.	To relate the distinct roles of **Random Networks**analytics for various applications
4.	To understand and analyse different types of networks
5.	To Understand and different analysis techniques for graph

Course Outcomes
After the completion of this course, students will be:

1.	Use mathematical principles in the study of graphs
2.	Apply the knowledge of graph theory to graphs of large size.
3.	Visualize the growth patterns of large networks
4.	Compute the various attributes that are characteristic of a large network
5.	Analyse mathematical models of large networks and evaluate their modelling capabilities.

Head of Department

Syllabus

Module I

Origins and Related Graph Theory: What is network science? General Principles. Set theoretic definition of a graph. Matrix algebra definition of a graph. The Konigsberg Graph. Spectral properties of graphs. Types of graphs. Topological structures. (10L)

Module II

Regular Networks: Defining regular networks, Network Characteristics - Diameter, Centrality, and Average Path Length, Binary Tree Network, Toroidal Network, Hypercube Networks. (6L)

Module III

Random Networks : Generation of Random Networks, Degree Distribution of Random Networks, Entropy of Random Networks, Properties of Random Networks, Weak Ties in Random Networks, Randomization of Regular Networks, Analysis. (8L)

Module IV

Small World Networks: Generating a Small-World Network, Properties of Small-World Networks, Phase Transition, Navigating Small Worlds, Weak Ties in Small-World Networks, Analysis. (8L)

Module V

Scale Free Networks: Generating a Scale-Free Network, Properties of Scale-Free Networks, Navigation in Scale-Free Networks, Analysis. (8L)

Text book:

Lewis T. G., "Network Science: Theory & Practice", 1st Edition, John Wiley & Sons. Inc. Publications, 2009.(T1)

Reference book:

Newman M., "Networks: An Introduction", 1st Edition, Oxford University Press, 2010.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
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3	3	3	3	3	2	1	1	1	1	1	3	2	2	3	3
4	3	3	3	3	2	1	1	1	1	1	3	1	1	3	1
5	3	3	3	3	2	1	1	1	1	1	3	1	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT431
Course title: Emerging Storage Technologies
Pre-requisite(s): CS301 Database Management System
Credits: L:3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students:

1.	An understanding of personal, professional and ethical responsibility.
2.	An ability to communicate effectively both in an oral and written form.
3.	Recognition of the need for, and an ability to engage in lifelong learning.
4.	Knowledge of contemporary issues in computer engineering.
5.	An ability to use the techniques, skill and modern engineering tools necessary for computer engineering practice.

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Course Outcomes:

After the completion of this course, students will be able to:

1	Understand various storage classifications and technologies
2	Analyse storage architectures, processes, components, topologies, connectivity options and zoning.
3	Evaluate different virtualization technologies related to storage solution.
4	Justify the implementation of a range of storage solutions to enable business continuity.
5	Analyse storage security design, implementation, monitoring and management.

Syllabus:

Module I Data Storage Fundamentals:

Introduction to enterprise IT infrastructure components, server-storage connectivity, virtualization technologies: Block-level and file-level storage virtualization technology, virtual provisioning and cloud computing, storage devices such as magnetic disk drive and solid state drive, and the factors to consider for storage investment.

(8L)

Module II

Storage System:

Data Classification, Storage Evolution and Data Center infrastructure. Host components, Connectivity, Storage, and Protocols. RAID level performance and availability considerations. Components and benefits of an intelligent storage system.

(8L)

Module III

Storage Networking Technology

Direct-Attached Storage (DAS)architecture, Storage Area Network (SAN) attributes, components, topologies, connectivity options and zoning. FC protocol stack, addressing, flow control, and classes of service. Networked Attached Storage (NAS)components, protocols, IP Storage Area Network (IP SAN) iSCSI, FCIP and FCoE architecture. Content Addressed Storage (CAS) elements, storage, and retrieval processes.

(10L)

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Module IV

Business Continuity:

Business Continuity measurement, terminologies, and planning. Backup designs, architecture, topologies, and technologies in SAN and NAS environments. Local and Remote replication using host and array-based replication technologies such as Synchronous and Asynchronous methods. (7L)

Module V

Storage security and Management:

Storage security framework and various security domains. Security implementation in SAN, NAS and IP-SAN networking. Monitoring and Storage management activities and challenges. (7L)

Text Books:

EMC, "Information Storage and Management", 2nd Edition, Wiley [ISBN: 978-0470294215], 2012.(T1)
Barker Richard, Massiglia Paul, "Storage Area Network Essentials", Wiley New York [ISBN: 978-0471034452] 2002.(T2)

Reference Books:

Troppens Ulf, Erkens, Rainer, Friedt Wolfgang Mueller, Wolafka Rainer, Haustein Nils, "Storage Networks Explained" ,2nd Edition, Wiley[ISBN: 978- 0470741436], 2009.(R1)

Preston W. Curtis, "Using SANs and NAS", O'Reilly & Associates Sebastopol, Calif. [ISBN:
978-0596001537], 2002. (R2)

Dwivedi Himanshu, "Securing Storage", Addison-Wesley Upper Saddle River, NJ [ISBN: 978-0321349958], 2006.(R3)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Head of Department

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Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	3	3	3	2	3	1	2	2	3	3	1	3	2
2	3	3	2	2	3	1	3	1	3	3	3	2	1	3	1
3	2	3	1	3	1	3	3	3	3	1	3	2	2	3	3
4	3	3	1	3	1	1	1	1	2	2	3	2	1	3	1
5	1	3	3	1	3	1	1	3	2	1	3	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT433
Course title: **Computer Vision**
Pre-requisite(s): CS327 Computer Graphics
Co- requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: IV
Branch: B Tech/IT

Course Objectives

This course enables the students:

1.	Be familiar with both the theoretical and practical aspects of computing with images.
2.	Have described the foundation of image formation, measurement, and analysis.
3.	Understand the geometric relationships between 2D images and the 3D world.
4.	Grasp the principles of state-of-the-art deep neural networks

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

1.	Developed the practical skills necessary to build computer vision applications.
2.	To have gained exposure to object and scene recognition and categorization from images.
3.	Develop algorithm for classification and clustering.
4.	Illustrate the techniques of feature extraction and analysis.
5.	Apply in different engineering application such activity recognition, computational photography, biometrics.

Syllabus

Module I Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis. (8L)

Module II

Edge detection, Edge detection performance, Hough transform, corner detection. (8L)

Module III

Segmentation, Morphological filtering, Fourier transforms Feature extraction, shape, histogram, color, spectral, texture, using CVI Ptools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing.

(8L)

Module IV

Pattern Analysis:

Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminate Function, Supervised, Un-supervised, Semi supervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods. (8L)

Module V

Recent trends in Activity Recognition, computational photography, Biometrics. (8L)

Text Books:

Szeliski , R.," Computer Vision: Algorithms and Applications,"Springer,2011.(T1)
Goodfellow, Bengio, and Courville,"Deep Learning," First Edison.MIT Press,2016.(T2)
Fisher,R.B.,Breckon,T. P. , Dawson-Howe,K,Fitzgibbon,A , Robertson,C., Trucco,E. , Williams,C. K. I., "Dictionary of Computer Vision and Image Processing," Second Edison,Wiley,2014.(T3)

Reference Book:

Forsyth,D.A.,Ponce,J.,"Computer Vision A Modern Approach," Second Edison, Pearson Education,2015.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Head of Department

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	1	1	2	1	1	3	2
2	2	3	3	1	1	1	1	1	1	1	1	2	1	3	1
3	2	3	2	3	3	1	1	1	1	1	1	3	2	3	3
4	3	1	1	1	2	1	1	2	1	1	1	2	1	3	1
5	2	2	1	2	3	1	1	1	1	3	1	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS436
Course title: **High Performance Computing**
Pre-requisite(s): CS421 Parallel Computing
Co- requisite(s):
Credits: L:3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the basic component of Parallel Computer Models.
2.	To explore the application areas of Parallel Computer.
3.	To understand the idea of Processors and Memory Hierarchy.
4.	To explore the different IR evolution techniques.
5.	To understand the concepts of Multithreaded and Data Flow Architecture.

Course Outcomes
After the completion of this course, students will be:

1.	Demonstrate different terminologies in High Performance Computer Architecture.
2.	Demonstrate and Implement the concepts of High Performance Computer Architecture
3.	Compare and differentiate the different parallel architectures in terms of various parameters.
4.	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
5.	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

Syllabus
Module I
Parallel Computer Models : The State of Computing, Multiprocessors and Multicomputer, Multifactor and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.
Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures. (8L)

Head of Department

Module II

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. (8L)

Module III

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

Module IV

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear Pipeline Processor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

(8L)

Module V

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques, Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.

(8L)

Text Book:

Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010. (T1)

Reference Book:

Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA. (R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	2	1	1	1	1	3	2
2	2	3	1	1	1	2	2	1	1	1	2	1	1	2	1
3	2	3	3	3	3	1	1	1	2	2	1	2	2	3	3
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	2
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS437
Course title: **High Performance Computing Lab**
Pre-requisite(s): CS430 High Performance Computing
Co- requisite(s):
Credits: L:0 T:0 P:3
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

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Course Objectives

This course enables the students to:

1.	Learn the concepts of parallel processing as it pertains to high performance computing.
2.	Learn to design parallel programs on high performance computing.
3.	Discuss issues of parallel programming.
4.	Learn the concepts of Multi-core processor.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Memorize parallel processing approaches.
CO2	Describe different parallel processing platforms involved in achieving High Performance Computing.
CO3	Discuss different design issues in parallel programming.
CO4	Design algorithms suited for Multicore processor and GPU systems using.
CO5	Learn parallel programmingusing message passing paradigm using open source APIs.

SYLLABUS

List of Programs as Assignments:

Lab Assignment No: 1

Objective:

Q1. To study the basic commands of linux.

Lab Assignment No: 2

Objective:

Q1. To establish Beowulf Cluster using MPI(Message Passing Interface) Library.

Lab Assignment No: 3

Objective:

Q1.Installation and configuration of Alchemi Grid.

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Lab Assignment No: 4

Objective:

Q1. Running a sample application on Alchemi Grid and analysing it. 5

Lab Assignment No: 5

Objective:

Q1.To study a Grid Simulation Toolkit.

Lab Assignment No: 6

Objective:

Q1. To run two sample programs using GridSim Toolkit.

Lab Assignment No: 7

Objective:

Q1.To study a Cloud Simulation Toolkit.

Books recommended:

TEXT BOOKS

1. Computer Architecture: Pipelined and Parallel Processor Design by M J Flynn.

REFERENCE BOOKS

2. Computer Architecture: A Quantitative Approach" by John L Hennessy and David A Patterson.

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	2	1	1	1	1	3	2
2	2	3	1	1	1	2	2	1	1	1	2	1	1	2	1
3	2	3	3	3	3	1	1	1	2	2	1	2	2	3	3
4	3	1	2	1	2	1	2	2	1	1	1	2	2	3	2
5	2	2	1	2	3	1	1	1	1	3	2	3	1	2	3

COURSE INFORMATION SHEET

Course code: IT402
Course title: **. NET Programming**
Pre-requisite(s): Nil
Co- requisite(s):
Credits:L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Head of Department

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Course Objectives

This course enables the students:

1.	To study basic and advanced features of the C# language
2.	To create form based and web based applications
3.	To study the internals of the .NET framework
4.	To know and study about the Common Language Runtime (CLR) and Common Language Infrastructure (CLI)

Course Outcomes

After the completion of this course, students will be able to:

1.	Install and configure Dot Net application development tools.
2.	develop, implement and creating Applications with C#
3	develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web
4.	explain Security in the .NET framework and Deployment in the .NET.
5.	develop Assemblies and Deployment in .NET, Mobile Application Development.

Syllabus

Module I

C# basics

C# and the .NET framework – C# basics – Objects and types – Inheritance –Arrays – Operators and casts – Indexers.

(8L)

Module II

Advanced C# features

Delegates and events – Strings and regular expressions – Generics – Collections–Memory management and pointers – Errors and exceptions. (8L)

Module III

I/O and network programming

Tracing and events - threading and synchronization - .Net security – localization –Manipulating XML - Managing the file system – basic network programming. (8L)

Module IV

Window and web applications

Window based applications – Data access with .NET – basics of ASP .NET -Introduction to web services. (8L)

Module V

.NET Features

Architecture – Assemblies – shared assemblies – CLR hosting – Appdomains –Reflection. (8L)

Head of Department

Text Books:

Nagel,C. , Evjen,B. , Glynn,J. , Watson,K. , and Skinner,M.,"Professional C# 4 with .NET 4," Wiley India, 2010.(T1)

Liberty ,J., and MacDonald ,B., "Learning C# 3.0," First Edition ,O'Reilly, 2008.(T2)

References Book:

Troelson ,A., "Pro C# 5.0 and the.NET 4.5 Framework," Sixth Edition, Apress,2012.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Head of Department

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	2	2	3	2	1	1	1	1	1	3	3	1	1	1
2	1	3	3	3	2	2	2	1	1	1	3	2	1	3	1
3	1	3	3	3	2	1	1	1	1	1	3	2	2	3	3
4	2	3	3	3	2	2	2	2	1	1	3	1	1	3	1
5	2	3	3	3	2	1	1	1	1	1	3	1	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

Head of Department

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COURSE INFORMATION SHEET

Course code: IT434
Course title: **Mobile Computing**
Pre-requisite(s): Nil
Co-requisite(s):
Credits: L:3 T:0 P:0
Class schedule per week: 3
Class: B. Tech
Semester / Level:IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Understand basic mobile network concepts and its architectures.
2.	Know Protocols like mobile telephony and introduce to the concepts of bluetooths etc.
3.	Comprehend the GSM architectures and its features that support mobile communications.
4.	Understand the network management and Middleware services used in Ip and Mobile telephony
5.	Get accustomed to the concepts like GPRS, 3G, 4G networks

Course Outcomes

After the completion of this course, students will be to:

1.	Identify the role of cellular networks in Mobile and Pervasive Computing
2.	Analyse about the basic architecture for a pervasive computing environment
3.	Assess the principles for routing and allocating the resources on the 3G-4G wireless network
4.	Evaluate mobile computing applications based on the paradigm of context aware computing
5.	Design and elaborate applications in mobile and pervasive computing environment

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Syllabus

Module I

Introduction: Mobility of bits and bytes, wireless the beginning, mobile computing, dialogue control, Networks, middleware and gateways, application and services, developing mobile computing applications, security in mobile computing, standard bodies. Mobile Computing Architecture: architecture for mobile computing, three tier architecture, design consideration, mobile computing through internet, making existing applications –mobile enabled. (8L)

Module II

Mobile Computing through Telephony: evolution of telephony, multiple access procedures, mobile computing through telephone, developing an IVR application, voice XML, telephone application programming interface. Emerging Technologies: introduction, Bluetooth, radio frequency identification, wireless broadband, mobile IP, IPV6, java card. (10L)

Module III

Global System for Mobile Communications GSM: introduction, GSM architecture , call routing in GSM, PLMN interface, GSM address and identifiers, network aspect in GSM, GSM frequency allocation, authenticity and security. Short Message Service SMS : Mobile computing over SMS, Short message services(SMS) , value added services through SMS, Accessing the SMS bearer. (8L)

Module IV

General Packet Radio Service GPRS:GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, applications for GPRS, limitations for GPRS, billing and charging in GPRS. Wireless Application Protocol WAP: introduction , WAP, MMS, GPRS applications.CDMA and 3G

Client Programming: introduction, moving beyond the desktop, a peak under the hood: hardware overview, mobile phone, PDA, design constraints in application for handheld devices. (10L)

Module V

Voice Over Internet Protocol and Convergence: VoIP, H 323 framework for VoIP 564, SIP, comparision between H.323 and SIP 570, Real time protocol, convergence technologies, call routing, voice over IP applications, IP multimedia subsystem, Mobile VoIP. (8L)

Text Book:

Talukedar ,A., Ahmed ,H., and Yavagal ,R. R," Mobile Computing Technology , Applications and Service Creation," Tata McGraw - Hill Education ,2010.(T1)

Reference Book:

Schiller ,J. H.," Mobile Communications," Second Edition, Addison Wesley, .(R1)
Rajkamal," MobileComputing, "Second Edison, Oxford University Press.(R2)

Head of Department

Behravanfar ,R.,"Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML," Cambridge University Press, 2004. (R3)

Adelstein, Frank, Gupta, Sandeep K.S.," Richard III, Golden ,Schwiebert, Loren, Fundamentals of Mobile and Pervasive Computing," McGraw-Hill Professional, 2005. (R4)Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing," Second Edison, Springer, 2003. (R5)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	2	3	1	1	2	1	1	1	1	2	1	1	3	2
2	2	3	3	1	1	1	1	1	1	1	1	2	1	3	1
3	2	3	2	3	3	1	1	1	1	1	1	3	2	3	3
4	3	1	1	1	2	1	1	2	1	1	1	2	1	3	1
5	2	2	1	2	3	1	1	1	1	3	1	3	1	2	3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT430
Course title: **Machine Learning Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: 4
Branch: CSE/IT

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Course Objectives:

This course enables the students:

A.	Make use of Data sets in implementing the machine learning algorithms
B.	To choose the appropriate machine learning design method for a specified application.
C.	Implement the machine learning concepts and algorithms in any suitable language of choice.
D.	Analyze and compare the different algorithms

Course Outcomes:

After the completion of this course, students will be able to:

1.	Gain knowledge about basic concepts of Machine Learning
2.	Identify machine learning techniques suitable for a given problem
3.	Solve the problems using various machine learning techniques
4.	Apply Dimensionality reduction techniques
5	Design application using machine learning techniques.

Syllabus:

11. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
12. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
13. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
14. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
15. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
16. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
17. Write a program to construct aBayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

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18. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
19. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
20. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Text Books:

Floreano, D. and Mattiussi, C., "Bio-Inspired Artificial Intelligence", MIT Press, 2008. (T1)
Neumann, F. and Witt, C., "Bioinspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010. (T2)
Elben, A. E. and Smith, J. E., "Introduction to Evolutionary Computing", Springer, 2010.(T3)
Goldberg, D. E., "Genetic algorithms in search, optimization, and machine learning", Addison- Wesley, 1989.(T4)
Haykin, Simon O., "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.(T5)

Reference Books:

Dorigo, M. and Stutzle, T., "Ant Colony Optimization", A Bradford Book, 2004.(R1)
Ebelhart, R. C. et al., "Swarm Intelligence", Morgan Kaufmann, 2001.(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
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CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	3	2	1	1	2	1	2	3	3	2
CO2	3	3	2	3	3	3	2	1	1	1	1	2	3	2	2
CO3	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2
CO4	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3
CO5	3	3	3	3	3	3	3	1	1	2	1	2	3	3	3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS494
Course title: Big Data Analytics
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To provide an overview of approaches facilitating data analytics on huge datasets in different domain.
2.	To provide the knowledge on NoSQL and different partitioning method to handle large datasets.
3.	To provide an overview of Apache Hadoop and HDFS Concepts and Interfacing with HDFS
4.	To understand Map Reduce Jobs in Hadoop framework
5.	To provide the knowledge of various Hadoop based tool for processing large datasets.

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Course Outcomes

After the completion of this course, students will be able to:

1.	Describe big data and use cases from selected business domains
2.	Explain NoSQL big data management
3.	Install, configure, and run Hadoop and HDFS
4.	Perform map-reduce analytics using Hadoop
5.	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

Syllabus

Module I

Introduction

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics. (8L)

Module II

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations. (8L)

Module III

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures. (8L)

Module IV

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats. (8L)

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Module V

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries. (8L)

Text Books:

Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.(T1)
P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.(T2)
Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.(3)

Reference Books:

Sammer ,E., "Hadoop Operations," O'Reilley, 2012.(R1)
Capriolo ,E., Wampler ,D., and Rutherglen ,J., "Programming Hive," O'Reilley, 2012.(R2)
George ,L., "HBase: The Definitive Guide," O'Reilley, 2011.(R3)
Gates ,A., "Programming Pig," O'Reilley, 2011.(R4)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	1	1
CO2	2	2	2	2	3	1	1	1	2	2	2	2	2	2	3
CO3	2	2	2	1	3	2	2	2	3	2	1	2	3	2	3
CO4	3	2	3	2	3	2	2	2	2	2	2	2	3	3	3
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS495
Course title: Big Data Analytics Lab
Pre-requisite(s): CS494 Big Data Analytics
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	To implement MapReduce programs for processing big data
2.	To realize storage of big data using H base, Mongo DB
3.	To analyze big data using linear models
4.	To analyze big data using machine learning techniques such as SVM Decision tree classification and clustering

Course Outcomes

After the completion of this course, students will be able to:

CO1	Process big data using Hadoop framework
CO2	Build and apply linear and logistic regression models
CO3	Perform data analysis with machine learning methods
CO4	Perform graphical data analysis
CO5	Simulate basic Engineering problems

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SYLLABUS

List of Programs as Assignments:

Lab Assignment No: 1

Objective:

Q1. To draw and explain Hadoop Architecture and Ecosystem with the help of a case study using WorkCount example. To define and install Hadoop.

Lab Assignment No: 2

Objective:

Q1. To implement the following file management tasks in Hadoop System (HDFS): Adding files and directories, Retrieving files, Deleting files

Lab Assignment No: 3

Objective:

Q1.To run a basic Word Count MapReduce program to understand MapReduce Paradigm: To count words in a given file, to view the output file, and to calculate execution time.

Lab Assignment No: 4

Objective:

Q1. Implement word count / frequency programs using MapReduce

Lab Assignment No: 5

Objective:

Q1.To study and implement basic functions and commands in R Programming.

Lab Assignment No: 6

Objective:

Q1. To implement Bloom Filters for filter on Stream Data in C++/java.

Lab Assignment No: 7

Objective:

Q1.To implement Bloom Filters for filter on Stream Data in C++/java.

Lab Assignment No: 8

Objective:

Q1.To implement clustering program using R programming.

Lab Assignment No: 9

Objective:

Q1. Visualize data using any plotting framework

Lab Assignment No: 10

Objective:

Q1.Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

Head of Department

Books recommended:

TEXT BOOKS

Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packet Publishing

REFERENCE BOOKS

3. Tom White, "Hadoop: The Definitive Guide", Second Edition, O'Reilly Yahoo Press
4. Robert D. Schneider, "Hadoop for Dummies", Wiley.

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	1	1
CO2	2	2	2	2	3	1	1	1	2	2	2	2	2	2	3
CO3	2	2	2	1	3	2	2	2	3	2	1	2	3	2	3
CO4	3	2	3	2	3	2	2	2	2	2	2	2	3	3	3
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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COURSE INFORMATION SHEET

Course code: CS490
Course title: **3D Simulation**
Pre-requisite(s): CS327 Computer Graphics
Co- requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: IV
Branch:

Course Objectives

This course enables the students to:

1.	To understand the basic concepts of 3D simulation.
2.	To learn the application of 3D simulation to solve real world problems.
3.	To explore the utilities of collision detection.
4.	To able to analyze a problem using animation and a model.

Course Outcomes

After the completion of this course, students will be able to:

1.	Develop 3D models and simulate for real application.
2.	Learn the tools for 3D simulation.
3.	Apply in real cases and analysis
4.	Solve real cases through computer simulation
5.	Develop an algorithm to identify collision.

Syllabus

Module I:
Rendering pipeline, Vectors, Matrices, and Transforms. (8L)

Module II:
Geometry for 3D, Ray Tracing, Lighting and Shading, Visibility Determination. (8L)

Module III:
Polygonal Techniques, Shadows, Curves and Surfaces, Collision Detection. (8L)

Module IV:
Linear Physics, Kinds of Simulation, Intermediate Modeling, Model Data, Animation. (8L)

Module V:
Case Studies for Health, Transport, Defense, Game, Science Simulation. (8L)

Head of Department

Text Books:

Mathematics for 3D Game programming and Computer Graphics, Eric Lengyel Third Edition, Cengage Learning.(T1)
3D Math Premier for Graphics and Game Development, by Flecher Dunn, Ian Parberry, WordwarePublishing.(T2)

References:

Simio and Simulation: Modeling, Analysis, Applications Fourth Edition Jeffrey S. Smith (Auburn University) David T. Sturrock (Simio LLC) W. David Kelton (University of Cincinnati), Published by Simio.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment
1. Student Feedback on Faculty
2. Student Feedback on Course

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	2	3	1	1	1	2	2	1	2	3	2	2
CO2	2	2	2	2	3	1	1	1	2	2	2	2	2	2	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2	3	2	3
CO4	3	3	3	3	3	2	2	2	2	2	1	2	3	2	3
CO5	3	3	3	3	2	2	2	2	2	2	3	3	3	2	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
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COURSE INFORMATION SHEET

Course code: CS493
Course title: **GP-GPU Programming**
Pre-requisite(s): Operating System
Co- requisite(s): None
Credits: L: 3 T: 0 P: 0
Class schedule per week: 03
Class: B. Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Identify the different kinds of parallel models used in computing
2.	Identify common programming constructs used in parallel programming.
3.	Understand the basic hardware of GP-GPUs.
4.	Visualize the concepts of grids, blocks and threads in GPU computing.
	Understand the different memory types available in GPU programming.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify the various components that go into the making of GPUs.
2.	Describe the compute capabilities of a GPU based system.
3.	Formulate logic in multiple dimensions to solve problems using GPUs.
4.	Utilize the various memory modules available in GPU.
5.	Measure the gain in performance between CPUs and GPUs.

Syllabus

Module I: A Short History of Supercomputing
Introduction, Von Neumann Architecture, CrayConnection Machine, Cell Processor, Multinode Computing, The Early Days of GPGPU Coding, The Death of the Single-Core Solution, NVIDIA and CUDAGPU Hardware, Alternatives to CUDA,:OpenCL,DirectCompute,CPU alternatives, Directives and libraries. (8L)

Head of Department

Module II: Understanding Parallelism with GPUs
Introduction, Traditional Serial Code, Serial/Parallel Problems, Concurrency, Locality, Types of Parallelism, Task-based parallelism, Data-based parallelism, Flynn's Taxonomy, Some Common Parallel Patterns, Loop-based patterns, Fork/joinpattern, Tiling/grids, Divide and conquer. (8L)

Module III: CUDA Hardware
Overview, PC Architecture, GPU Hardware, CPUs and GPUsCompute Levels, Characteristics of different compute levels. (8L)

Module IV: Grids, Blocks, and Threads
What it all Means, Threads, Problemdecomposition, How CPUs and GPUs are different, Task execution model, Threading on GPUs, A peek at hardware, CUDA kernels, Blocks, Block arrangement, Grids, Stride and offset, X and Y thread indexes, Warps, Branching, GPUutilization, Block Scheduling. (8L)

Module V: Memory Handling with CUDA
Introduction, Caches, Types of data storage, RegisterUsage, Shared Memory, Sorting using shared memory, Radix sort, Merging lists, Parallel merging, Parallelreduction, A hybridapproach, Shared memory on different GPUs, Shared, Constant Memory, Constant memorycaching, Constant memory broadcast, Constant memory updates at runtime, Global Memory, Scoreboarding, Global memory sorting, Sample sort, Texture Memory, Texture caching, Hardware manipulation of memory fetches.
(8L)

Text Book:

Cook S., "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs," First Edition, Morgan Kauffman, 2013.(T1)

Reference Books:

Kirk W. B., Hwu W. W., "Programming Massively Parallel Processors", Second Edition, Morgan Kauffman, 2013.(R1)

Gaps in the syllabus (to meet Industry/Profession requirements):N/A

POs met through Gaps in the Syllabus:N/A

Topics beyond syllabus/Advanced topics/Design:N/A

POs met through Topics beyond syllabus/Advanced topics/Design:N/A

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Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	1	3	1	1	1	1	1	1	2	3	1	1
CO2	2	3	2	2	3	1	2	1	2	1	1	2	2	2	2
CO3	3	3	3	3	3	1	2	1	1	2	2	2	3	3	2
CO4	3	3	3	2	3	1	1	1	2	2	2	2	2	2	3
CO5	3	3	2	3	3	1	1	1	2	2	2	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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Syllabus M.Tech CS CBCS

COURSE INFORMATION SHEET

Course code: CS501

Course title: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Pre-requisite(s): Discrete Mathematics

Co- requisite(s):

Credits: 3 L: 3 T: 0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students to:

1.	Present basic concepts and techniques of linear algebra, probability, statistics and graph theory
2.	Develop mathematical thinking and problem-solving skill
3.	Provide the foundations of probabilistic and statistical analysis
4.	Explain graphs to formulate computational problems

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate skills in solving mathematical problems
CO2	Apply knowledge of computing and mathematics appropriate to the discipline
CO3	Analyze problems and identify the computing requirements appropriate to its solution
CO4	Explain basic concepts in probability theory and statistical analysis
CO5	Articulate the advanced courses in Computer science such as Coding Theory, Artificial Intelligence, Numerical Computation, etc.

SYLLABUS

Module I:

Linear Algebra

Introduction: Matrices and solving set of linear equations, Vector space, Subspace, Linear combination of vectors, Linear dependence and independence of vectors, Bases and dimensions.

(8L)

Module II:

Inner product spaces, Orthogonal vectors and dual vectors, Eigen values and Eigen vectors, Linear programming.

(8L)

Module III:

Probability and Statistics

Frequency distribution and measures of central tendency mean, median mode, quartiles, measures of dispersions and skewness, standard deviation, mean deviation, coefficient of variation, moments.

(8L)

Module IV:

Probability: definition, Distribution: discrete and continuous, Chi-square test, t-test.

(8L)

Head of Department

Module V:

Graph Theory

Introduction: Graphs and its types, Representation of graphs: Adjacency matrix, Incidence matrix, Adjacency list, Planar graph, Kuratowski's Graphs, Clique and maximum Clique finding algorithms.

(8L)

Books recommended:

TEXT BOOK

4. K. Haffman, and R. Kunze, "Linear Algebra", 2nd Edition, Pearson, 2015. **(T1)**
5. G. Williams, "Linear Algebra with Applications", 4th Edition, John & Bartlett. **(T2)**
6. W. Navidi, "Statistics for Engineers and Scientists", 2nd Edition, TMH, 2008. **(T3)**
7. J.K. Goyal, and J. N. Sharma, "Mathematical Statistics", Krishna Prakashan, 2017. **(T4)**
8. NarasinghDeo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001. **(T5)**
9. Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002. **(T6)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	3	1	1	1	1
CO3	2	3	2	1	1	1
CO4	3	2	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS502

Course title: ADVANCED DATA STRUCTURES

Pre-requisite(s): Data Structures, Algorithm Analysis

Co- requisite(s):

Credits: 3 L: 3 T:0 P:0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students:

1.	The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2.	Students should be able to understand the necessary mathematical abstraction to solve problems.
3.	To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4.	Student should be able to come up with analysis of efficiency and proofs of correctness.

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Course Outcomes

After the completion of this course, students are expected to:

CO1	Understand the implementation of symbol table using hashing techniques.
CO2	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
CO3	Develop algorithms for text processing applications.
CO4	Interpret the basic working of advanced heaps.
CO5	Appraise the implementation of symbol table using hashing techniques.

SYLLABUS

Module I:

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

(8L)

Module II:

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

(8L)

Module III:

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

(8L)

Module IV:

Heaps: Balanced Search Trees as Heaps, Array-Based Heaps, Heap-Ordered Trees and Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps, Heap-Related Structures with Constant-Time Updates.

(8L)

Head of Department

Module V:

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

(8L)

Books recommended:

TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004.**(T1)**
2. Peter Brass, "Advanced Data Structures," Cambridge University Press, 1st Edition.**(T2)**
3. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002.**(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	2	3	3	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS504

Course title: DISTRIBUTED SYSTEMS

Pre-requisite(s): Data Structure, Operating system

Co- requisite(s):

Credits: 3 L:3 T:0 P:0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

The course objectives are to enable the students to learn:

1.	Role of distributed systems in day-to-day life
2.	Distributed system models and communication methods
3.	Concepts of distributed file systems and distributed transactions
4.	Resource management techniques in distributed environment
5.	Analysing the approaches for designing and supporting distributed systems

Course Outcomes

After the completion of this course, students will be able to:

CO1	Identify trends and challenges in distributed systems
CO2	Understand various distributed system models and communication methods
CO3	Learn the concepts of distributed file systems and distributed transactions
CO4	Learn approaches for resource management in distributed environment
CO5	Understand the requirements for designing and supporting distributed systems

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SYLLABUS

Module 1:

Introduction: Examples of Distributed Systems, Trends in Distributed Systems, Resource sharing, Challenges. Case study: World Wide Web.

Networking and Internetworking: Types of network, Network principles, Internet protocols

(8L)

Module 2:

Interprocess Communication: Client-server communication, Group communication, Network virtualization.

Remote Invocation: Request-reply protocols, Remote procedure call, Remote method invocation.

Indirect Communication: Publish subscribe system, Message queues, Shared memory approaches.

(8L)

Module 3:

Peer to Peer Systems: Introduction, Napster and its legacy, Middleware, Routing overlays.

Distributed File systems: Introduction, File service architecture, Case Study: NFS.

(8L)

Module 4:

Time and Global States: Clocks, events, and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, Distributed debugging

Coordination and Agreement – Distributed mutual exclusion, Elections, Coordination and agreement in group communication.

(8L)

Module 5:

Distributed Transactions: Flat and nested transactions, Atomic commit protocols, Concurrency Control, Distributed deadlocks, Transaction recovery.

Replication: Introduction, System model, Fault tolerant services, Transactions with replicated data.

Head of Department

(8L)

TEXT BOOK

1. G. Coulouris, J. Dollimore, T. Kindberg, Distributed Systems Concepts and Design, 5th Edition, Pearson Education, 2012**.(T1)**

REFERENCE BOOKS

1. A. S. Tanenbaum, M. Van Steen, Distributed Systems: Principles and Paradigms, Pearson Education, 2007. **.(R1)**
2. P. K. Sinha, Distributed Systems: Concepts and Design, Prentice Hall, 2007. **(R1)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

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Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	1	2
CO2	3	3	3	1	3	1
CO3	2	3	3	3	2	1
CO4	3	3	3	3	1	1
CO5	2	2	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS503

Course title: ADVANCED DATA STRUCTURES LAB

Pre-requisite(s):

Co- requisite(s): Advanced Data Structures

Credits: 2 L: 0 T: 0 P: 4

Class schedule per week: 04

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students to:

1.	The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2.	Students should be able to understand the necessary mathematical abstraction to solve problems.
3.	To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4.	Student should be able to come up with analysis of efficiency and proofs of correctness.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand to implement the symbol table using hashing techniques.
CO2	Develop program for AVL, Red-Black trees, B-trees and Splay trees
CO3	Develop program for text processing applications
CO4	Learn the basic working of advanced heaps
CO5	Understand the implementation of symbol table using hashing techniques

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Write a program to implement a dictionary using the following ADTs. We assume all the entries in the dictionary to be distinct integers.

   a) Binary Search Tree (BST)
   b) Red Black Tree (RBT)

   Each ADT should support five operations, void Insert(val), boolean Delete(val), boolean Search(val), void ClearADT() and void DisplayADT(). Both search and delete operations should respond with a boolean value indicating whether the search/delete was successful or not. The objective of this assignment is to compare the performance of BST and RBT ADTs. You have to compute the time taken for completion of operations and study how the running times of ADT operations will vary across the two ADT implementations.

2. **Lab Assignment No: 2**

   Implement data structures to maintain a list of elements. In particular, implement the list as an array and as a linked list. Write a program to remove duplicates from the list. The code for remove duplicates functionality should remain the same across the two implementations of the list.

   Implement the following sequence of operations on the skip list:

   a) remove() b) insert () c) Search() d) Update()

   Assume the coin flips for the first insertion yield two heads followed by tails, and those for the second insertion yield three heads followed by tails.

3. **Lab Assignment No: 3**

   Implement different Hashing functions and Collision Resolution Techniques.

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4. **Lab Assignment No: 4**

Implement Kruskal's algorithm for finding the minimum spanning tree of a given (positively) weighted (undirected) graph G. You must use the Union-Find data structure that implements both "union by rank" and "path compression" heuristics.

5. **Lab Assignment No: 5 &6**

Implement the following priority queues:

a) Binary Heap b) Binomial Heap c) Fibonacci Heap

Your program should then create an appropriate priority queue object and perform makeHeap() method. After that, you should give the user menu options to insert(key), delete(key), extractMin(), findMin(), decrease(key), increase(key) updateKey(currentKey, newKey), and displayHeap(filename). You may assume that keys will be unique. For displayHeap(filename), you must output the tree structure of the priority queue (including linked list edges in Binomial Heap, etc) as a directed tree in the dot language format1 and store it in a file named filename (given as parameter).

6. **Lab Assignment No: 7&8**

Implement Text Processing using Huffman Coding.

Implement the compact representation of the suffix trie for the string "minimize minime".

Implement a standard trie for the following set of strings: {abab, baba, ccccc, bbaaaa, caa, bbaacc, cbcc, cbca }.

7. **Lab Assignment No: 9 &10**

One way to mask a message, *M*, using a version of *steganography*, is to insert random characters into *M* at pseudo-random locations so as to expand *M* into a larger string, *C*.

For instance, the message,

ILOVEMOM,

could be expanded into

AMIJLONDPVGEMRPIOM.

It is an example of hiding the string, *M*, in plain sight, since the characters in *M* and *C* are not encrypted. As long as someone knows where the random

Head of Department

Books recommended:

TEXTBOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004. **(T1)**
2. Peter Brass, "Advanced Data Structures," Cambridge University Press, 1st Edition. **(T2)**
3. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002. **(T3)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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CD6	Self- learning such as use of NPTEL materials and internets
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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	2	2	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD7

COURSE INFORMATION SHEET

Course Code: CS509
Course title: ADVANCED COMPUTER ALGORITHM
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Computer Science and Engineering

Course Objectives

After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behaviour using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Analyse and compare different approaches of computer algorithm for different practical application.
CO2	Student should understand the concept of NP-hard and NP-complete and reducibility.
CO3	Student should develop basic knowledge of a wide range of advanced algorithm design techniques, approximation algorithms, randomized algorithms and parallel algorithm.
CO4	Student should develop basic advanced algorithm analysis skills for analysing the approximation ratio of approximation algorithms and the probability of randomized algorithms.
CO5	Students should gain a good understanding on a wide range of advanced algorithmic problems, their relations and variants, and application to real-world problems.

SYLLABUS

Module I:

Design Paradigms

Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.

(8L)

Module II:

Theory of NP- Hard and NP-Complete Problems

P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes.

(8L)

Module III:

ApproximationAlgorithms

Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms.

(8L)

Module IV:

Parallel Algorithms

Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

(8L)

Module V:

Probabilistic Algorithms & Randomized Algorithms

Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems

(8L)

Text Books:

1. T.H. Cormen, C.E.Leiserson, and R.L. Rivest, “Introduction to Algorithms”.
2. G.Brassard, and P.Bratley, “Fundamentals of Algorithmics”.
3. Vijay V.Vazirani, “Approximation Algorithms”.

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Reference Books:

1. D.Harel, "Algorithmics: The spirit of computing".
2. R. Motwani& P. Raghavan, "Randomized Algorithms," Cambridge University Press, 1995.

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	1	2
CO2	3	3	3	1	3	1
CO3	2	3	3	3	2	1
CO4	3	3	3	3	1	1
CO5	2	2	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

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COURSE INFORMATION SHEET

Course Code: CS511
Course title: ADVANCED DATABASE MANAGEMENT SYSTEM
Pre-requisite(s): UG level concepts of Database management systems
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Computer Science and Engineering

Course Objectives

This course enables the students to:

1.	Understand transaction control and concurrency issues in databases.
2.	Have knowledge of locking mechanisms in a database management system
3.	Have idea of the backend activities involved in recovering data from databases
4.	Have knowledge of data warehousing and features of centralized and distributed database
5.	Obtain an insight into Open Issues in Data Warehouses, Mobile Databases Multimedia Databases Geographic Information Systems Genome Data Management

Course Outcomes

After the completion of this course, students will be able to:

CO1	To understand the fundamental and advanced concepts required for modeling and designing the database
CO2	To understand the advanced database technologies.
CO3	To effectively model and design the complex database systems
CO4	To effectively map the well-designed database to the level of implementation.
CO5	To understand the concepts of distributed database and various access and allocation methods.

SYLLABUS

Module I :

Review of basic concepts, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL.

(8L)

Module II :

Concurrency Control Techniques, Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking.

(8L)

Head of Department

Module III :
Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Recovery in Multidatabase Systems, Database Backup and Recovery from Catastrophic Failures.

(8L)

Module IV :
Distributed Databases and Client-Server Architectures, Distributed Database Concepts, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Types of Distributed Database Systems, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, An Overview of 3-Tier Client-Server Architecture.

(8L)

Module V :
Data Modeling for Data Warehouses, Characteristics of Data Warehouses, Introduction, Definitions, and Terminology Building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse Versus Views Problems and Open Issues in Data Warehouses, Mobile Databases, Multimedia Databases, Geographic Information Systems, Genome Data Management.

(8L)

Text Books:

1. Elmasri R., Navathe S.B., "Fundamentals of Database Systems", 5th Edition, Pearson Education/Addison Wesley, 2007**.(T1)**

Reference Books:

1. C.J. Date, "An introduction to Database Systems", 7th Edition.,Pearson Education, New Delhi, 2004. **(R1)**
2. H. Korth et al., "Database Management System Concepts", 3rd Edition, TMH, New Delhi, 2002. **(R2)**
3. B.Desai, "Database Management Systems", Galgotia Publications, New Delhi, 1998. **(R3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	1	2
CO2	3	3	3	1	3	1
CO3	2	3	3	3	2	1
CO4	3	3	3	3	1	1
CO5	2	2	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course Code: CS512
Course title: ARTIFICIAL INTELLIGENCE
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Computer Science and Engineering

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Course Objectives

After the completion of this course, students will be able to:

1.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
2.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
3.	An ability to design a system, component or process to meet desired needs within realistic constraints.
4.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
5.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Recall the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
CO2	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
CO3	Understanding the various concepts of knowledge representations and demonstrate working. knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO4	To develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
CO5	Write various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

SYLLABUS

Module I:

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature of Environment, Structure of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining The Problem as State Space Search, Production System, Problem Characteristics, Issues in The Design of Search Programs.

(8L)

Module II:

Search Techniques: Solving Problems by Searching, Problem Solving Agents, Searching for Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search for Constraint Satisfaction Problems.

Head of Department

Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Minimax Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

(8L)

Module III:

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, Natural Deduction.

Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.

(8L)

Module IV:

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster -Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning.

Learning: Forms of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning.

(8L)

Module V:

Natural Language Processing: Brief introduction to Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planning uncertain movements, robotic software architecture, application domains.

(8L)

TEXT BOOKS:

1. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education. **(T1)**
2. E. Rich & K. Knight, "Artificial Intelligence", 2/e, TMH, New Delhi, 3rd Edition, TMH. **(T2)**

REFERENCE BOOKS:

1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, New Delhi, 2006. **(R1)**
2. D.W. Rolston, "Principles of AI & Expert System Development", TMH, New Delhi. **(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	1	1
CO5	2	2	2	3	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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Mapping Between COs and Course Delivery (CD) methods			
CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course Code: CS510
Course title: ADVANCED ALGORITHM LAB
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: L:0 T:0 P: 2
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/5
Branch: Computer Science and Engineering

Course Objectives

After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyse requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behaviour using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Able to know the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations.
CO2	Able to determine the practical implications of asymptotic notations.
CO3	Able to Implement, analyse, and compare algorithms.
CO4	Able to Know the difference between the dynamic programming concept and a greedy approach.
CO5	Able to know and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Programs on Polynomial vs logarithmic running times

2. **Lab Assignment No: 2**
   Programs on Divide-and-conquer algorithms

3. **Lab Assignment No: 3**
   Programs on Greedy and dynamic-programming algorithms

4. **Lab Assignment No: 4**

   Programs on Binary trees

5. **Lab Assignment No: 5**
   Programs on Heaps and priority queues

6. **Lab Assignment No: 7**
   Programs on Binary search trees

7. **Lab Assignment No: 8**
   Programs on Hash tables

8. **Lab Assignment No: 9**
   Programs on Graph traversal

9. **Lab Assignment No: 10**
   Programs on Shortest paths in graphs.

Head of Department

Books recommended:

Textbooks:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001. **(T1)**
2. Sanjoy Dasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, Tata McGraw-Hill, 2008. **(T2)**
3. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005. **(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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COURSE INFORMATION SHEET

Course code: CS601
Course title: GRAPH THEORY
Pre-requisite(s): Discrete Mathematics
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/6
Branch: Computer Science and Engineering

Course Objectives

This course enables the students to:

1.	Learn and become comfortable with graphs and its terminologies
2.	Understand applications of graph theory to practical problems and other branches of mathematics
3.	Understand various graphs algorithms along with its analysis.
4.	Practice creative problem solving and improve skills in this area

Course Outcomes

After the completion of this course, students will be able to:

CO1	Attain knowledge about different types of graphs and their applications in real world.
CO2	Perceive the role of cut-set, cut-vertex and fundamental circuits in network flows.
CO3	Create an awareness of planar and dual graph.
CO4	Understand how to represent graphs in computer system
CO5	Apply the concept of graph coloring and partitioning techniques in NP-problems

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SYLLABUS

Module I :

Introduction: Graphs and its applications, Finite and infinite graphs, incidence and degree, isolated Vertex, pendant Vertex, and Null graph, paths and circuits, isomorphism, sub graphs, walks, paths, and circuits, connected graphs, disconnected graphs and components, Connectivity checking algorithm, Euler graphs, Operations on graphs, more on Euler graphs, Hamiltonian paths and circuits, Travelling Salesman problem.

(8L)

Module II:

Trees and Fundamental circuits: Trees and its properties, Distance and centers in a tree, Algorithm for checking if a graph is Tree, Partial k-trees, Dynamic Programming in partial k-trees, spanning trees, Spanning trees in a Weighted graph, Prim's and Kruskal's algorithms

Cut set and cut vertices: Properties of a cut set, Fundamental circuits and cut sets, connectivity and separability, Computing connected components, Menger's theorem, Network flows, 1-Isomorphism, 2-Isomorphism.

(8L)

Module III:

Planar and Dual Graphs: Planar graph, Kuratowski's Graphs, Representations of a planar graph, Detection of planarity, Planar Separator Theorem, Geometric Dual, Combinatorial, Duel, Thickness and crossings, Algorithms for finding Clique and maximum clique**.**

(8L)

Module IV:

Matrix Representation of Graphs: Incidence matrix, Adjacency matrix, Adjacency list, Circuits Matrix, Fundamental Circuit Matrix and Rank of B, Cut-set Matrix, Relationships among A *f*, B*f* and C*f*, path Matrix**.**

(8L)

Module V:

Coloring, Covering and partitioning: Chromatic number, Chromatic partitioning, Chromatics polynomial, Coverings, Four colour problem, Algorithm for graph colouring.

Directed Graphs: Digraphs and its types, Digraphs and binary Relations, Directed paths and connectedness, Euler Digraphs, Trees with Directed Edges, Fundamental Circuits in Di graphs, Matrices A, B and C of Digraphs, Adjacency Matrix of a Digraph, Paired Comparisons and Tournaments, Acyclic Di graphs and De-cyclization**.**

(8L)

Textbooks:

1. Narasingh Deo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001. **(T1)**

Reference Books:

1. Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002. **(R1)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

Head of Department

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POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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PROGRAM ELECTIVE I

COURSE INFORMATION SHEET

Course code: CS506

Course title: MACHINE LEARNING

Pre-requisite(s): Design of Algorithms, Mathematics II, Artificial Intelligence

Co- requisite(s):

Credits: 3 L: 3 T: 0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Course Objectives

This course enables the students:

1.	To formulate machine learning problems corresponding to different applications.
2.	To understand various supervised, semi-supervised and unsupervised machine learning algorithms.
3.	To familiarize various machine learning software libraries and data sets publicly available.
4.	To develop machine learning based system for various real-world problems.
5.	To assess how the choice of a machine-learning algorithm impacts the accuracy of a system.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity
CO2	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses
CO3	Implement machine learning solutions to classification, regression, and clustering problems
CO4	Design and implement various machine learning algorithms in a range of real-world applications
CO5	Evaluate and analyse the performance of a machine-learning algorithm or a system based on machine learning algorithm.

SYLLABUS

Module I:
Introduction to Machine Learning
Machine Learning – what and why? Basics of Linear Algebra and Statistics,
Overview of target function representations; Linear Regression.

(8L)

Module II:
Supervised Learning
Basics of Feature Selection and Evaluation, Decision Tree, Overfitting and Pruning, Logistic regression, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts.

(8L)

Module III:

Neural Networks

Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

(8L)

Head of Department

Module IV:
Unsupervised and Semi Supervised Learning
Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. K-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabled data.

(8L)

Module V:
Ensemble
Committees of multiple hypotheses, bagging, boosting, active learning with ensembles.

(8L)

Books recommended:

TEXT BOOK

1. Tom Mitchell, "Machine Learning", Latest Edition, Mc-Graw Hill. **(T1)**

REFERENCE BOOK

1. Shai Shalev-Shwartz, and Shai Ben-David, "Understanding Machine Learning", Cambridge University Press, 2017. **(R1)**
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006. **(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
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CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT503

Course title: WIRELESS SENSOR NETWORKS

Pre-requisite(s): Basic Networking Fundamentals

Co-requisite(s):

Credits: 3 L: 3 T: 0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

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Name of Teacher:

Course Objectives

This course enables the students to:

1.	Familiarize with the principles of sensor nodes, network deployment and architectures.
2.	Know the data transmission and routing protocols. Know the differences among different networks.
3.	Analyze or compare the performance of different routing and MAC protocol
4.	Evaluate the performance of different MAC protocols and clustering algorithm
5.	Compute the throughput and channel utilization for different network scenarios.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Obtain a broad understanding about the network architecture of wireless sensor network.
CO2	Understand all basic characteristics of wireless sensor networks and sensor nodes.
CO3	Understand the principles of data transmission, clustering algorithm and routing protocols.
CO4	Analyze and evaluate different constraint of wireless sensor network, e.g., coverage, power management, security and data collisions.
CO5	Design and development of new sensor network architecture.

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SYLLABUS

Module I:

Fundamentals of Sensor Networks

Introduction to wireless sensor networks, Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem communication interfaces- prototypes, Application of Wireless sensors.

(8L)

Module II:

Communication Characteristics and Deployment Mechanisms

Wireless Transmission Technology and Systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization Clock and the Synchronization Problem - Basics of time Synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization.

(8L)

Module III:

Mac Layer

Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols, Power Aware Multi-Access with signalling, Sensor MAC-Timeout MAC-Data gathering MAC.

(8L)

Module IV:

Routing in Wireless Sensor Networks

Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing Geographical Based Routing-Transport layer- Transport Protocol Design issues, Performance of Transport Control Protocols.

(8L)

Module V:

Middleware and Security Issues

WSN middleware Principles-Middleware Architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security.

Head of Department

(8L)

Books recommended:

TEXT BOOK

1. WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011. **(T1)**
2. KazemSohraby, Daniel manoli, "Wireless Sensor networks- Technology, Protocols and Applications", Wiley Inter Science Publications 2010. **(T2)**

REFERENCE BOOK

1. BhaskarKrishnamachari, "Networking Wireless Sensors", Cambridge University Press, 2005. **(R1)**
2. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati, "Wireless Sensor Networks", Springer Science 2004. **(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	2	1	1	1	1
CO3	3	3	1	1	1	1
CO4	2	3	2	1	1	1
CO5	2	3	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS507

Course title: COMPUTABILITY AND COMPLEXITY THEORY

Pre-requisite(s): Automata Theory and Computer algorithms

Co-requisite(s):

Credits: 3 L: 3 T: 0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students to:

1.	Give introduction to the mathematical foundations of computation including automata
2.	Learn about the issues in finite representations for languages and machines, as well as gain a more formal understanding of algorithms and procedures.
3.	Motivate and expose to the fundamental understanding of computation under resource constraints.
4.	Set a research level exposure to deeper topics in complexity theory.

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Course Outcomes

After the completion of this course, students will be able to:

CO 1	Relate formal languages and mathematical models of computation
CO 2	Attain knowledge about different types of languages and the corresponding machines for computations
CO 3	Understand the limitations on what computers can't do, and learn examples of unsolvable problems
CO 4	Analyse P, NP, NP-C, NP-Hard, Tractable and Intractable problems
CO 5	Explain reduction of problems for easy and hard problems

SYLLABUS

Module I:

Basic background on automata and languages, Types of automata and languages, Turing machines, Encoding and Enumeration of Turing Machines, k-tape Turing machines, non-deterministic Turing machines, Universal Turing machine, Resource bounded computation, Halting problem

(8L)

Module II:

Context Sensitive Language and Chomosky Hierarchy Recursive enumerable languages, Recursive languages, Decidable and recognizable language, Turing-decidable languages, Turing-recognizable languages, Kolmogorov Complexity

(8L)

Module III:

Primitive recursive function, partial recursive function, Recursive and recursive enumeration sets, Programming systems, Unsolvable problems, a non-recursive language and an unsolvable problem, Rice Theorem, More unsolvable problems, PCP

(8L)

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Module IV:

Measuring complexity- Big Oh, small oh and other notations, Analysing algorithms, Time and space complexity of a Turing machine, Complexity analysis of multi-tape TM

(8L)

Module V:

Complexity classes: P, NP, NP-C, NP-Hard problem, PSPACE, NP-complete problems- clique, vertex cover, Hamiltonian cycle, graph colouring problem, graph isomorphism, Reduction from NP-C problem to another problem, Cook-Levin Theorem,Tractable and Intractable problems, Reducing one problem to another problem**,** Additional classes of problems- RP**,** ZPP

(8L)

Books recommended:

TEXT BOOK

1. Lewis H.R., Papadimitriou C.H., "Elements of the Theory of Computation", PHI Publ., 2nd edition, New Delhi. **(T1)**

REFERENCE BOOK

1. Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2008. **(R1)**
2. John Martin, "Introduction to Languages and the Theory of Computation", 3rd ed. McGraw Hill, New York, NY, 2003. **(R2)**
3. Dexter Kozen, "Theory of Computation", Springer publication. **(R3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	2	1	1	1	1
CO3	3	3	1	1	1	1
CO4	2	3	2	1	1	1
CO5	2	3	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD4,CD5,CD7

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PE Lab 1

COURSE INFORMATION SHEET

Course code: IT509

Course title: MATLAB PROGRAMMING

Pre-requisite(s):

Co- requisite(s):

Credits: 2 L: 0 T: 0 P: 4

Class schedule per week: 04

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring MATLAB
2.	Develop mathematical thinking and problem-solving skill
3.	To enable the student on how to approach for solving Engineering problems using simulation tools.
4.	To provide a foundation in use of this software for real time app

Course Outcomes

After the completion of this course, students will be able to:

CO1	Express programming & simulation for engineering problems.
CO2	Find importance of this software for Lab Experimentation.
CO3	Analyze problems and write basic mathematical, electrical, electronic problems in Matlab
CO4	Implement programming files with GUI Simulink.
CO5	Simulate basic Engineering problems

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SYLLABUS

List of Programs as Assignments:

32. Lab Assignment No: 1

Objective: To Understand and Implement Matrix Algebra

1. To create Sparse matrices using the function sparse.
2. To convert a sparse matrix to full matrix.

33. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

1. To measure the daily high temperatures in three cities with different color.
2. To solve a different cities temperature do the filter.

34. Lab Assignment No: 3

Objective: To Understand and Implement Data Interpolation

1. To Draw 2-D random data.
2. To Draw Threshold of Human Hearing.

35. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

36. Lab Assignment No: 5

Objective: To Understand and Implement Fourier Analysis

1.To solve the use of the FFT, consider the problem of estimating the continuous Fourier transform of the signal

$f(t)=2e^{-3t}$ $t \geq 0$, where f(t) is gven by

$F(\omega)=2/(3+j\ \omega)$

2. To design sawtooth Waveform at arbitrary points.

37. Lab Assignment No: 6

Objective: To Understand and Implement Optimization

1. To solve 1-D minimization and maximization.
2. To design Rosenbrock's banana function.

38. Lab Assignment No: 7

Objective: To Understand and Implement Differential Equations

1. Design a van der Pol Solution.
2. To solve Jacobian matrix.

39. Lab Assignment No: 8

Objective: To Understand and Implement Two-Dimensional Graphics

1. To add new plots to an existing plot by using the hold command.
2. To create new Figure windows, use the figure command in the Command window or the **New Figure** selection from the **File** menu in the Command or Figure window.

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40. Lab Assignment No: 9

Objective: To Understand and Implement Three- Dimensional Graphics

1. Plot = 2 with 0 5in polar coordinates.
2. Design a Surface plot using the surf function.

41. Lab Assignment No: 10

Objective: To Understand and Implement Images, Movies, and Sound

1. To display 8-bit intensity and RGB images.
2. To convert between indexed images and movie frames.

42. Lab Assignment No: 11

Objective: To Understand and Implement Graphical User Interfaces

1. Using uigetfile to find the startup.m file on the author's computer.
2. Write a program using the function **guidata,** which stores and retrieves data in the GUI figure **'ApplicationData'** property.
3. How to put walls by clicking a mouse button to make an arbitrary maze.
4. Design a GUI System.

Books recommended:

TEXTBOOK

1. Duane Hanselman, bruce Littlefield, Mastering MATLAB 7, Reason edu., 2nd edition, 2008. **(T1)**
2. Sandeep Nagar, Introduction to MATLAB for Engineers and Scientists: Solutions for Numerical Computation and Modeling, APress, 2017. **(T2)**

REFERENCE BOOK

1. MATLAB Primer by MATHWORKS. **(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus:

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Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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CD5	Industrial visits/in-plant training
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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	3	2	1	2	1
CO4	3	3	2	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD7

Head of Department

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COURSE INFORMATION SHEET

Course code: IT510

Course title: JAVA PROGRAMMING

Pre-requisite(s):

Co- requisite(s): None

Credits: 2 L: 0 T: 0 P: 4

Class schedule per week: 04

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring JAVA.
2.	Knowledge of the structure and model of the Java programming language.
3.	Use the Java programming language for various programming technologies.
4.	To provide a foundation for Java programming language to solve the given problems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Write, compile, and execute Java programs that may include basic data types and control flow constructs using J2SE or other Integrated Development Environments (IDEs)
CO2	Write, compile, and execute Java programs manipulating Strings and text documents.
CO3	Write, compile, execute Java programs that include GUIs and event driven programming
CO4	Create Applets and GUI
CO5	Executing Client server and socket programming

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SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Objective: To Understand and Implement COLLECTION FRAMEWORK
   1. To create sparse matrices using the function sparse.
   2. To convert a sparse matrix to full matrix.
2. **Lab Assignment No: 2**
   Objective: To Understand and Implement Generic Programming
   1. Write the tasks performed by type erasure?
   2. Write a generic method to exchange the positions of two different elements in an array?
3. **Lab Assignment No: 3**
   Objective: To Understand and Implement REFLECTION
   1. Write a program that finds and displays inheritance hierarchy of a specified class?
   2. Write a program that shows all public fields of a specified class?
4. **Lab Assignment No: 4**
   Objective: GUI Development with Swing
   1. Working with Text Fields
   2. Working with Buttons
   3. Working with Lists
   4. Working with Scroll Panes
5. **Lab Assignment No: 5**
   Objective: Implementing Robust Geometric Primitives
   1. Java Program to Apply Above-Below-on Test to Find the Position of a Point with respect to a Line
   2. Java Program to Compute the Area of a Triangle Using Determinants
   3. Java Program to Compute the Volume of a Tetrahedron Using Determinants
   4. Java Program to Find the Area of any Polygon Using Triangulation
6. **Lab Assignment No: 6**
   Objective: To Understand and Implement examples on “Convex Hull”
   1. Java Program to Implement Graham Scan Algorithm to Find the Convex Hull
   2. Java Program to Implement Gift Wrapping Algorithm in Two Dimensions
   3. Java Program to Implement Jarvis March to Find the Convex Hull
7. **Lab Assignment No: 7**

   Objective: To Understand and Implement examples on “Nearest Neighbor Search”
   1. Java Program to Find the Nearest Neighbour Using K-D Tree Search
   2. Java Program to Find Nearest Neighbour Using Voronoi Diagram
8. **Lab Assignment No: 8**

   Objective: To Understand and Implement Network Programming
   1. Working with URLs
   2. Socket Server Programming
   3. Client Server Programming

Head of Department

9. Lab Assignment No: 9

Objective: To Understand and Implement SOCKET PROGRAMMING
1.Write a java socket program to get the resource http://www.google.com/index.html using HTTP protocol?
2. Write a program how do you get the IP address of a machine from its hostname?

10. Lab Assignment No: 10

Objective: To Understand and Implement Java Web Applications
1. Simple Servlet
2. Java Web Applications - Get Request
3. Java Web Applications - Post Request

11. Lab Assignment No: 11

Objective: To Understand and Implement Advanced Java Input/output (NIO)
1. File Copying With NIO
2. Working with Buffers
3. Working with File Data

Books recommended:

TEXTBOOKS

1. Uttam K Roy, Advanced JAVA Programming, Oxford University Press, 1st Edition, 2015 **(T1)**
2. HeerbertSchildt, Java: A Beginner's Guide, SeventhEdition,Oracle Press, 2014 **(T2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	3	2	2	2	2	1
CO4	3	2	3	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD7

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COURSE INFORMATION SHEET

Course code: IT511

Course title: R PROGRAMMING

Pre-requisite(s):

Co- requisite(s): None

Credits: 2 L: 0 T: 0 P: 4

Class schedule per week: 04

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring R
2.	Develop basic thinking for data analysis.
3.	To enable the student on how to approach for statistical Analysis
4.	To provide a foundation in use of this software

Course Outcomes

After the completion of this course, students will be able to:

CO1	Manipulate data within R
CO2	Perform basic data analysis procedures
CO3	Create plots
CO4	Implement programming features like accessing R packages, writing R functions
CO5	Simulation & Profiling with R

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SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To Understand and Implement Data Types

1. Data Types - R Objects and Attributes
2. Data Types - Vectors and Lists
3. Data Types - Matrices
4. Data Types - Factors
5. Data Types - Missing Values
6. Data Types - Data Frames
7. Data Types - Names Attribute
8. Data Types - Summary

2. **Lab Assignment No: 2**

Objective: To Understand and Implement Data Analysis

1. Reading Tabular Data
2. Reading Large Tables
3. Textual Data Formats
4. Connections: Interfaces to the Outside World
5. Subsetting - Basics
6. Subsetting - Lists
7. Subsetting - Matrices
8. Subsetting - Partial Matching
9. Subsetting - Removing Missing Values
10. Vectorized Operations
11.

3. **Lab Assignment No: 3**

Objective: To Understand and Implement Swirl

1. Workspace and Files
2. Sequences of Numbers
3. Vectors

4. **Lab Assignment No: 4**

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

5. **Lab Assignment No: 5**

Objective: To Understand and Implement Control Structures

1. If-else
2. Control Structures - For loops
3. Control Structures - While loops
4. Control Structures - Repeat, Next, Break

Head of Department

6. **Lab Assignment No: 6**

Objective: To Understand and Implement Functions

1. Functions (part 2)
2. Scoping Rules - Symbol Binding
3. Scoping Rules - R Scoping Rules
4. Scoping Rules - Optimization Example (OPTIONAL)

7. **Lab Assignment No: 7 &8**

Objective: To Understand and Implement Loop Functions and Debugging

1. Loop Functions - lapply
2. Loop Functions - apply
3. Loop Functions - mapply
4. Loop Functions - tapply
5. Loop Functions – split

8. **Lab Assignment No: 9 & 10**

Objective: To Understand and Implement Two-Dimensional Graphics

1. Generating Random Numbers
2. Simulation - Simulating a Linear Model
3. Simulation - Random Sampling

Books recommended:

TEXT BOOKS

1. Norman Matloff, The Art of R Programming, A Tour of Statistical Software Design 1st Edition, (**T1)**
2. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Orielly, 1st Edition. **(T2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	2	2	1	1	1
CO4	3	1	1	1	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD7

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Program Electives III

COURSE INFORMATION SHEET

Course code: CS605

Course title: HIGH PERFORMANCE COMPUTER ARCHITECTURE

Pre-requisite(s): Computer Architecture/Organization, Operating System, Parallel Computing

Co- requisite(s):

Credits:3 L:3 T:0 P:0

Class schedule per week: 03
Class: M. Tech

Semester / Level: III/6

Branch: Computer Science &Engineering

Course Objectives

This course enables the students to:

	To Explain different terminologies in High Performance Computer Architecture.
2	To introduce basic concepts of High-Performance Computer Architecture
3	Hands on the different parallel architectures in terms of various parameters.
4	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
5	Provide the students with practice on running complex problem in high performance computing machines.

Head of Department

Course Outcomes

After the completion of this course, students will be:

CO1	Describe different terminologies in High Performance Computer Architecture.
CO2	Demonstrate and Implement the concepts of High-Performance Computer Architecture
C03	Compare and differentiate the different parallel architectures in terms of various parameters.
CO4	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
CO5	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

SYLLABUS

Module I

Parallel Computer Models: The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

(8L)

Program and Network Properties: Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Module II

Program and Network Properties: Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

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(8L)

Module III

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

Module IV

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non-Linear Pipeline Processor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

(8L)

Module V

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques, Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Data Flow and Hybrid Architectures.

(8L)

Head of Department

Textbook:

1.Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010. **(T1)**

Reference Book:

1.Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA. **(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD5, CD7

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Program Elective II

COURSE INFORMATION SHEET

Course code: CS515
Course title: ADVANCED OPERATING SYSTEM
Pre-requisite(s): C/C++/Java Programming, Data Structure, Operating system
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Computer Science and Engg.
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Introducing the advance concepts of modern operating systems
2.	Illustrating various design issues in different environments
3.	Evaluating design choices with performance analysis
4.	Identifying thrust areas in research in operating systems

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand and implement basic services and functionalities of the operating system using system calls. .
CO2	Use modern operating system calls and synchronization libraries in software/ hardware interfaces.
CO3	Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.
CO4	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
CO5	Implement memory management schemes and page replacement schemes.

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SYLLABUS

Module I:
Introduction: History, Hardware Review, Types of Operating Systems, Operating System Concepts, System Calls, Operating System Structure, Research on Operating systems
(8L)

Module II:
Virtualization and Clouds: Requirements, Hypervisors, Techniques, Memory Virtualization, I/O Virtualization, Multicore CPUs, Clouds.
(8L)

Module III:
Multiple Processor Systems: Multiprocessors, Multicomputers, Distributed Systems, Research on Multiple Processor Systems
(8L)

Module IV:
Security: Security Problems, /controlling Access to Resources, Formal Models, Cryptography, Authentication, Exploiting Software, Attacks, Malwares, Defenses
(8L)

Module V:
Operating system Design: Design Problem, Interface Design, Implementation, Performance, Trends
(8L)

TEXT BOOKS:

1. Andrew S. Tanenbaum, Modern Operating Systems, 4th Edition, Pearson Education, 2014. **(T2)**

REFERENCE BOOKS:

2. William Stalling, Operating System: Internal and Design Principles, 8th Edition, Pearson International, 2014. **(R1)**
3. Silberschatz, Galvin, Gagne, Operating System Concepts, 10th Edition, Wiley, 2017. **(R2)**
4. D. M. Dhamdhare, Operating Systems, Tata McGraw Hill India, 2012. **(R3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Head of Department

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	1	1
CO5	2	2	2	3	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code:IT516

Course title: DATA MINING AND DATA ANALYSIS

Pre-requisite(s):

Co- requisite(s): None

Credits: 3 L: 3 T: 0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: II/5

Branch: Computer Science & Engg.

Name of Teacher:

Head of Department

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Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

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SYLLABUS

Module I:
Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.
(8L)

Module II:
Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.
(8L)

Module III:
Frequent Pattern Mining, Summarizing Item sets, Itemset Mining, Sequence Mining.
(8L)

Module IV:
Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.
(8L)

Module V:
Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.
(8L)

Text Books:

1. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016. **(T1)**
2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014. **(T2)**
3. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015. **(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code:CS517

Course title: DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS

Pre-requisite(s): Data Structure, Operating system

Co- requisite(s): None

Credits:3 L:3 T:0 P:0

Class schedule per week: 03

Class: M.Tech

Semester / Level:II/5

Branch: Computer Science & Engg.

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Course Objectives

1.	An implementation-oriented introduction to programming paradigms for parallel computers.
2.	Modelling, analysis and measurement of program performance.
3.	Description, implementation and use of parallel programming.
4.	Understanding parallel communication operations and use of library routines and applications.

Course Outcomes

After the completion of this course, students will:

CO1	Understand principles of parallel algorithms and describe the developments in the field of parallel computing.
CO2	Develop ability to compare the performance of different methods
C03	Demonstrate advanced knowledge of the elements of parallel programming
CO4	Analyse performance of parallel algorithms
CO5	Design and implement parallel algorithms

SYLLABUS

ModuleI:

Introduction to Parallel Computing: Scope of Parallel Computing, Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.

(8L)

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Module II:

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.

(8L)

Module III :

Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-toAll Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.

(8L)

Module IV :

Analytical Modelling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics.

(8L)

Module V:

Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators.

(8L)

Textbooks:

1. Ananth Grama, Anshul Gupta, Gorge Karypis, Vipin Kumar, Introduction to Parallel Computing, 2nd Edition, Pearson Education,2004. **(T1)**

Reference Book:

1. Michael J. Quinn, Parallel Computing: Theory and Practice, 2nd Edition, McGraw Higher Education, 2002. **(R1)**
2. Zbinieu J Czech, Introduction to Parallel Computing, 1st Edition, Cambridge University Press, 2017. **(R2)**
3. An Introduction to Parallel Programming, Peter Pacheco, 1st Edition, Morgan Kaufmann, 2011. **(R3)**

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	3	3	3	2	1
2	3	3	3	2	1	1
3	3	2	2	3	1	1
4	3	3	2	1	3	1
5	2	1	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD5, CD7

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PE LAB-2

COURSE INFORMATION SHEET

Course code:IT517

Course title: DATA MINING AND DATA ANALYSIS LAB

Pre-requisite(s):

Co- requisite(s): None

Credits: 2 L: 0 T: 0 P: 4

Class schedule per week: 04

Class: M. Tech

Semester / Level: II/5

Branch: Computer Science & Engg.

Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem-solving techniques for various datasets

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   . Build a Data Warehouseand Explore WEKA tool.

2. **Lab Assignment No: 2**

   . Demonstration of preprocessingon variousdatasets.

3. **Lab Assignment No: 3**

   Q3. Demonstration of Association rule process on dataset using apriori algorithm.

4. **Lab Assignment No: 4**

   Q4. Demonstrate performance of classification on various data sets.

5. **Lab Assignment No: 5**

   Q5. Demonstrate performance ofclustering on various data sets.

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6. **Lab Assignment No: 6**

   Q6. Demonstrate performance ofRegression on various data sets

7. **Lab Assignment No: 7**

   Q7. Implement following algorithms for various datasets

   G. Apriori Algorithm.
   H. FP-Growth Algorithm.
   I. K-means clustering.

8. Q8. **Lab Assignment No: 8**

   Implement Bayesian Classification for various datasets

9. **Lab Assignment No: 9**

   Q9 Implement Decision Tree for various datasets.

10. **Lab Assignment No: 10**

    Q10. Implement Support Vector Machines.

11. **Lab Assignment No: 11**

    Q11Applications of classification for web mining.

12. **Lab Assignment No: 12**

    Q12. Case Study on Text Mining or any commercial application

Head of Department

Books recommended:

TEXTBOOKS:

3. Jiawei Han &MichelineKamber - Data Mining Concepts & Techniques Publisher Harcout India. Private Limited. **(T1)**

REFERENCE BOOKS:

7. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006. **(R1)**
8. A. Berson& S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004. **(R2)**
9. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006. **(R3)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

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Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
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CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2		1
CO2	3	3	2		1	
CO3	2	3	2	1	1	1
CO4	3				1	1
CO5	3	2	1			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD7

COURSE INFORMATION SHEET

Course code:CS518

Course title: PARALLEL COMPUTING LAB.

Pre-requisite(s):

Co- requisite(s): None

Credits: 2 L: 0 T: 0 P: 4

Class schedule per week: 04

Class: B. Tech

Semester / Level: II/5

Branch: Computer Science &Engineering

Name of Teacher:

Head of Department

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Course Objectives

This course enables the students to:

1.	To describe benefits and applications of parallel computing.
2.	Explain architectures of multicore CPU, GPUs and HPC clusters, including the key concepts in parallel computer architectures, e.g. shared memory system, distributed system, NUMA and cache coherence, interconnection
3.	Understand principles for parallel and concurrent program design, e.g. decomposition of works, task and data parallelism, processor mapping, mutual exclusion, locks.
4.	write programs that effectively use parallel collections to achieve performance.
5.	To use large scale parallel machines to solve problems as well as discuss the issues related to their construction and use.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Reason about task and data parallel programs.
CO2	Express common algorithms in a functional style and solve them in parallel.
CO3	To analyse a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
CO4	Write parallel program using OpenMP, CUDA, MPI programming models.
CO5	Perform analysis and optimization of parallel program.

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SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Objective: To understand and Implement basic MPI program.
   Q1. Write a program that uses MPI and has each MPI process print
   'Hello world from process i of n' using the rank in MPI_COMM_WORLD for i and the size of MPI_COMM_WORLD for n.
   Q2. Write a parallel program to print any input message supplied by user.
2. **Lab Assignment No: 2**
   Objective: To Understand and Implement MPI program.
   Q1. Write a parallel program to add two one dimensional arrays of size 'n'.
   Q2. Write a parallel program to add two matrices of order n * n.
3. **Lab Assignment No: 3**
   Objective: To Understand and Implement MPI program.
   Q1. Write a parallel program to multiply two matrices.
   Q2. Write a parallel program to multiply a matrix of order n x n by a vector of size n.
4. **Lab Assignment No: 4**
   Objective: To Understand and Implement MPI program.
   Q1. Write a parallel Program to count the no. of vowels in a text.
   Q2. Write a parallel program to find the largest element of n elements.
5. **Lab Assignment No: 5**
   Objective: To Understand and Implement MPI program.
   Q1. Write a parallel program to count no. of characters, words and lines in a file.
   Q2. Write a parallel program to find factorial value of an integer.
6. **Lab Assignment No: 6**
   Objective: To Understand and Implement MPI program.
   Q1. Write a parallel program to find the transpose of a given Matrix.
   Q2. Write a parallel program to implement ring topology.
7. **Lab Assignment No: 7**
   Objective: To Understand and Implement MPI program.
   Q1. Write a parallel program to find the largest and the second largest from a list of elements considering minimum no. of comparisons.
   Q2. Write a parallel program to sort n elements, using any sorting technique.
8. **Lab Assignment No: 8**
   Objective: To Understand and Implement MPI program.
   Q1. Write a parallel program to solve a set of linear equations using gauss elimination method.
   Q2. Write a parallel program to find the inverse of a given matrix of n*n order.

Head of Department

9. Lab Assignment No: 9

Objective: To Understand and Implement MPI program.

Q1. Write a parallel program to find minimal path (minimal cost) in an undirected graph.

Q2. Write a parallel program to find roots of an equation using N-R method.

Books recommended:

TEXTBOOKS

5. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Introduction to Parallel Computing (2nd Edition). **(T1)**
6. Edition), PDF, Amazon, cover theory, MPI and OpenMP introduction Recommended: John Cheng, Max Grossman, and Ty McKercher, Professional CUDA C Programming, 1st Edition 2014. **(T2)**

REFERENCE BOOKS

3. Barbara Chapman, Gabriele Jost, and Ruud van der Pas, Using OpenMP: Portable Shared Memory Parallel Programming, 2007. **(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	2	1	1	3					
CO2	2	1	1	1	3			3		
CO3	1	2	3	3	3					
CO4		1	1	3	2					1
CO5	1	1	2	2				2		3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD7

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COURSE INFORMATION SHEET

Course code: CS516
Course title: ADVANCED OPERATING SYSTEM LAB
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/5
Branch: Computer Science &Engineering

Name of Teacher:

Course Objectives
This course enables the students to:

1.	Gain practical experience with designing and implementing concepts of operating systems such as system calls.
2.	Implement and develop CPU scheduling.
3.	Implement and understand process management, memory management.
4.	To provide a foundation in use of file systems and deadlock handling using C language in Linux environment.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Understand and implement basic services and functionalities of the operating system using system calls. .
CO2	Use modern operating system calls and synchronization libraries in software/ hardware interfaces.
CO3	Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.
CO4	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
CO5	Implement memory management schemes and page replacement schemes.

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SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Objective: To Understand and Implement Directory Structure
   Q1. WAP to create a File directory system.
2. **Lab Assignment No: 2**
   Objective: To Understand and Implement Scheduling processes
   Q1. WAP to schedule various processes
3. **Lab Assignment No: 3**
   Objective: To Understand and Implement FCFS
   Q1. WAP to implement FCFS CPU Scheduling
4. **Lab Assignment No: 4**
   Objective: To Understand and Implement SJF
   Q1. WAP to implement SJF CPU scheduling.
5. **Lab Assignment No: 5**
   Objective: To Understand and Implement SRTF
   Q1.WAP to implement SRTF CPU scheduling.
6. **Lab Assignment No: 6**
   Objective: To Understand and Implement Scheduling algorithms
   Q1. WAP to implement Round Robin Scheduling
7. **Lab Assignment No: 7**
   Objective: To Understand and Implement Scheduling algorithms
   Q1 WAP to implement SRTF scheduling.
8. **Lab Assignment No: 8**
   Objective: To Understand and Implement context switching
   Q1. WAP to implement Round Robin Scheduling with context switching.
9. **Lab Assignment No: 9**
   Objective: To Understand and Implement context switching.
   Q1.WAP to implement SRTF with context switching.
10. **Lab Assignment No: 10**
    Objective: To Understand and Implement Page Replacement Techniques
    Q1. WAP to implement FCFS page replacement algorithm.
    Q2. WAP to implement Optimal page replacement algorithm.

Books recommended:

Textbooks:

1. Operating System Concepts (2012): Abraham Silberschatz Yale University PETER BAER GALVIN Pluribus Networks GREG GAGNE Westminster College. **(T1)**
2. Operating Systems (2003) by Deitel, Deitel, and Choffnes. (**T2**)

Head of Department

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real-world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	2
CO2	2	3	3	3	3	2
CO3	3	2	2	1	1	1
CO4	3	3	3	2	3	1
CO5	2	2	2	2	1	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD4
CO2	CD1, CD2, CD5
CO3	CD1, CD2
CO4	CD1, CD3, CD5
CO5	CD1, CD2

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PE – 3

COURSE INFORMATION SHEET

Course code: CS605

Course title: HIGH PERFORMANCE COMPUTER ARCHITECTURE

Pre-requisite(s): Computer Architecture/Organization, Operating System, Parallel Computing

Co- requisite(s):

Credits:3 L:3 T:0 P:0

Class: M. Tech

Semester / Level: II/6

Branch: Computer Science &Engineering

Course Objectives

This course enables the students to:

1.	To Explain different terminologies in High Performance Computer Architecture.
2.	To introduce basic concepts of High Performance Computer Architecture
3.	Hands on the different parallel architectures in terms of various parameters.
4.	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
5.	Provide the students with practice on running complex problem in high performance computing machines.

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Course Outcomes

After the completion of this course, students will be:

CO1	Describe different terminologies in High Performance Computer Architecture.
CO2	Demonstrate and Implement the concepts of High Performance Computer Architecture
C03	Compare and differentiate the different parallel architectures in terms of various parameters.
CO4	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
CO5	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

SYLLABUS

Module I:

Parallel Computer Models : The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

(8L)

Module II:

Program and Network Properties : Conditions for Parallelism, Program Partitioning and Scheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

(8L)

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Module III:

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

Module IV:

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear Pipeline Processor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

(8L)

Module V:

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques, Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.

(8L)

TEXT BOOK:

1. Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010. **(T1)**

REFERENCE BOOK:

1. Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA. **(R1)**

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Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD5, CD7

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COURSE INFORMATION SHEET

Course Code: IT508
Course title: CLOUD COMPUTING
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students to:

1.	Understand about security requirements in cloud.
2.	Learn about infrastructure security at different levels
3.	Know about management standards of cloud security
4.	Develop and Apply trust-based security model to different layers

Course Outcomes

After the completion of this course, students will be able to:

CO1	Identify security aspects of each cloud model
CO2	Implement a public cloud instance using a public cloud service provider
CO3	Apply trust-based security model to different layer
CO4	Develop a risk-management strategy for moving to the Cloud
CO5	Identify various research domain of cloud computing

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SYLLABUS

Module I:

Introduction: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

(8L)

Module II:

Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.

(8L)

Module III:

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

(8L)

Module IV:

Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS, Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.

(8L)

Head of Department

Module V:

Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud, Recent developments in hybrid cloud and cloud security.

(8L)

Textbooks:

1. John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises", Publication Date: November 2, 2009. **(T1)**
2. Tim Mather, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)", ISBN-10: 0596802765, O'Reilly Media, September 2009. **(T2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	1	1
CO2	3	3	3	2	1	1
CO3	3	2	2	1	1	1
CO4	3	2	1	1	1	1
CO5	1	2	3	1	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

COURSE INFORMATION SHEET

Course code: IT518

Course title: INTERNET OF THINGS

Pre-requisite(s):

Co-requisite(s):

Credits:3 L:3 T:0 P:0

Class schedule per week: 03

Class: M. Tech

Semester / Level: III/05

Branch: Computer Science &Engineering

Course Objectives

This course enables the students:

1.	Understand the basic concept and the IOT Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Head of Department

Course Outcomes

After the completion of this course, students will be:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
C03	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

ModuleII:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

ModuleIII:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

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ModuleIV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN, Transport Layer TCP, MPTCP, UDP, DCCP,

Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

ModuleV:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

(8L)

Books recommended:

TEXTBOOK

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. **(T1)**
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

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POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
D4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
C03	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD5, CD7

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PE LAB-3

COURSE INFORMATION SHEET

Course code: IT519

Course title: INTERNET OF THINGS LAB

Pre-requisite(s):

Co-requisite(s):

Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04

Class: M. Tech

Semester / Level: I/05

Branch:Computer Science & Engg.

Course Objectives

This course enables the students:

1.	Understand the basic concept and the IoT Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes

After the completion of this course, students will be:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
C03	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

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SYLLABUS

List of Programs as Assignments:

23. **Lab Assignment No: 1**
    Glowing LEDs.
    Toggling LED's.
24. **Lab Assignment No: 2**
    Transmitting a string through UART
    Controlling LEDs blinking pattern through UART.
25. **Lab Assignment No: 3**
    Echo each character typed on HyperTerminal
    Digital IO configuration.
    Timer based LED Toggle.
26. **Lab Assignment No: 4**
    Scanning the available SSID's in the range of Wi-FI Mote.
    Connect to the SSID of choice
27. **Lab Assignment No: 5**
    Demonstration of a peer to peer network topology.
    check the connectivity to any device in the same network.
28. **Lab Assignment No: 6**
    Send hello world to TCP server existing in the same network
    Reading of atmospheric pressure value from pressure sensor.
29. **Lab Assignment No: 7**
    I2C protocol study
    Reading Temperature and Relative Humidity value from the sensor.
    Reading Light intensity value from light sensor.
30. **Lab Assignment No: 8**
    Proximity detection with IR LED.
    Generation of alarm through Buzzer.
31. **Lab Assignment No: 9**
    Timestamp with RTC
    IO Expander.
    Relay control.
32. **Lab Assignment No: 10**
    I2C based 12-channel ADC
    EEPROM read and write
33. **Lab Assignment No: 11**
    Transmitting the measured physical value from the UbiSense Over the Air.

Head of Department

Textbooks:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014. **(T1)**

4. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(T2)**

Reference books:

4. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**

Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:" **(R2)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

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Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
D4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
C03	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD5, CD7

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COURSE INFORMATION SHEET

Course code:IT603

Course title: PYTHON PROGRAMMING LAB

Pre-requisite(s):

Co- requisite(s): None

Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04

Class:

Semester / Level: III/6

Branch: Computer Science and Engg.

Name of Teacher:

Course Objectives

This course enables the students to:

1.	To introduce with fundamentals and grammar of Python programming.
2.	To understand and be able to use basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
3.	To learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
4.	To understand the process and skills necessary to effectively attempt a programming problem and implement it with a specific programming language -- Python.
5.	To understand a python program written by someone else and be able to debug and test the same.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	To use their problem-solving abilities to implement programs in Python.
CO2	To apply Python in software development, testing and systems administration environments.
CO3	To develop Python applications for a variety of uses
CO4	To understand the fact that there is more than one right solution to a problem.
CO5	Work in industry environment with good enough knowledge about Python programming.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Objective: To Implement basic Python programming.

   Q1. Create a new program called hello world.py. Use this file to write your very First "Hello, world!" program.

   Q2. Write a Python program containing exactly one print statement that produces the following output:

   A
   B
   C
   D
   E
   F

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2. Lab Assignment No: 2

Objective: To Understand and Implement the concept of if-else-if statements.

Q1. Write a Python program that requests five integer values from the user. It then prints one of two things: if any of the values entered are duplicates, it prints "DUPLICATES"; otherwise, it prints "ALL UNIQUE".

Q2. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. Each binary digit should be entered one per line, starting with the leftmost digit, as shown below.

Enter leftmost digit: 1
Enter the next digit: 0
Enter the next digit: 0
Enter the next digit: 1
The value is 9

Q3. Develop and test a program that prompts the user for their age and determines approximately how many breaths and how many heartbeats the person has had in their life. The average respiration (breath) rate of people changes during different stages of development. Use the breath rates given below for use in your program:

	Breaths per Minute
Infant	30–60
1 –4 years	20–30
5 –14 years	15–25
adult	12–20

For heart rate, use an average of 67.5 beats per second.

3. Lab Assignment No: 3

Objective: To Understand and Implement the flow control statements.

Q1. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4... 1/10.

Q2. Write a program using a for loop that calculates exponentials. Your program should ask the user for a base ‘b’ and an exponent ‘exp’, and calculate b^exp.

Q3. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user input? a negative number? As a programmer, you should always consider “edge conditions” like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don’t include a condition that catches negative numbers, what will your program do?)

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4. Lab Assignment No: 4

Objective: To practice drawing patterns

Q1. Write the program to print the following pattern: ex if the user enters 7, the program will print

```
    *
   **
  ***
 ****
*****
******
*******
******
*****
 ****
  ***
   **
    *
```

Q2. Write a program in python to print the following pattern:

```
          1
         1 1
        121
 1331
      12641
 15101051
1615201561
```

5. Lab Assignment No: 5

Objective: To Understand and Implement methods in Python.

Q1. Write a method fact that takes a number from the user and prints its factorial.

Q2. Write a Python function named compare3 that is passed three integers and returns true if the three integers are in order from smallest to largest, otherwise it returns false.

Q3. Write a python function named modCount that is given a positive integer and a second positive integer, m<=n, and returns how many numbers between 1 and n are evenly divisible by m.

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6. **Lab Assignment No: 6**
   Objective: To Understand and Implement the concept of Recursion
   Q1. Write a program to read an integer number. Print the reverse of this number using recursion.
   Q2. Write a program that calculates the GCD using recursive functions.
7. **Lab Assignment No: 7**
   Objective: To Understand and Implement Sorting techniques
   Q1. Write a program to sort the list of elements using Insertion sort.
   Q2. Write a program to sort the list of elements using Merge sort.
   Q3. Write a program to multiply the two matrices.
8. **Lab Assignment No: 8**
   Objective: To Understand and Implement the concept of Strings in Python
   Q1. Write a program to check whether string is a palindrome or not.
   Q2. Write a program to implement format method available with string object.
9. **Lab Assignment No: 9**
   Objective: To Understand and Implement Dictionary
   Q1. Program to demonstrate the built-in functions within the dictionary.
   Q2. Program to implement dictionary as an associative array
10. **Lab Assignment No: 10**
    Objective: To Understand and Implement File Handling.
    Q1. Program to open the file in the read mode and use of for loop to print each line present in the file.
    Q2. Write a Python program to illustrate Append vs write mode.
    Q3. Write a Program to read and write data from a file.

Books recommended:

TEXTBOOKS

1. Krishna P. R., Object Oriented Programming through JAVA, 1st Edition, Universities Press, 2008. **(T1)**
2. Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi. **(T2)**
3. Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi. **(T3)**

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REFERENCE BOOKS

1. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi. **(R1)**
2. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi. **(R2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	1	3	
CO2	2	1	1	1	3	
CO3	1	2	3	3	3	
CO4		1	1	3	2	
CO5	1	1	2	2		

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD7

COURSE INFORMATION SHEET

Course code:IT604

Course title: WEB APP DEVELOPMENT LAB

Pre-requisite(s):

Co- requisite(s): None

Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04

Class:

Semester / Level: III/6

Branch: Computer Science & Engg.

Name of Teacher:

Course Objectives

This course enables the students to:

1.	To get familiar with basics of the Internet Programming.
2.	To acquire knowledge and skills for creation of web site considering both client and server-side programming
3.	To gain ability to develop responsive web applications
4.	To explore different web extensions and web services standards

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Course Outcomes
After the completion of this course, students will be able to:

CO1	Analyze a web page and identify its elements and attributes.
CO2	Implement interactive web page(s) using HTML, CSS and JavaScript.
CO3	Demonstrate Rich Internet Application.
CO4	Build Dynamic web sites using server-side Programming and Database connectivity.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Objective: To Understand and Implement HTML
   Q1. To create a simple html file to demonstrate the use of different tags.
   Q2. To create an html file to link to different html page which contains images, tables, and also link within a page.
   Q3. To create an html page with different types of frames such as floating frame, navigation frame & mixed frame.
   Q4. To create a registration form as mentioned below.
   Create an html page named as "registration.html"
   a) set background colors
   b) use table for alignment
   c) provide font colors & size
2. **Lab Assignment No: 2**
   Objective: To Understand and Implement CSS
   Q1. To create an html file by applying the different styles using inline, external & internal style sheets.
   1. Create an external style sheet named as "external_css.css" and provide some styles for h2, hr, p & a tags.
   2. Create an html file named as "Style_sheet.html"

   a) Include the external style sheet with necessary tag.

   b) Include the internal style sheet for body tags & also use class name, so that the style can be applied for all tags.

   c) Include a tag with inline style sheet.

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3. **Lab Assignment No: 3**

Objective: To Understand and Implement JavaScript

Q1. To write a Javascript program to define a user defined function for sorting the values in an array.

Q2. Create an html page named as "exception.html" and do the following.

1. within the script tag write code to handle exception

a) define a method RunTest() to get any string values(str) from the user and cll the method Areletters(str).

b) In Areletters(str) method check whether str contain only alphabets (a-z, AZ), if not throw exception.

c) Define an exception method Input Exception(str) to handle the exception thrown bythe above method.

2. Within the body tag define a script tag to call Runtest() method defined.

Q3. To display the calendar using javascript code by getting the year from the user.

Q4. To create a html page to display a new image & text when the mouse comes over the existing content in the page.

4. **Lab Assignment No: 4**

Objective: To Understand and Implement ASP

Q1. To create an ASP file to find the no of hits on the page and to have rotating banner content.

Q2. To create a table of content using ASP program & navigate within the pages.

Q3. Create an ASP file named as request.asp

a) Create a simple form to get the first name & last name and a button submit. When the button is clicked the values in the text box are printed by response object by Request.QueryString

b) Create a hyperlink with some values defined in the tag & display the same using request & response object.

Q4. To display all the content in the database using ASP program.

Lab Assignment No: 5

Objective: To Understand and Implement Java Servlets

Q1. To create a simple servlet program to display the date (using Tomcat server).

Q2. To create a servlet program to retrieve the values entered in the html file (Using NetBeans IDE).

Q3. To display the cookie values that are entered in the html page using servlet program. (using NetBean IDE).

Lab Assignment No: 6

Objective: To Understand and Implement XML

Q1. To create a simple catalog using XML file

Q2. To create external style sheet and using the style sheet in xml file.

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Lab Assignment No: 7

Objective: To Understand and Implement PHP

Q1. To create a php program to demonstrate the different file handling methods.

Q2. To create a php program to demonstrate the different predefined function in array, Math, Data & Regular Expression.

Books recommended:

TEXTBOOKS

1. Web Technologies: A Computer Science Perspective, Jeffrey C Jackson, Pearson Education , India. **(T1)**
2. Stephen Wynkoop, Running a perfect website, QUE, 1999. **(T2)**

REFERENCE BOOKS

1. Eric Ladd, Jim O' Donnel, Using HTML 4, XML and Java, Prentice Hall of India-QUE, 1999 **(R1)**

2. Chris Bates, Web Programming - Building Intranet applications, Wiley Publications, 2004 **(R2)**

3. Deitel, Deitel & Nieto, Internet and World Wide Web - How to Program, Pearson Education Asia, 2000. **(R3)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real-world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		3			2	
CO2	1	3	3		1	2
CO3	2		1	2	2	1
CO4	1	3	3		1	

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3
CO2	CD2, CD3, CD6
CO3	CD1, CD2, CD3, CD6
CO4	CD3, CD6, CD7

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OPEN ELECTIVES I

COURSE INFORMATION SHEET

Course code: CS514

Course title: SOFTWARE METRICS

Pre-requisite(s): Software Engineering, Software Testing

Co- requisite(s):

Credits: 3 L:3 T:0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

After the completion of this course, students will be:

1.	Provide a basic understanding and knowledge of the software metrics.
2.	Understand the importance of Metrics data collection.
3.	Analysis and Metrics for object-oriented systems.
4.	Understand external product attributes, Dynamic Metrics and Resource measurement.

Course Outcomes

After the completion of this course, students will be:

CO1	Able to understand the importance of the software development process.
CO2	Analyze the importance of modelling and modelling language.
C03	Design and develop correct and robust software products.
CO4	Explain the business requirements pertaining to software development.
CO5	Design Metrics for object-oriented systems.

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SYLLABUS

ModuleI:

Basics of measurement: Measurement in software engineering Scope of software metrics Representational theory of measurement Measurement and models Measurement scales Meaningfulness in measurement Goal-based framework for software measurement Classifying software measures Determining what to measure Software measurement validation Empirical investigation Types of investigation Planning and conducting investigations.

(8L)

ModuleII:

Measuring size, Aspects of software size Length, functionality and complexity Measuring structure Types of structural measures Control-flow structure Modularity and information flow attributes Data structures.

(8L)

ModuleIII:

Modeling software quality Measuring aspects of software quality Software reliability Basics of software reliability Software reliability problem Parametric reliability growth models Predictive accuracy Recalibration of software-reliability growth predictions Importance of operational environment Wider aspects of software reliability.

(8L)

ModuleIV:

The intent of object-oriented metrics Distinguishing characteristics of object-oriented metrics Various object-oriented metric suites LK suite CK suite and MOOD metrics

Runtime Software Metrics Extent of Class Usage Dynamic Coupling Dynamic Cohesion and Data Structure Metrics.

(8L)

ModuleV:

The intent of component-based metrics, Distinguishing characteristics of comp.

Measuring productivity, teams, tools, and methods.

(8L)

Head of Department

Books recommended:

Textbook

1. "Software Metrics: A rigorous and Practical Approach" by Norman E. Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 2nd Edition, 1997. **(T1)**
2. "Applied Software Measurement" by Capers Jones, McGraw Hill, 2008. **(T2)**

Reference Book

1. "Object-Oriented Software Metrics" by Mark Lorenz, Jeff Kidd, Prentice Hall, 1994. **(R1)**
2. "Practical Software Metrics for Project Management And Process Improvement" by Robert B Grady, Hewlett Packard Professional Books, 1st Edition, 2004. **(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	2	2	3	1	1	1
CO3	1	3	3	2	2	2
CO4	3	3	3	2	1	1
CO5	2	1	3	3	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS522

Course title: PATTERN RECOGNITION AND APPLICATION

Pre-requisite(s): Linear Algebra, Vector Calculus, Data Structure& Programming

Co- requisite(s):

Credits: 3 L: 3 T: 0 P: 0

Class schedule per week: 03

Class: M.Tech

Semester / Level:I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students to:

1.	Be familiar with both the theoretical and practical aspects Pattern Recognition.
2.	Have described the foundation of pattern formation, measurement, and analysis.
3.	Understand the mathematical and computer aspects of while extracting features of an object.
4.	Learn the techniques of clustering and classification for various applications.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
CO2	Solve Decision-making model using Statistical and Mathematical Decision Theory.
CO3	Design clusters for various Pattern using classical and Modern clustering techniques.
CO4	Analyzing various Techniques for Pattern Classification and Clustering.
CO5	Develop Model for Pattern classification through Probabilistic or fuzzy.

SYLLABUS

Module I:

Introduction: Feature Vectors, Classifiers, Supervised, Unsupervised, MATLAB Tools. Classifiers Based on Bayesian Theory, Linear Classifiers, Nonlinear Classifiers.

(8L)

ModuleII:

Feature Selection, Feature Generation I: Data Transformation and Dimensionality Reduction, Feature Generation II.

(8L)

Module III:

Template Matching, Context Dependent Classification, Super vised Learning.

(8L)

Module IV:

Clustering Basic Concepts, sequential Algorithms.

(8L)

ModuleV:

Hierarchical algorithms, Fuzzy clustering, probabilistic clustering, Hard Clustering, Optimization.

Head of Department

(8L)

Books recommended:

TEXT BOOK

1. "Pattern Recognition" by S Theodoridis, K Koutroumbas, Elsevier, 5thEdition, 2015. **(T1)**
2. "Pattern Recognition" by N NarshimaMurty, Springer, University press, 2nd Edition, 2015. **(T2)**

REFERENCE BOOK

1. R.O. Duda et.al,"Pattern Classification", 2ndEdition, John Wiley, New York, 2002. **(R1)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT518
Course title: INTERNET OF THINGS

Pre-requisite(s):

Co-requisite(s):

Credits: 3 L:3 T:0 P:0

Class schedule per week: 03

Class: M. Tech

Semester / Level: I/5

Branch: Computer Science and Engineering

Name of Teacher:

Course Objectives

This course enables the students to:

1.	Understand the basic concept and the IoT Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
CO3	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

ModuleII:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

ModuleIII:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

ModuleIV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN, Transport Layer TCP, MPTCP, UDP, DCCP,

Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

Head of Department

Module V:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

(8L)

Books recommended:

TEXTBOOK

3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. **(T1)**
4. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
4. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT570

Course title: **Basics of Python programming**

Pre-requisite(s):

Co- requisite(s):

Credits: L: 0 T:1 P:2

Class schedule per week: 1

Class: M. Tech

Semester / Level:

Branch:

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Course Objectives

This course enables the students:

1.	To facilitate skills required to Install and run the Python interpreter
2.	To facilitate skills required to Create and execute Python programs
3.	To introduce the Understanding the concepts offile I/O
4.	To provide skills to read data from a text file using Python
5.	To discover the interesting patterns using appropriate Python visualization libraries

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Understand how to convert the problems into algorithms
2.	Analyse and develop the algorithms to Python programs.
3.	Design programs with Interactive Input and Output, utilizing arithmetic expression repetitions, decision making, arrays.
4.	Develop modular Python programs using functions
5.	Design programs using file Input and Output.

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Syllabus

Module I

Problem Analysis-Formal Definition of a Problem, Algorithms, Flowcharts, Examples for Algorithms and Flowcharts

Introduction to Python- Variables, Operators, Expressions, Evaluation of Expressions, String Operations, Input and Output functions

Module II

Control Statements- Decision making statements, Iterative Statements, Loop Control Statements

Strings and Lists- String Operations, Tuples and Dictionaries-Operations and Examples

Module III

Functions- Function Definition and Call, Mathematical functions, User defined Functions, Parameters and Arguments, Type Conversion and Coercion

Module IV

Files – Different File Operations, File Object Attributes, Directories

Exceptions- Except clause, Exception with arguments, Raising an Exception, User Defined Exceptions

Module V

Introduction to Classes and Objects- Object Oriented Features, Attributes, Instances, Garbage Collection

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SYLLABUS

List of Programs as Assignments:

43. Lab Assignment No: 1

Objective: ToImplement basic Python programming.

Q1. Create a new program called hello world.py. Use this file to write your very First "Hello, world!" program.

Q2. Write a Python program containing exactly one print statement that produces the following output:

A
B
C
D
E
F

44. Lab Assignment No: 2

Objective: To Understand and Implement the concept of if-else-if statements.

Q1.Write a Python program that requests five integer values from the user. It then prints one of two things: if any of the values entered are duplicates, it prints "DUPLICATES"; otherwise, it prints "ALL UNIQUE".

Q2. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. Each binary digit should be entered one per line, starting with the leftmost digit, as shown below.

Enter leftmost digit: 1
Enter the next digit: 0
Enter the next digit: 0
Enter the next digit: 1
The value is 9

Q3.Develop and test a program that prompts the user for their age and determines approximately how many breaths and how many heartbeats the person has had in their life. The average respiration (breath) rate of people changes during different stages of development. Use the breath rates given below for use in your program:

	Breaths per Minute
Infant	30–60
1 –4 years	20–30
5 –14 years	15–25
adult	12–20

For heart rate, use an average of 67.5 beats per second.

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45. Lab Assignment No: 3

Objective: To Understand and Implement the flow control statements.

Q1. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4... 1/10.

Q2. Write a program using a for loop that calculates exponentials. Your program should ask the user for a base 'b' and an exponent 'exp', and calculate b^exp.

Q3. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user input a negative number? As a programmer, you should always consider "edge conditions" like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don't include a condition that catches negative numbers, what will your program do?)

46. Lab Assignment No: 4

Objective: To practice drawing patterns

Q1.Write the program to print the following pattern: ex if the user enters 7, the program would print

```
   *
  **
 ***
****
*****
******
*******
******
*****
****
***
**
*
```

Q2.Write a program in python to print the following pattern:

```
          1
         1 1
         121
1331
        12641
15101051
1615201561
```


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47. Lab Assignment No: 5

Objective: To Understand and Implement methods in Python.

Q1.Write a method fact that takes a number from the user and prints its factorial.

Q2. Write a Python function named compare3 that is passed three integers and returns true if the three integers are in order from smallest to largest, otherwise it returns false.

Q3. Write a python function named modCount that is given a positive integer and a second positive integer, m<=n, and returns how many numbers between 1 and n are evenly divisible by m.

48. Lab Assignment No: 6

Objective: To Understand and Implement the concept of Recursion

Q1. Write a program to read an integer number. Print the reverse of this number using recursion.

Q2. Write a program that calculates the GCD using recursive functions.

49. Lab Assignment No: 7

Objective: To Understand and Implement Sorting techniques

Q1. Write a program to sort the list of elements using Insertion sort.

Q2. Write a program to sort the list of elements using Merge sort.

Q3.Write a program to multiply the two matrices.

50. Lab Assignment No: 8

Objective: To Understand and Implement the concept of Strings in Python

Q1. Write a program to check whether string is a palindrome or not.

Q2. Write a program to implement format method available with string object.

51. Lab Assignment No: 9

Objective: To Understand and Implement Dictionary

Q1. Program to demonstrate the built in functions within the dictionary.

Q2. Program to implement dictionary as an associative array

52. Lab Assignment No: 10

Objective: To Understand and Implement File Handling.

Q1. Program to open the file in the read mode and use of for loop to print each line present in the file.

Q2. Write a Python program to illustrate Append vs write mode.

Q3. Write a Program to read and write data from a file.

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Text book:

1. Downey A.,How to think like a computer scientist: Learning with Python.

Reference books:

1.JoseJeeva, Taming Python by Programming, Khanna Publishing House.

2. Jose J. Introduction to Computing and Problem Solving with Python, (ISBN: 978-93-82609-810).

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	3
CO2	3	3	2	2	1	3
CO3	2	2	2	1	2	1
CO4	3	1	1	3	2	2
CO5	3	2	1	3	1	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT522

Course title: CYBER SECURITY AND DIGITAL FORENSICS

Pre-requisite(s): Computer Basics, Programming and Problem solving

Co-requisite(s):

Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech.
Semester / Level: I/5
Branch: Computer Science and Engineering
Name of Teacher:

Course Objectives

This course enables the students:

1.	Know about computer-based crime.
2.	Understand Technical and legal aspects of computer crime investigations
3.	Know the limitations of law and its enforcement agencies.
4.	Learn the procedures of recovering computer evidence and seize process.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Exposure on computer-based crime.
CO2	Technical and legal aspects of computer crime investigations
C03	Know the limitations of law and its enforcement agencies.
CO4	Learn the procedures of recovering computer evidence and seize process.
CO5	Apply techniques for finding, preserving, presenting, and extracting information from the digital devices.

SYLLABUS

Module I:

Introduction: Cyberspace and Criminal Behavior, Traditional problems associated with computer-based crime, e cash problems, Computer Technology and History: Computer Language, Hardware, software, operating system, Internet, Network language.

(8L)

ModuleII:

Early Hackers and Theft Components: Phreakers, Hacking, Commodities, Intellectual property.

Contempory computer crime: web based criminal activity, money laundering,

(8L)

Module III:

Identity theft and identity fraud: Typologies of internet theft, virtual identity, credit identity. Prevalence and victimology, physical methods, of identity theft, phishing, spyware, trojans, insurance and loan fraud, immigration fraud. Terrorism and organized crime:Terror online, criminal activities, organized crime as cyber gangs., technology used in organized crime. Data piracy.

(8L)

Module IV:

Avenues for Prosecution and Government efforts: Act, Law enforcement agencies, International efforts, Cyber law and its amendments of current state, other legal considerations.

(8L)

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ModuleV:

Forensic Terminologies and Developing forensic capabilities, Searching and seizing computer related evidence, Processing of evidence and report preparation.

(8L)

Books recommended:

TEXT BOOK

1. "Computer Forensics and Cyber Crime" by M.T.Britz, Pearson Education, First Impression, 2012.**(T1)**
2. "Computer Crime and investigation" by E Casey, Springer, 1st Edition, 2001. **(T2)**

REFERENCE BOOK

1. "Computer Crime Investigations and Law" by C Easttom& D.J.Taylor, Carenage Learning. **(R1)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	2	1
CO2	3	3	3	1	1	1
CO3	3	3	3	2	1	1
CO4	2	3	2	2	2	1
CO5	2	3	2	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD4, CD5,CD7

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OPEN ELECTIVE-II

COURSE INFORMATION SHEET

Course code: IT523

Course title: BIOMETRIC SECURITY

Pre-requisite(s):

Co- requisite(s):

Credits:3 L:3 T:0 P:0

Class schedule per week: 03

Class: M. Tech

Semester / Level: II/5

Course Objectives

This course enables the students to:

1.	To understand the brief functioning of biometric system.
2.	To know the different types of biometric and their accuracy.
3.	To increase the likelihood that biometric technologies, when deployed, will be as protective of personal and informational privacy as possible.
4.	To raise awareness of privacy issues for end users and for students.
5.	To increase security of the system as well as data.

Course Outcomes

After the completion of this course, students will be able to:

1.	Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2.	Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
3.	Developing new advanced authentication algorithms.
4.	Analyze the accurate discrimination between individuals.
5.	Illustrate the two-factor authentication system.

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SYLLABUS

Module I:

Biometrics- Introduction- benefits of biometrics over traditional authentication systems -benefits of biometrics in identification systems-selecting a biometric for a system –Applications - Key biometric terms and processes - biometric matching methods -Accuracy in biometric systems.

(8L)

Module II:

Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern.

(8L)

Module III :

Technical description – characteristics - strengths – weaknesses – deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.

(8L)

Module IV:

signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.

(8L)

Module V:

Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation plan.

(8L)

TEXT BOOKS :

1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi: “Biometrics -Identity verification in a network”, 1st Edition, Wiley Eastern, 2002. **(T1)**
2. John Chirillo and Scott Blaul : “Implementing Biometric Security”, 1st Edition, Wiley Eastern Publication, 2005. **(T2)**

Head of Department

REFERENCE BOOKS :

1. John Berger: "Biometrics for Network Security", 1st Edition, Prentice Hall, 2004. **(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Head of Department

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	3	3	3	2	1
2	3	3	3	2	1	1
3	3	2	2	3	1	1
4	3	3	2	1	3	1
5	2	1	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT504

Course title: APPLIED CRYPTOGRAPHY

Pre-requisite(s):

Co- requisite(s):

Credits:3 L:3 T:0 P:0

Class schedule per week: 03

Class: M. Tech

Semester / Level: II/5

Branch: Computer Science &Engineering

Course Objectives

This course enables the students:

1	To understand the foundations of cryptographic attacks.
2	To gain knowledge of encrypting data, and to choose between different algorithms.
3	Prepare students for research in the area of cryptography and enhance student's communication and problem-solving skills
4	To differentiate between the encryption techniques and know their suitability to an application.
5	To effectively apply their knowledge to the construction of secure cryptosystems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand the various types of cryptographic protocols and the mathematics behind cryptography.
CO2	Describe the various types of ciphers and hash functions.
CO3	Apply the different cryptographic techniques to solve real life problems.
CO4	Evaluate different techniques as to their suitability to various applications.
CO5	Develop a cryptosystem keeping in view social issues and societal impacts.

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SYLLABUS

Module I:

Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols - Advanced Protocols - Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography.

(8L)

Module II:

Key Length - Key Management – Public Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information.

(8L)

Module III:

Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation - Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab – RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

(8L)

Module IV:

Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design - N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes

(8L)

Module V:

RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes - Ongchnorr-Shamir -Cellular Automata - Feige-Fiat-Shamir -Guillou-Quisquater - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol - IBM Secret-Key Management Protocol - MITRENET - Kerberos - IBM Common Cryptographic Architecture.

(8L)

Head of Department

TEXT BOOKS:

2. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C" John Wiley & Sons, Inc, 2nd Edition, 1996. **(T1)**

3. 2. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004. **(T2)**
4. Atul Kahate, "Cryptography and Network Security", Tata McGrew Hill, 2003. **(T3)**

REFERENCE BOOKS:

1. William Stallings- Cryptography & Network Security Principles and Practice, Pearson Education. **(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	1	2	
CO2	3	3	3		2	
C03		3	2		1	
CO4			3	2		2
CO5		3		1		1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD5,CD7

COURSE INFORMATION SHEET

Course code: IT524

Course title: IMAGE PROCESSING TECHNIQUES

Pre-requisite(s):

Co- requisite(s):

Credits:3 L:3 T:0 P:0

Class schedule per week: 3

Class: M. Tech

Semester / Level: II/5

Branch: Computer Science &Engineering

Course Objectives

This course enables the students:

1.	Understand the basic concept of Digital Image Processing
2.	To Learn the Fourier, Transform & its application
3.	Understand the basic components of filters
4.	Understand the basic concept of Image Compression Fundamentals
5.	Understand the basic concept of Image Segmentation.

Head of Department

Course Outcomes

After the completion of this course, students will be:

1.	Understand the concept of image formation, digitization, and role human visual system plays in perception of image data and spatial filtering techniques for enhancing the appearance of an image.
2.	Acquire an appreciation for various frequency-based filtering techniques for enhancing the appearance of an image, duly applying them in different applications.
3.	Discern the difference between noise models, gain an insight into assessing the degradation function and realize different spatial and frequency-based filtering techniques for reduction and removal of noise.
4.	Synthesize a solution to image compression using the concept of information theory and lossless and lossy compression techniques.
5.	Design and create practical solutions using morphological and image segmentation operators for common image processing problems and assess the results.

Syllabus

Module I:

Introduction to Digital Image Processing, Elements of Visual Perception, Image Sensing & Acquisition, Sampling and Quantization, Basic Relationships between Pixels, Intensity Transformations, Histogram Processing, Spatial Convolution & Correlation, Smoothing Spatial Filters, Sharpening Spatial Filters.

(8L)

Module II:

Introduction to the Fourier Transform, Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Image Smoothing using Frequency Domain filters, Image Sharpening using Frequency Domain filters, Selective Filtering, Basics of Fast Fourier Transform, Basics of: Walsh- Hadamard Transform; K-L Transform; Discrete Cosine Transform.

(8L)

Module III:

Model of Image Degradation/Restoration Process, Noise Probability Density Functions, Restoration in presence of Noise only, Periodic Noise Reduction using Frequency Domain filtering, Circulant Matrices, Block Circulant Matrices, Unconstrained Restoration, Constrained Restoration, Basics of Inverse Filtering

(8L)

Head of Department

Module IV:
Image Compression Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria, Image Compression Models– Source Encoder and Decoder, Channel Encoder and Decoder, Elements of Information Theory, Error-Free Compression – Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.Color Fundamentals, Color Models, Basics of Full Color Image Processing.

(8L)

Module V:
Morphological Image Processing- Preliminaries, Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformation, Boundary Extraction, Hole Filling, Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning
Image Segmentation- Fundamentals, Point, Line and Edge Detection, Thresholding, Region Based Segmentation, Segmentation based on color.

(8L)

Text books:

3. Rafael. C. Gonzalez & Richard E. Woods- Digital Image Processing, 3/e Pearson Education, New Delhi – 2009. **(T1)**

Reference books:

7. W.K.Pratt-Digital Image Processing, 4/e, John Wiley & sons, Inc. 2006. **(R1)**
8. M. Sonka et al. Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007. **(R2)**
9. Jayaraman, Digital Image Processing, Tata McGraw-Hill Education, 2011. **(R3)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD2, CD5, CD7

COURSE INFORMATION SHEET

Course code: CS524

Course title: SOFT COMPUTING

Pre-requisite(s):

Co- requisite(s):

Credits:3 L:3 T:0 P:0

Class schedule per week: 3

Class: M. Tech

Semester / Level: II/5

Branch: Computer Science &Engineering

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Course Objectives

After the completion of this course, students will be:

1.	To understand the concepts of soft computing
2.	To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
3.	To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
4.	To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.
5.	To develop neural network models.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Solve numericals on Fuzzy sets and Fuzzy Reasoning.
CO2	Develop Fuzzy Inference System (FIS).
C03	Solve problems on Genetic Algorithms
CO4	Explain concepts of neural networks
CO5	Develop neural networks models for various applications.

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SYLLABUS

Module I:

Introduction: Soft Computing vs. hard computing, soft computing paradigms, Basic mathematics of soft computing, learning and statistical approaches to classification and regression.

Fuzzy Logic: Introduction, Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Membership functions, fuzzification and defuzzification.

(8L)

Module II:

Fuzzy Rule Base System: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making. **Applications**: Fuzzy logic in modeling and control, image processing

(8L)

Module III:

Neural Networks: Introduction, Biological neural network, learning paradigms. Artificial Neural Network (ANN): Evolution of Basic neuron modeling, Difference between ANN and human brain, McCulloch-Pitts neuron models, Learning paradigms, activation function, Single layer Perceptron, Perceptron learning, Windrow-Hoff/ Delta learning rule, Multilayer Perceptron, Adaline, Madaline, different activation functions, Back propagation network, momentum, limitation, FBFN, Convolution Networks, Kohonen SOM, Hopfield Networks, HebbNet.

(8L)

Module IV:

Genetic Algorithms: Introduction, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems such as TSP (Travelling salesman problem),

Applications:Genetic Algorithm based Back propagation Networks.

Head of Department

(8L)

Module V:

Particle Swarm Optimization: Background, Operations of Particle Swarm Optimization, Basic Flow of Particle Swarm Optimization, Comparison between GA and PSO, Applications of PSO.

Ant Colony Optimization: Ant Colony Optimization Algorithm, Ant System, Ant Colony System, Basic Flow of Ant colony Optimization, Applications of ACO.

(8L)

TEXT BOOKS:

1. S.N. Sivanandam,Principle of Soft Computing, Wiley India. **(T1)**
2. Simon Haykins," Neural Networks: A Comprehensive Foundation, Pearson Education,2002. **(T2)**
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997. **(T3)**

REFERENCE BOOKS

1. K.S.Ray ,"Soft Computing and Its application", Vol 1, Apple Academic Press.2015. **(R1)**
2. K.H.Lee ,"First Course on Fuzzy Theory and App.", Adv in Soft Computing Spinger.2005. **(R2)**
3. H.Z.Zimmermann ,"Fuzzy Set Theory and its App " , 4th Ed.Spinger Science,2001. **(R3)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

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POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
C03	3	3	3	2	1	3
CO4	2	2	3	3	1	2
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1, CD6
CO3	CD1, CD2,
CO4	CD1, CD7
CO5	CD1, CD2,

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COURSE INFORMATION SHEET

Course code:IT571

Course title**: Introduction to R Programming**

Pre-requisite(s):

Co- requisite(s):

Credits: L: 0 T:1 P:2

Class schedule per week: 1

Class: M. Tech

Semester / Level:

Branch:

Course Objectives

This course enables the students:

1.	To develop problem solving skills
2.	To learn programming and to solve problems using computers
3.	To learn Data Manipulation, Analysis and Visualization using Computers
4.	To introduce students to the key concepts and ideas of a statistical computing environment
5.	To introduce students to fundamental concepts in (scientific) programming in general.

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Course Outcomes

After the completion of this course, students will be to do the following:

1.	Design programs with Interactive Input and Output, utilizing arithmetic expression, repetitions and decision making
2.	Design programs using the fundamental data structures in R
3.	Develop programs in R interfacing files and URLs
4.	Solve Mathematical problems using R
5.	Design graphs and simulations in R

Syllabus

Module I

Introduction- R reserved words, Variables and Constants, Operators, Operator Precedence

Getting Data in and out of R –Accessing the Keyboard and Monitor, Reading in Larger Datasets

Module II

Control Statements- if ..else, for loop, while loop, repeat loop, break and next

Data Structures- Vectors, Arrays, Matrices, Lists, Data Frames, Factors, Operations on Dates and Times

Module III

Strings: Overview of String Manipulation Functions

Functions: Function Syntax, Environment and Scope, Recursive Function

Interfaces to the Outside World: File Connections, Reading Lines of a Text File Reading From a URL Connection

Module IV

Maths in R- Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations, Set Operations.

Simulation -Generating Random Numbers, Simulating a Linear Model, Random Sampling

Module V

Graphics-Creating Graphs, Customising Graphs

Introduction to Object Oriented Features- Concept of Class and Object

Head of Department

SYLLABUS

List of Programs as Assignments:

9. Lab Assignment No: 1

Objective: To Understand and Implement Data Types

9. Data Types - R Objects and Attributes
10. Data Types - Vectors and Lists
11. Data Types - Matrices
12. Data Types - Factors
13. Data Types - Missing Values
14. Data Types - Data Frames
15. Data Types - Names Attribute
16. Data Types - Summary

10. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

12. Reading Tabular Data
13. Reading Large Tables
14. Textual Data Formats
15. Connections: Interfaces to the Outside World
16. Subsetting - Basics
17. Subsetting - Lists
18. Subsetting - Matrices
19. Subsetting - Partial Matching
20. Subsetting - Removing Missing Values
21. Vectorized Operations

11. Lab Assignment No: 3

Objective: To Understand and Implement Swirl

4. Workspace and Files
5. Sequences of Numbers
6. Vectors

12. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

13. Lab Assignment No: 5

Objective: To Understand and Implement Control Structures

5. If-else
6. Control Structures - For loops
7. Control Structures - While loops
8. Control Structures - Repeat, Next, Break

Head of Department

14. **Lab Assignment No: 6**
    Objective: To Understand and Implement Functions
    5. Functions (part 2)
    6. Scoping Rules - Symbol Binding
    7. Scoping Rules - R Scoping Rules
    8. Scoping Rules - Optimization Example (OPTIONAL)
15. **Lab Assignment No: 7 &8**
    Objective: To Understand and Implement Loop Functions and Debugging
    6. Loop Functions - lapply
    7. Loop Functions - apply
    8. Loop Functions - mapply
    9. Loop Functions - tapply
    10. Loop Functions – split
16. **Lab Assignment No: 9 & 10**
    Objective: To Understand and Implement Two-Dimensional Graphics
    4. Generating Random Numbers
    5. Simulation - Simulating a Linear Model
    6. Simulation - Random Sampling

Text books:

2. Matloff Norman, The Art of R Programming– A Tour of Statistical Software Design.(T1)

3. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Orielly, 1st Edition. (T2)

Reference books:

1. Grolemund Garret,Hands-On Programming with R.(R1)

2. Gardener Mark,Beginning R: The Statistical Programming Language.(R2)

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

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POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	3
CO2	3	3	2	2	1	2
CO3	2	2	2	3	1	3
CO4	3	1	2	3	1	1
CO5	3	2	1	3	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course Code: CS512

Course title: ARTIFICIAL INTELLIGENCE

Pre-requisite(s): Design and Analysis of Algorithms, Data Structures

Co- requisite(s): None

Credits:3 L:3 T:0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: II/5

Branch: Computer Science and Engineering

Course Objectives

After the completion of this course, students will be able to:

1.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
2.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
3.	An ability to design a system, component or process to meet desired needs within realistic constraints.
4.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
5.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Recall the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
CO2	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
CO3	Understanding the various concepts of knowledge representations and demonstrate working. knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO4	To develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
CO5	Write various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

SYLLABUS

Module I:

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature of Environment, Structure of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining the Problem as State Space Search, Production System, Problem Characteristics, Issues in The Design of Search Programs.

(8L)

Module II:

Search Techniques: Solving Problems by Searching, Problem Solving Agents, Searching for Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

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Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search for Constraint Satisfaction Problems.

Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Minimax Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

(8L)

Module III:

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, Natural Deduction. **Representing Knowledge Using Rules:** Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.

(8L)

Module IV:

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster -Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning.

Learning: Forms of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning.

(8L)

Module V:

Natural Language Processing: Brief introduction to Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planning uncertain movements, robotic software architecture, application domains.

(8L)

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TEXTBOOKS:

3. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education. **(T1)**
4. E. Rich & K. Knight, "Artificial Intelligence", 2/e, TMH, New Delhi, 3rd Edition, TMH. **(T2)**

REFERENCE BOOKS:

3. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, New Delhi, 2006. **(R1)**
4. D.W. Rolston, "Principles of AI & Expert System Development", TMH, New Delhi. **(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	1	1
CO5	2	2	2	3	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD6
CO2	CD1,
CO3	CD1, CD2, CD3,
CO4	CD1, CD3
CO5	CD1, CD2, CD7

COURSE INFORMATION SHEET

Course code:IT516

Course title: DATA MINING AND DATA ANALYSIS

Pre-requisite(s):

Co- requisite(s): None

Credits: 3 L: 3 T: 0 P: 0

Class schedule per week: 03

Class: M. Tech

Semester / Level: II/5

Branch: Computer Science & Engg.

Name of Teacher:

Head of Department

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Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem-solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

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SYLLABUS

Module I:
Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.

(8L)

Module II:
Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.

(8L)

Module III:
Frequent Pattern Mining, Summarizing Itemsets, Itemset Mining, Sequence Mining.

(8L)

Module IV:
Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.

(8L)

Module V:
Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.

(8L)

Textbooks:

1. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016. **(T1)**
2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014. **(T2)**
3. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015. **(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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Syllabus M.Tech IT CBCS

COURSE INFORMATION SHEET

Course code: CS501
Course title: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
Pre-requisite(s): Discrete Mathematics
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Present basic concepts and techniques of linear algebra, probability, statistics and graph theory
2.	Develop mathematical thinking and problem-solving skill
3.	Provide the foundations of probabilistic and statistical analysis
4.	Explain graphs to formulate computational problems

Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate skills in solving mathematical problems
CO2	Apply knowledge of computing and mathematics appropriate to the discipline
CO3	Analyze problems and identify the computing requirements appropriate to its solution
CO4	Understand basic concepts in probability theory and statistical analysis
CO5	Study the advanced courses in Computer science such as Coding Theory, Artificial Intelligence, Numerical Computation, etc.

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SYLLABUS

Module I:
Linear Algebra
Introduction: Matrices and solving set of linear equations, Vector space, Subspace, Linear combination of vectors, Linear dependence and independence of vectors, Bases and dimensions. (8L)

Module II:
Inner product spaces, Orthogonal vectors and dual vectors, Eigen values and Eigen vectors, Linear programming.

(8L)

Module III:
Probability and Statistics
Frequency distribution and measures of central tendency, mean, median mode, quartiles, measures of dispersions and skewness, standard deviation, mean deviation, coefficient of variation, moments.

(8L)

Module IV:
Probability: definition, Distribution: discrete and continuous, Chi-square test, t-test.

(8L)

Module V:
Graph Theory
Introduction: Graphs and its types, Representation of graphs: Adjacency matrix, Incidence matrix, Adjacency list, Planar graph, Kuratowski's Graphs, Clique and maximum Clique finding algorithms.

(8L)

Books recommended:

TEXT BOOK

10. K. Haffman, and R. Kunze, "Linear Algebra", 2nd Edition, Pearson, 2015.**(T1)**
11. G. Williams, "Linear Algebra with Applications", 4th Edition, John & Bartlett.**(T2)**
12. W. Navidi, "Statistics for Engineers and Scientists", 2nd Edition, TMH, 2008.**(T3)**
13. J.K. Goyal, and J. N. Sharma, "Mathematical Statistics", Krishna Prakashan, 2017**(T4).**

REFERENCE BOOK

2. NarasinghDeo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001.**(R1)**
3. Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

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POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	3	1	1	1	1
CO3	2	3	2	1	1	1
CO4	3	2	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS502
Course title: ADVANCED DATA STRUCTURES
Pre-requisite(s): Data Structures, Algorithm Analysis
Co- requisite(s):
Credits: 3 L: 3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2.	Students should be able to understand the necessary mathematical abstraction to solve problems.
3.	To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4.	Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

After the completion of this course, students are expected to:

CO1	Understand the implementation of symbol table using hashing techniques.
CO2	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
CO3	Develop algorithms for text processing applications.
CO4	Learn the basic working of advanced heaps.
CO5	Understand the implementation of symbol table using hashing techniques.

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SYLLABUS

Module I:
Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

(8L)

Module II:
Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

(8L)

Module III:
Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

(8L)

Module IV:
Heaps: Balanced Search Trees as Heaps, Array-Based Heaps, Heap-Ordered Trees and Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps, Heap-Related Structures with Constant-Time Updates.

(8L)

Module V:
Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

(8L)

Books recommended:

TEXT BOOK

4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004.**(T1)**
5. Peter Brass, "Advanced Data Structures," Cambridge University Press, 1stEdition.**(T2)**
6. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002.**(T3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	2	3	3	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6
CO3	CD1, CD2, CD3,CD4
CO4	CD1, CD3,CD6
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT501
Course title: INFORMATION THEORY AND CODING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

After the completion of this course, students will be able to:

1.	To understand the role of information theory for an efficient, error-free and secure delivery of information using binary data streams.
2.	To have a complete understanding of error-control coding.
3.	To understand encoding and decoding of digital data streams.
4.	To introduce methods for the generation of these codes and their decoding techniques.
5.	To have a detailed knowledge of compression and decompression techniques.
6.	To evaluate the performance of various coding techniques over noisy communication channels.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	To be able to understand the principles behind an efficient, correct and secure transmission of digital data stream.
CO2	To be familiar with the basics of error-coding techniques.
CO3	To have knowledge about the encoding and decoding of digital data streams.
CO4	Generation of codes and knowledge about compression and decompression techniques.
CO5	To be able to understand the performance requirements of various coding techniques.
CO6	To produce professionals who will be able to conduct research in information theory.

SYLLABUS

Module I:

Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measure for Continuous Random Variables, Source coding theorem, Huffman Coding, Shannon- Fano -Elias Coding, Arithmetic Coding, The Lempel-Ziv Algorithm, Run Length Encoding, and the PCX Format, Rate Distribution Function, Optimum Quantizer Design, Entropy Rate of a Stochastic Process.

(8L)

Module II:

Channel Capacity and Coding: Introduction, Channel Model, Channel Capacity, Channel Coding, Information Capacity Theorem, the Shannon Limit, Channel Capacity for MIMO System, Random Selection of Code. Error Control Coding (Channel Coding).

(8L)

Module III:

Linear Block Codes for Error Correction: Introduction to Error Correction Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check (LDPC) Codes, Optimal Linear Codes, Maximum Distance Separable (MDS) Codes, Bound on Minimum Distance, Space Time Block Codes.

(8L)

Module IV:

Cyclic Codes: Introduction to the Cyclic Codes, Polynomials, The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check(CRC) Codes, Circuit Implementation of Cyclic Codes.

Head of Department

(8L)

Module V:

Bose Chaudhuri Hocquenghem (BCH) Codes: introduction to the Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials, in Terms of Minimal Polynomials, Some Examples if BCH Codes, Reed –Solomon Codes, Implementation of Reed –Solomon Encoders and Decoders, Performance of RS Codes Over Real Channels, Nested Codes.

(8L)

Books recommended:

TEXT BOOKS

1. R. Bose, "Information theory Coding and Cryptography," 2nd Edition, McGraw-Hill, 2008.**(T1)**

REFERENCE BOOKS

1. ArijitSaha, Nilotpal Manna, Surajit Mandal, Information Theory, Coding and cryptography, Pearson India, 2013.**(R1)**
2. Cover Thomas and Joy Thomas, Elements of Information Theory, Wiley India Pvt. Ltd. 2nd Edition, 2006.**(R2)**
3. Salvatore Gravano, Introduction to errorControl Codes, Oxford Univ. Press, 2017.**(R3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	2	2	3	3	1	2
CO5	2	3	3	2	1	1
CO6	2	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD4
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6
CO5	CD1,CD2, ,CD5,CD7

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PROGRAM ELECTIVE – I

COURSE INFORMATION SHEET

Course code: CS506
Course title: MACHINE LEARNING
Pre-requisite(s): Design of Algorithms, Mathematics 2, Artificial Intelligence
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students:

1.	To formulate machine learning problems corresponding to different applications.
2.	To understand various supervised, semi-supervised and unsupervised machine learning algorithms.
3.	To familiarize various machine learning software libraries and data sets publicly available.
4.	To develop machine learning based system for various real-world problems.
5.	To assess how the choice of a machine learning algorithm impacts the accuracy of a system.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity
CO2	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses
CO3	Implement machine learning solutions to classification, regression, and clustering problems
CO4	Design and implement various machine learning algorithms in a range of real-world applications
CO5	Evaluate and analyse the performance of a machine learning algorithm or a system based on machine learning algorithm.

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SYLLABUS

Module I:
Introduction to Machine Learning
Machine Learning – what and why? Basics of Linear Algebra and Statistics, Overview of target function representations; Linear Regression.

(8L)

Module II:
Supervised Learning
Basics of Feature Selection and Evaluation, Decision Tree, Overfitting and Pruning, Logistic regression, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts.

(8L)

Module III:
Neural Networks
Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

(8L)

Module IV:
Unsupervised and Semi Supervised Learning
Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabled data.

(8L)

Module V:
Ensemble
Committees of multiple hypotheses, bagging, boosting, active learning with ensembles.

(8L)

Books recommended:

TEXT BOOKS

2. Tom Mitchell, "Machine Learning", Latest Edition, Mc-Graw Hill.**(T1)**

REFERENCE BOOKS

3. Shai Shalev-Shwartz, and Shai Ben-David, "Understanding Machine Learning", Cambridge University Press, 2017.**(R1)**
4. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD4
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT503
Course title: WIRELESS SENSOR NETWORKS
Pre-requisite(s): Basic Networking Fundamentals
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Familiarize with the principles of sensor nodes, network deployment and architectures.
2.	Know the data transmission and routing protocols. Know the differences among different networks.
3.	Analyze or compare the performance of different routing and MAC protocol
4.	Evaluate the performance of different MAC protocols and clustering algorithm
5.	Compute the throughput and channel utilization for different network scenarios.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Obtain a broad understanding about the network architecture of wireless sensor network.
CO2	Understand all basic characteristics of wireless sensor networks and sensor nodes.
CO3	Understand the principles of data transmission, clustering algorithm and routing protocols.
CO4	Analyze and evaluate different constraint of wireless sensor network, e.g., coverage, power management, security and data collisions.
CO5	Design and development of new sensor network architecture.

SYLLABUS

Module I:

Fundamentals of Sensor Networks

Introduction to wireless sensor networks, Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem communication interfaces- prototypes, Application of Wireless sensors.

(8L)

Module II:

Communication Characteristics and Deployment Mechanisms

Wireless Transmission Technology and Systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization Clock and the Synchronization Problem - Basics of time Synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization.

(8L)

Module III:

Mac Layer

Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols, Power Aware Multi-Access with signalling, Sensor MAC-Timeout MAC-Data gathering MAC.

(8L)

Module IV:

Routing in Wireless Sensor Networks

Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing Geographical Based Routing-Transport layer- Transport Protocol Design issues, Performance of Transport Control Protocols.

(8L)

Head of Department

Module V:
Middleware and Security Issues
WSN middleware Principles-Middleware Architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security.

(8L)

Books recommended:

TEXT BOOKS

3. WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011.**(T1)**
4. KazemSohraby, Daniel manoli, "Wireless Sensor networks- Technology, Protocols and Applications", Wiley Inter Science Publications 2010. **(T2)**

REFERENCE BOOKS

2. BhaskarKrishnamachari, "Networking Wireless Sensors", Cambridge University Press, 2005. **(R1)**
3. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati, "Wireless Sensor Networks", Springer Science 2004.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	2	1	1	1	1
CO3	3	3	1	1	1	1
CO4	2	3	2	1	1	1
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS507
Course title: COMPUTABILITY AND COMPLEXITY THEORY
Pre-requisite(s): Automata Theory and Computer algorithms
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Give introduction to the mathematical foundations of computation including automata
2.	Learn about the issues in finite representations for languages and machines, as well as gain a more formal understanding of algorithms and procedures.
3.	Motivate and expose to the fundamental understanding of computation under resource constraints.
4.	Set a research level exposure to deeper topics in complexity theory.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Relate formal languages and mathematical models of computation
CO2	Attain knowledge about different types of languages and the corresponding machines for computations
CO3	Understand the limitations on what computers can't do, and learn examples of unsolvable problems
CO4	Analyse P, NP, NP-C, NP-Hard, Tractable and Intractable problems
CO5	Explain reduction of problems for easy and hard problems

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SYLLABUS

Module I:
Basic background on automata and languages, Types of automata and languages, Turing machines,Encoding and Enumeration of Turing Machines, k-tape Turing machines, non-deterministic Turing machines, Universal Turing machine, Resource bounded computation, Halting problem.

(8L)

Module II:
Context Sensitive Language andChomosky Hierarchy Recursive enumerable languages, Recursive languages, Decidable and recognizable language, Turing-decidable languages, Turing-recognizable languages, Kolmogorov Complexity

(8L)

Module III:
Primitive recursive function, partial recursive function, Recursive and recursive enumeration sets, Programming systems, Unsolvable problems, a non-recursive language and an unsolvable problem, Rice Theorem, More unsolvable problems, PCP

(8L)

Module IV:
Measuring complexity- Big O, small oh and other notations, Analysing algorithms, Time and space complexity of a Turing machine, Complexity analysis of multi-tape TM

(8L)

Module V:
Complexity classes: P, NP, NP-C, NP-Hard problem, PSPACE, NP-complete problems- clique, vertex cover, Hamiltonian cycle, graph colouring problem, graph isomorphism, Reduction from NP-C problem to another problem, Cook-Levin Theorem,Tractable and Intractable problems, Reducing one problem to another problem**,** Additional classes of problems- RP**,** ZPP.

(8L)

Books recommended:

TEXT BOOK

2. Lewis H.R., Papadimitriou C.H.- Elements of the Theory of Computation:, PHI Publ. , 2nd edition, New Delhi. **(T1)**

REFERENCE BOOKS

4. Hopcroft J.E., Motwani R. and Ullman J.D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2008.**(R1)**
5. John Martin. Introduction to Languages and the Theory of Computation, 3rd ed. McGraw Hill, New York, NY, 2003.**(R2)**
6. Dexter Kozen, Theory of Computation, Springer publication. **(R3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	2	1	1	1	1
CO3	3	3	1	1	1	1
CO4	2	3	2	1	1	1
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

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Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

OPEN ELECTIVE – I

COURSE INFORMATION SHEET

Course code: CS514
Course title: SOFTWARE METRICS
Pre-requisite(s): Software Engineering, Software Testing
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

After the completion of this course, students will be:

1.	Provide a basic understanding and knowledge of the software metrics.
2.	Understand the importance of Metrics data collection.
3.	Analysis and Metrics for object-oriented systems.
4.	Understand external product attributes, Dynamic Metrics and Resource measurement.

Course Outcomes

After the completion of this course, students will be:

CO1	Able to understand the importance of the software development process.
CO2	Analyze the importance of modelling and modelling language.
C03	Design and develop correct and robust software products.
CO4	Explain the business requirements pertaining to software development.
CO5	Design Metrics for object-oriented systems.

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SYLLABUS

ModuleI:
Basics of measurement : Measurement in software engineering Scope of software metrics Representational theory of measurement Measurement and models Measurement scales Meaningfulness in measurement Goal-based framework for software measurement Classifying software measures Determining what to measure Software measurement validation Empirical investigation Types of investigation Planning and conducting investigations. (8L)

ModuleII:
Measuring size, Aspects of software size Length, functionality and complexity Measuring structure Types of structural measures Control-flow structure Modularity and information flow attributes Data structures.

(8L)

ModuleIII:
Modeling software quality Measuring aspects of software quality Software reliability Basics of software reliability Software reliability problem Parametric reliability growth models Predictive accuracy Recalibration of software-reliability growth predictions Importance of operational environment Wider aspects of software reliability.

(8L)

ModuleIV:
The intent of object-oriented metrics Distinguishing characteristics of object-oriented metrics Various object-oriented metric suites LK suite CK suite and MOOD metrics
Runtime Software Metrics Extent of Class Usage Dynamic Coupling Dynamic Cohesion and Data Structure Metrics.

(8L)

ModuleV:
The intent of component-based metrics, Distinguishing characteristics of comp.
Measuring productivity, teams, tools, and methods.

(8L)

Books recommended:

TEXT BOOK

3. "Software Metrics: A rigorous and Practical Approach" by Norman E. Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 2nd Edition, 1997. **(T1)**
4. "Applied Software Measurement" by Capers Jones, McGraw Hill, 2008. **(T2)**

REFERENCE BOOK

3. "Object-Oriented Software Metrics" by Mark Lorenz, Jeff Kidd, Prentice Hall, 1994. **(R1)**
4. "Practical Software Metrics For Project Management And Process Improvement" by Robert B Grady, Hewlett Packard Professional Books, 1st Edition, 2004.**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations
Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Head of Department

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	2	2	3	1	1	1
CO3	1	3	3	2	2	2
CO4	3	3	3	2	1	1
CO5	2	1	3	3	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS522
Course title: PATTERN RECOGNITION AND APPLICATION
Pre-requisite(s): Linear Algebra, Vector Calculus, Data Structure& Programming
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M.Tech
Semester / Level:I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

5.	Be familiar with both the theoretical and practical aspects Pattern Recognition.
6.	Have described the foundation of pattern formation, measurement, and analysis.
7.	Understand the mathematical and computer aspects of while extracting features of an object.
8.	Learn the techniques of clustering and classification for various applications.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
CO2	Solve Decision-making model using Statistical and Mathematical Decision Theory.
CO3	Design clusters for various Pattern using classical and Modern clustering techniques.
CO4	Analyzing various Techniques for Pattern Classification and Clustering.
CO5	Develop Model for Pattern classification through Probabilistic or fuzzy.

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SYLLABUS

Module I:
Introduction: Feature Vectors, Classifiers, Supervised, Unsupervised, MATLAB Tools. Classifiers Based on Bayesian Theory, Linear Classifiers, Nonlinear Classifiers.

(8L)

ModuleII:
Feature Selection, Feature Generation I: Data Transformation and Dimensionality Reduction, Feature Generation II.

(8L)

Module III:
Template Matching, Context Dependent Classification, Super vised Learning.

(8L)

Module IV:
Clustering Basic Concepts, sequential Algorithms.

(8L)

ModuleV:
Hierarchical algorithms, Fuzzy clustering, probabilistic clustering, Hard Clustering, Optimization.

(8L)

Books recommended:

TEXT BOOK

3. "Pattern Recognition" by S Theodoridis, K Koutroumbas, Elsevier, 5th Edition, 2015.**(T1)**
4. "Pattern Recognition" by N NarshimaMurty, Springer, University press, 2nd Edition, 2015. **(T2)**

REFERENCE BOOK

2. R.O.Dudaet.al,"Pattern Classification", 2nd Edition, John Wiley, New York, 2002. **(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Head of Department

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT518
Course title: INTERNET OF THINGS
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives
This course enables the students to:

6.	Understand the basic concept and the IoT Paradigm
7.	Know the state of art architecture for IoT applications
8.	Learn the available protocols used for IoT
9.	Design basic IoT Applications.
10.	Evaluate optimal IoT applications.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
CO3	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

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SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

ModuleII:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

ModuleIII:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

ModuleIV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN,Transport Layer TCP, MPTCP, UDP, DCCP,

Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

ModuleV:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

(8L)

Head of Department

Books recommended:

TEXT BOOK

5. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**
6. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

5. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
6. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT522
Course title: CYBER SECURITY AND DIGITAL FORENSICS
Pre-requisite(s): Computer Basics, Programming and Problem solving
Co-requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech.
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students:

5.	Know about computer-based crime.
6.	Understand Technical and legal aspects of computer crime investigations
7.	Know the limitations of law and its enforcement agencies.
8.	Learn the procedures of recovering computer evidence and seize process.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Exposure on computer-based crime.
CO2	Technical and legal aspects of computer crime investigations
CO3	Know the limitations of law and its enforcement agencies.
CO4	Learn the procedures of recovering computer evidence and seize process.
CO5	Apply techniques for finding, preserving, presenting, and extracting information from the digital devices.

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SYLLABUS

ModuleI:
Introduction: Cyberspace and Criminal Behavior, Traditional problems associated with computer-based crime, e cash problems, Computer Technology and History: Computer Language, Hardware, software, operating system, Internet, Network language.

(8L)

ModuleII:
Early Hackers and Theft Components: Phreakers, Hacking, Commodities, Intellectual property. Contempory computer crime: web based criminal activity, money laundering,

(8L)

Module III:
Identity theft and identity fraud: Typologies of internet theft, virtual identity, credit identity. Prevalence and victimology, physical methods, of identity theft, phishing, spyware, trojans, insurance and loan fraud, immigration fraud. Terrorism and organized crime:Terror online, criminal activities, organized crime as cyber gangs., technology used in organized crime. Data piracy.

(8L)

Module IV:
Avenues for Prosecution and Government efforts: Act, Law enforcement agencies, International efforts, Cyber law and its amendments of current state, other legal considerations.

(8L)

ModuleV:
Forensic Terminologies and Developing forensic capabilities, Searching and seizing computer related evidence, Processing of evidence and report preparation.

(8L)

Books recommended:

TEXT BOOK

3. "Computer Forensics and Cyber Crime" byM.T.Britz, Pearson Education, First Impression, 2012.**(T1)**
4. "Computer Crime and investigation" by E Casey, Springer, 1st Edition, 2001. **(T2)**

REFERENCE BOOK

2. "Computer Crime Investigations and Law" by C Easttom&D.J.Taylor, Carenage Learning. **(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Head of Department

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	2	1
CO2	3	3	3	1	1	1
CO3	3	3	3	2	1	1
CO4	2	3	2	2	2	1
CO5	2	3	2	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS503
Course title: ADVANCED DATA STRUCTURES LAB
Pre-requisite(s):
Co- requisite(s): Advanced Data Structures
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2.	Students should be able to understand the necessary mathematical abstraction to solve problems.
3.	To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4.	Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand to implement the symbol table using hashing techniques.
CO2	Develop program for AVL, Red-Black trees, B-trees and Splay trees
CO3	Develop program for text processing applications
CO4	Learn the basic working of advanced heaps
CO5	Understand the implementation of symbol table using hashing techniques

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SYLLABUS

List of Programs as Assignments:

6. Lab Assignment No: 1

Write a program to implement a dictionary using the following ADTs. We assume all the entries in the dictionary to be distinct integers.

a) Binary Search Tree (BST)
b) Red Black Tree (RBT)

Each ADT should support five operations, void Insert(val), boolean Delete(val), boolean Search(val), void ClearADT() and void DisplayADT(). Both search and delete operations should respond with a boolean value indicating whether the search/delete was successful or not. The objective of this assignment is to compare the performance of BST and RBT ADTs. You have to compute the time taken for completion of operations and study how the running times of ADT operations will vary across the two ADT implementations.

7. Lab Assignment No: 2

Implement data structures to maintain a list of elements. In particular, implement the list as an array and as a linked list. Write a program to remove duplicates from the list. The code for remove duplicates functionality should remain the same across the two implementation of the list.

Implement the following sequence of operations on the skip list:

a) remove() b) insert() c) Search() d) Update()

Assume the coin flips for the first insertion yield two heads followed by tails, and those for the second insertion yield three heads followed by tails.

8. Lab Assignment No: 3

Implement different Hashing functions and Collision Resolution Techniques.

9. Lab Assignment No: 4

Implement Kruskal's algorithm for finding the minimum spanning tree of a given (positively) weighted (undirected) graph G. You must use the Union-Find data structure that implements both "union by rank" and "path compression" heuristics.

Head of Department

10. Lab Assignment No: 5 &6

Implement the following priority queues:

a) Binary Heap b) Binomial Heap c) Fibonacci Heap

Your program should then create an appropriate priority queue object and perform makeHeap() method. After that, you should give the user menu options to insert(key), delete(key), extractMin(), findMin(), decrease(key), increase(key) updateKey(currentKey, newKey), and displayHeap(filename). You may assume that keys will be unique. For displayHeap(filename), you must output the tree structure of the priority queue (including linked list edges in Binomial Heap, etc) as a directed tree in the dot language format1 and store it in a file named filename (given as parameter).

7. Lab Assignment No: 7&8

Implement Text Processing using Huffman Coding.

Implement the compact representation of the suffix trie for the string "minimize minime".

Implement a standard trie for the following set of strings: {abab, baba, ccccc, bbaaaa, caa, bbaacc, cbcc, cbca }.

8. Lab Assignment No: 9 &10

One way to mask a message, *M*, using a version of *steganography*, is to insert random characters into *M* at pseudo-random locations so as to expand *M* into a larger string, *C*.

For instance, the message,

ILOVEMOM,

could be expanded into

AMIJLONDPVGEMRPIOM.

It is an example of hiding the string, *M*, in plain sight, since the characters in *M* and *C* are not encrypted. As long as someone knows where the random

Books recommended:

TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004. **(T1)**
2. Peter Brass, "Advanced Data Structures," Cambridge University Press, 1st Edition. **(T2)**
3. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002. **(T3)**

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Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	2	2	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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PROGRAM ELECTIVE LAB –I

COURSE INFORMATION SHEET

Course code: IT509
Course title: MATLAB PROGRAMMING
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring MATLAB
2.	Develop mathematical thinking and problem-solving skill
3.	To enable the student on how to approach for solving Engineering problems using simulation tools.
4.	To provide a foundation in use of this software for real time app

Course Outcomes

After the completion of this course, students will be able to:

CO1	Express programming & simulation for engineering problems.
CO2	Find importance of this software for Lab Experimentation.
CO3	Analyze problems and write basic mathematical ,electrical ,electronic problems in Matlab
CO4	Implement programming files with GUI Simulink.
CO5	Simulate basic Engineering problems

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SYLLABUS

List of Programs as Assignments:

53. Lab Assignment No: 1

Objective: To Understand and Implement Matrix Algebra

1. To create Sparse matrices using the function sparse.
2. To convert a sparse matrix to full matrix.

54. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

1. To measure the daily high temperatures in three cities with different color.
2. To solve a different cities temperature do the filter.

55. Lab Assignment No: 3

Objective: To Understand and Implement Data Interpolation

1. To Draw 2-D random data.
2. To Draw Threshold of Human Hearing.

56. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

57. Lab Assignment No: 5

Objective: To Understand and Implement Fourier Analysis

1.To solve the use of the FFT, consider the problem of estimating the continuous Fourier transform of the signal

$f(t)=2e^{-3t}$ $t \geq 0$, where f(t) is gven by

$F(\omega)=2/(3+j\ \omega)$

2. To design sawtooth Waveform at arbitrary points.

58. Lab Assignment No: 6

Objective: To Understand and Implement Optimization

1. To solve 1-D minimization and maximization.
2. To design Rosenbrock's banana function.

59. Lab Assignment No: 7

Objective: To Understand and Implement Differential Equations

1. Design a van der Pol Solution.
2. To solve Jacobian matrix.

60. Lab Assignment No: 8

Head of Department

Objective: To Understand and Implement Two-Dimensional Graphics

1. To add new plots to an existing plot by using the hold command.
2. To create new Figure windows, use the figure command in the Command window or the **New Figure** selection from the **File** menu in the Command or Figure window.

61. Lab Assignment No: 9

Objective: To Understand and Implement Three- Dimensional Graphics

1. Plot = 2 with 0 5in polar coordinates.
2. Design a Surface plot using the surf function.

62. Lab Assignment No: 10

Objective: To Understand and Implement Images, Movies, and Sound

1. To display 8-bit intensity and RGB images.
2. To convert between indexed images and movie frames.

63. Lab Assignment No: 11

Objective: To Understand and Implement Graphical User Interfaces

1. Using uigetfile to find the startup.m file on the author's computer.
2. Write a program using the function **guidata,** which stores and retrieves data in the GUI figure **'ApplicationData'** property.
3. How to put walls by clicking a mouse button to make an arbitrary maze.
4. Design a GUI System.

Books recommended:

TEXT BOOK

3. Duane Hanselman, bruce Littlefield, Mastering MATLAB 7, Reason edu., 2nd edition, 2008. **(T1)**
4. Sandeep Nagar, Introduction to MATLAB for Engineers and Scientists: Solutions for Numerical Computation and Modeling, A Press, 2017.**(T2)**

REFERENCE BOOK

4. MATLAB Primer by MATHWORKS. **(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

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POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	3	2	1	2	1
CO4	3	3	2	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT510
Course title: JAVA PROGRAMMING
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives
This course enables the students to:

1.	To familiarize the student in introducing and exploring JAVA.
2.	Knowledge of the structure and model of the Java programming language.
3.	Use the Java programming language for various programming technologies.
4.	To provide a foundation for Java programming language to solve the given problems.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Write, compile, and execute Java programs that may include basic data types and control flow constructs using J2SE or other Integrated Development Environments (IDEs)
CO2	Write, compile, and execute Java programs manipulating Strings and text documents.
CO3	Write, compile, execute Java programs that include GUIs and event driven programming
CO4	Create Applets and GUI
CO5	Executing Client server and socket programming

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Objective: To Understand and Implement COLLECTION FRAMEWORK
   1. To create sparse matrices using the function sparse.
   2. To convert a sparse matrix to full matrix.
2. **Lab Assignment No: 2**
   Objective: To Understand and Implement Generic Programming
   1. Write the tasks performed by type erasure?
   2. Write a generic method to exchange the positions of two different elements in an array?
3. **Lab Assignment No: 3**
   Objective: To Understand and Implement REFLECTION
   1. Write a program that finds and displays inheritance hierarchy of a specified class?
   2. Write a program that shows all public fields of a specified class?
4. **Lab Assignment No: 4**
   Objective: GUI Development with Swing
   1. Working with Text Fields
   2. Working with Buttons
   3. Working with Lists
   4. Working with Scroll Panes

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5. Lab Assignment No: 5

Objective: Implementing Robust Geometric Primitives

1. Java Program to Apply Above-Below-on Test to Find the Position of a Point with respect to a Line
2. Java Program to Compute the Area of a Triangle Using Determinants
3. Java Program to Compute the Volume of a Tetrahedron Using Determinants
4. Java Program to Find the Area of any Polygon Using Triangulation

6. Lab Assignment No: 6

Objective: To Understand and Implement examples on "Convex Hull"

1. Java Program to Implement Graham Scan Algorithm to Find the Convex Hull
2. Java Program to Implement Gift Wrapping Algorithm in Two Dimensions
3. Java Program to Implement Jarvis March to Find the Convex Hull

7. Lab Assignment No: 7

Objective: To Understand and Implement examples on "Nearest Neighbor Search"

1. Java Program to Find the Nearest Neighbour Using K-D Tree Search
2. Java Program to Find NearestNeighbour Using Voronoi Diagram

8. Lab Assignment No: 8

Objective: To Understand and Implement Network Programming

1. Working with URLs
2. Socket Server Programming
3. Client Server Programming

9. Lab Assignment No: 9

Objective: To Understand and Implement SOCKET PROGRAMMING

1.Write a java socket program to get the resource http://www.google.com/index.html using HTTP protocol?

2. Write a program how do you get the IP address of a machine from its hostname?

10. Lab Assignment No: 10

Objective: To Understand and Implement Java Web Applications

1. Simple Servlet
2. Java Web Applications - Get Request
3. Java Web Applications - Post Request

11. Lab Assignment No: 11

Objective: To Understand and Implement Advanced Java Input/output (NIO)

1. File Copying With NIO
2. Working with Buffers
3. Working with File Data

Head of Department

Books recommended:

TEXT BOOKS

1. Uttam K Roy, Advanced JAVA Programming, Oxford University Press, 1st Edition , 2015 **(T1)**
2. HeerbertSchildt, Java: A Beginner's Guide, SeventhEdition,Oracle Press, 2014 **(T2)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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Direct Assessment

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Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Head of Department

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	3	2	2	2	2	1
CO4	3	2	3	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course Code: CS509
Course title: ADVANCED COMPUTER ALGORITHM
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 06
Class: M. Tech
Semester / Level: II/05
Branch: Computer Science and Engineering

Course Objectives

After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behaviour using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Analyze and compare different approaches of computer algorithm for different practical application.
CO2	Student should understand the concept of NP-hard and NP-complete and reducibility.
CO3	Student should develop basic knowledge of a wide range of advanced algorithm design techniques, approximation algorithms, randomized algorithms and parallel algorithm.
CO4	Student should develop basic advanced algorithm analysis skills for analysing the approximation ratio of approximation algorithms and the probability of randomized algorithms.
CO5	Students should gain a good understanding on a wide range of advanced algorithmic problems, their relations and variants, and application to real-world problems.

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SYLLABUS

Module I:
Design Paradigms
Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.

(8L)

Module II :
Theory of NP- Hard and NP-Complete Problems
P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes.

(8L)

Module III :
ApproximationAlgorithms
Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms.

(8L)

Module IV :
Parallel Algorithms
Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

(8L)

Module V :
Probabilistic Algorithms & Randomized Algorithms
Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems

(8L)

Text Books:

4. T.H. Cormen, C.E.Leiserson, and R.L. Rivest, “Introduction to Algorithms”.
5. G.Brassard, and P.Bratley, “Fundamentals of Algorithmics”.
6. Vijay V.Vazirani, “Approximation Algorithms”.

Reference Books:

3. D.Harel, “Algorithmics: The spirit of computing”.
4. R. Motwani& P. Raghavan, “Randomized Algorithms,” Cambridge University Press, 1995.

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

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Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	1	2
CO2	3	3	3	1	3	1
CO3	2	3	3	3	2	1
CO4	3	3	3	3	1	1
CO5	2	2	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

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COURSE INFORMATION SHEET

Course Code: IT512
Course title: ADVANCED WEB TECHNOLOGY
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students:

1.	To appreciate problems of traditional web designing techniques.
2.	To understand the basics of the MVC architecture
3.	To understand ASP.NET's implementation of the MVC model
4.	To understand how to leverage the model for medium to large projects
5.	To optimize the performance and rendering of web sites for different types of clients.

Course Outcomes

After the completion of this course, students will be:

CO1	Able to design models, controllers and views in ASP.NET
CO2	Will be able to establish secure and optimized database connections from the web sites
CO3	Will be able to perform secure and optimized user management and role handling
CO4	Optimize the design aspects of the web sites in a responsive fashion.
CO5	Understand techniques to handle scalability of web sites i.e. using caches

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SYLLABUS

Module I:
MVC, Asp.NET MVC, ORMs, Entity Framework, Models, Database Contexts, Adding Controllers, Views, Filtering, Searching related entitites.

(8L)

Module II:
ViewBag, View Model, Complex Filtering, Data Validation, Annotations, Sorting, Paging, Routing Configurations, Many to many relationships with the Entity Framework, Partial Views.

(8L)

Module III:
Authentication, Authorization, ASP.NET Identity, Role Management, User management, Password management.

(8L)

Module IV:
CSS Fundamentals, Selectors, Inheritance, Cascading, Box Model, Advanced CSS, Animations.

(8L)

Module V:
Designing Responsive web sites, Media Queries, Developing for mobiles and Tablets.

(8L)

Text books:
Naylor L., "ASP.NET MVC with Entity Framework and CSS", 1st Edition, Apress, 2017. **.(T1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

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Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	1	1	1	1	1
CO3	3	1	1	2	2	1
CO4	2	3	1	1	1	1
CO5	3	1	1	1	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

COURSE INFORMATION SHEET

Course Code: IT513
Course title: BIG DATA ANALYTICS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives
This course enables the students:

1.	To provide an overview of approaches facilitating data analytics on huge datasets in different domain.
2.	To provide the knowledge on NoSQL and different partitioning method to handle large datasets.
3.	To provide an overview of Apache Hadoop and HDFS Concepts and Interfacing with HDFS
4.	To understand Map Reduce Jobs in Hadoop framework
5.	To provide the knowledge of various Hadoop based tool for processing large datasets.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Describe big data and use cases from selected business domains
CO2	Explain NoSQL big data management
CO3	Install, configure, and run Hadoop and HDFS
CO4	Perform map-reduce analytics using Hadoop
CO5	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

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Syllabus

Module I :

Introduction

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

(8L)

Module II:

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

(8L)

Module III:

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

(8L)

Module IV:

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

(8L)

Module V:

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries

(8L)

Text Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013. .**(T1)**
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012. .**(T2)**
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012. .**(T3)**

Reference Books:

1. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.**(R1)**
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.**(R2)**
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.**(R3)**
4. Alan Gates, "Programming Pig", O'Reilley, 2011.**(R4)**

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Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	1	1	1
CO2	3	2	1	1	1	1
CO3	3	1	1	2	2	2
CO4	2	3	1	1	1	1
CO5	3	1	1	1	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

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Program Elective II

COURSE INFORMATION SHEET

Course Code: IT508
Course title: CLOUD COMPUTING
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives
This course enables the students to:

1.	Understand about security requirements in cloud.
2.	Learn about infrastructure security at different levels
3.	Know about management standards of cloud security
4.	Develop and Apply trust-based security model to different layers

Course Outcomes
After the completion of this course, students will be able to:

CO1	Identify security aspects of each cloud model
CO2	Implement a public cloud instance using a public cloud service provider
CO3	Apply trust-based security model to different layer
CO4	Develop a risk-management strategy for moving to the Cloud
CO5	Identify various research domain of cloud computing

SYLLABUS

Module I:
Introduction: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

(8L)

Module II:
Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.

(8L)

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Module III:
Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

(8L)

Module IV:
Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS, Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.

(8L)

Module V:
Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud, Recent developments in hybrid cloud and cloud security.

(8L)

Text Books:

3. John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises", Publication Date: November 2, 2009..**(T1)**
4. Tim Mather, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)", ISBN-10: 0596802765, O'Reilly Media, September 2009..**(T2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	1	1
CO2	3	3	3	2	1	1
CO3	3	2	2	1	1	1
CO4	3	2	1	1	1	1
CO5	1	2	3	1	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

COURSE INFORMATION SHEET

Course code:IT516
Course title: DATA MINING AND DATA ANALYSIS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

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Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications.
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

SYLLABUS

Module I :

Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.

(8L)

Module II:

Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.

(8L)

Module III:

Frequent Pattern Mining, Summarizing Itemsets, Itemset Mining, Sequence Mining.

(8L)

Module IV:

Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.

(8L)

Module V:

Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.

(8L)

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Text Books:

4. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016.**(T1)**
5. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014.**(T2)**
6. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015.**(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Head of Department

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Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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COURSE INFORMATION SHEET

Course code: IT518
Course title: INTERNET OF THINGS
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Understand the basic concept and the IoT Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
CO3	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

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SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

ModuleII:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

ModuleIII:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

ModuleIV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN,Transport Layer TCP, MPTCP, UDP, DCCP,

Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

ModuleV:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

(8L)

Head of Department

Books recommended:

TEXT BOOK

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT570
Course title: **Basics of Python programming**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T:1 P:2
Class schedule per week: 1
Class: M. Tech
Semester / Level:
Branch:

Course Objectives

This course enables the students:

1.	To facilitate skills required to Install and run the Python interpreter
2.	To facilitate skills required to Create and execute Python programs
3.	To introduce the Understanding the concepts offile I/O
4.	To provide skills to read data from a text file using Python
5.	To discover the interesting patterns using appropriate Python visualization libraries

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Understand how to convert the problems into algorithms
2.	Analyse and develop the algorithms to Python programs.
3.	Design programs with Interactive Input and Output, utilizing arithmetic expression repetitions, decision making, arrays.
4.	Develop modular Python programs using functions
5.	Design programs using file Input and Output.

Syllabus

Module I

Problem Analysis-Formal Definition of a Problem, Algorithms, Flowcharts, Examples for Algorithms and Flowcharts

Introduction to Python- Variables, Operators, Expressions, Evaluation of Expressions, String Operations, Input and Output functions

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Module II

Control Statements- Decision making statements, Iterative Statements, Loop Control Statements

Strings and Lists- String Operations, Tuples and Dictionaries-Operations and Examples

Module III

Functions- Function Definition and Call, Mathematical functions, User defined Functions, Parameters and Arguments, Type Conversion and Coercion

Module IV

Files – Different File Operations, File Object Attributes, Directories

Exceptions- Except clause, Exception with arguments, Raising an Exception, User Defined Exceptions

Module V

Introduction to Classes and Objects- Object Oriented Features, Attributes, Instances, Garbage Collection

SYLLABUS

List of Programs as Assignments:

64. Lab Assignment No: 1

Objective: ToImplement basic Python programming.

Q1. Create a new program called hello world.py. Use this file to write your very First "Hello, world!" program.

Q2. Write a Python program containing exactly one print statement that produces the following output:

A
B
C
D
E
F

65. Lab Assignment No: 2

Objective: To Understand and Implement the concept of if-else-if statements.

Q1.Write a Python program that requests five integer values from the user. It then prints one of two things: if any of the values entered are duplicates, it prints "DUPLICATES"; otherwise, it prints "ALL UNIQUE".

Q2. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. Each binary digit should be entered one per line, starting with the leftmost digit, as shown below.

Enter leftmost digit: 1
Enter the next digit: 0
Enter the next digit: 0
Enter the next digit: 1
The value is 9

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Q3.Develop and test a program that prompts the user for their age and determines approximately how many breaths and how many heartbeats the person has had in their life. The average respiration (breath) rate of people changes during different stages of development. Use the breath rates given below for use in your program:

	Breaths per Minute
Infant	30–60
1 –4 years	20–30
5 –14 years	15–25
adult	12–20

For heart rate, use an average of 67.5 beats per second.

66. <u>Lab Assignment No: 3</u>

Objective: To Understand and Implement the flow control statements.

Q1. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4... 1/10.

Q2. Write a program using a for loop that calculates exponentials. Your program should ask the user for a base 'b' and an exponent 'exp', and calculate b^exp.

Q3. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user input a negative number? As a programmer, you should always consider "edge conditions" like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don't include a condition that catches negative numbers, what will your program do?)

67. <u>Lab Assignment No: 4</u>

Objective: To practice drawing patterns

Q1.Write the program to print the following pattern: ex if the user enters 7, the program would print

```
   *
  **
 ***
****
*****
******
*******
******
*****
****
***
**
*
```


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Q2.Write a program in python to print the following pattern:

```
    1
   1 1
   121
 1331
  12641
 15101051
1615201561
```

68. Lab Assignment No: 5

Objective: To Understand and Implement methods in Python.

Q1.Write a method fact that takes a number from the user and prints its factorial.

Q2. Write a Python function named compare3 that is passed three integers and returns true if the three integers are in order from smallest to largest, otherwise it returns false.

Q3. Write a python function named modCount that is given a positive integer and a second positive integer, m<=n, and returns how many numbers between 1 and n are evenly divisible by m.

69. Lab Assignment No: 6

Objective: To Understand and Implement the concept of Recursion

Q1. Write a program to read an integer number. Print the reverse of this number using recursion.

Q2. Write a program that calculates the GCD using recursive functions.

70. Lab Assignment No: 7

Objective: To Understand and Implement Sorting techniques

Q1. Write a program to sort the list of elements using Insertion sort.

Q2. Write a program to sort the list of elements using Merge sort.

Q3.Write a program to multiply the two matrices.

71. Lab Assignment No: 8

Objective: To Understand and Implement the concept of Strings in Python

Q1. Write a program to check whether string is a palindrome or not.

Q2. Write a program to implement format method available with string object.

72. Lab Assignment No: 9

Objective: To Understand and Implement Dictionary

Q1. Program to demonstrate the built in functions within the dictionary.

Q2. Program to implement dictionary as an associative array

73. Lab Assignment No: 10

Objective: To Understand and Implement File Handling.

Q1. Program to open the file in the read mode and use of for loop to print each line present in the file.

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Q2. Write a Python program to illustrate Append vs write mode.
Q3. Write a Program to read and write data from a file.

Text book:

1. Downey A.,How to think like a computer scientist: Learning with Python.

Reference books:

1.JoseJeeva, Taming Python by Programming, Khanna Publishing House.
2. Jose J. Introduction to Computing and Problem Solving with Python, (ISBN: 978-93-82609-810).

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

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Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	3
CO2	3	3	2	2	1	3
CO3	2	2	2	1	2	1
CO4	3	1	1	3	2	2
CO5	3	2	1	3	1	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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Open Elective II

COURSE INFORMATION SHEET

Course code: IT523
Course title: BIOMETRIC SECURITY
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students to:

1.	To understand the brief functioning of biometric system.
2.	To know the different types of biometric and their accuracy.
3.	To increase the likelihood that biometric technologies, when deployed, will be as protective of personal and informational privacy as possible.
4.	To raise awareness of privacy issues for end users and for students.
5.	To increase security of the system as well as data.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
CO2	Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
CO3	Developing new advanced authentication algorithms.
CO4	Analyze the accurate discrimination between individuals.
CO5	Illustrate the two factor authentication system.

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SYLLABUS

Module I:
Biometrics- Introduction- benefits of biometrics over traditional authentication systems -benefits of biometrics in identification systems-selecting a biometric for a system –Applications - Key biometric terms and processes - biometric matching methods -Accuracy in biometric systems.
(8L)

Module II:
Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern.
(8L)

Module III:
Technical description – characteristics - strengths – weaknesses – deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.
(8L)

Module IV:
signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.
(8L)

Module V:
Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation plan.
(8L)

TEXT BOOKS :

1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi : "Biometrics -Identity verification in a network", 1st Edition, Wiley Eastern, 2002..**(T1)**
2. John Chirillo and Scott Blaul : "Implementing Biometric Security", 1st Edition, Wiley Eastern Publication, 2005. .**(T2)**

REFERENCE BOOKS :

1. John Berger: "Biometrics for Network Security", 1st Edition, Prentice Hall, 2004..**(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	3	3	3	2	1
2	3	3	3	2	1	1
3	3	2	2	3	1	1
4	3	3	2	1	3	1
5	2	1	3	2	1	1

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If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT504
Course title: APPLIED CRYPTOGRAPHY
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students:

1.	To understand the foundations of cryptographic attacks.
2.	To gain knowledge of encrypting data, and to choose between different algorithms.
3.	Prepare students for research in the area of cryptography and enhance students communication and problem solving skills
4.	To differentiate between the encryption techniques and know their suitability to an application.
5.	To effectively apply their knowledge to the construction of secure cryptosystems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand the various types of cryptographic protocols and the mathematics behind cryptography.
CO2	Describe the various types of ciphers and hash functions.
CO3	Apply the different cryptographic techniques to solve real life problems.
CO4	Evaluate different techniques as to their suitability to various applications.
CO5	Develop a cryptosystem keeping in view social issues and societal impacts.

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SYLLABUS

Module I:
Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols - Advanced Protocols - Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography.

(8L)

Module II:
Key Length - Key Management – Public Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information.

(8L)

Module III:
Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation - Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab – RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

(8L)

Module IV:
Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design - N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes

(8L)

Module V:
RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes - Ongchnorr-Shamir -Cellular Automata - Feige-Fiat-Shamir -Guillou-Quisquater - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol - IBM Secret-Key Management Protocol - MITRENET - Kerberos - IBM Common Cryptographic Architecture.

(8L)

TEXT BOOKS:

1. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C" John Wiley & Sons, Inc, 2nd Edition, 1996.**(T1)**

2. 2. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004. **(T2)**

3. Atul Kahate, "Cryptography and Network Security", Tata McGrew Hill, 2003. **(T3)**

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REFERENCE BOOKS:

1. William Stallings- Cryptography & Network Security Principles and Practice, Pearson Education. **(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching throughresearch papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	1	2	
CO2	3	3	3		2	
C03		3	2		1	
CO4			3	2		2
CO5		3		1		1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS605
Course title: HIGH PERFORMANCE COMPUTER ARCHITECTURE
Pre-requisite(s): Computer Architecture/Organization, Operating System, Parallel Computing
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/6
Branch:Information Technology

Course Objectives

This course enables the students to:

	1. To Explain different terminologies in High Performance Computer Architecture.
	2. To introduce basic concepts of High Performance Computer Architecture
	3. Hands on the different parallel architectures in terms of various parameters.
	4. Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
	5. Provide the students with practice on running complex problem in high performance computing machines.

Course Outcomes

After the completion of this course, students will be:

CO1	Describe different terminologies in High Performance Computer Architecture.
CO2	Demonstrate and Implement the concepts of High Performance Computer Architecture
C03	Compare and differentiate the different parallel architectures in terms of various parameters.
CO4	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
CO5	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

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SYLLABUS

Module I:

Parallel Computer Models : The State of Computing, Multiprocessors andMulticomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Program and Network Properties : Conditions for Parallelism, Program Partitioning andScheduling, Program Flow Mechanism, System Interconnect Architectures.

(8L)

Module II:

Program and Network Properties : Conditions for Parallelism, Program Partitioning andScheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, ParallelProcessing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

(8L)

Module III:

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler andVector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

Module IV:

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear PipelineProcessor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, CacheCoherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

(8L)

Module V:

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques,Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.

(8L)

TEXT BOOK:

2. Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010.**(T1)**

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REFERENCE BOOK:

2. Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA.**(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching throughresearch papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
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COURSE INFORMATION SHEET

Course code: IT524
Course title: IMAGE PROCESSING TECHNIQUES
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 3
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives

This course enables the students:

1.	Understand the basic concept of Digital Image Processing
2.	To Learn the Fourier Transform & its application
3.	Understand the basic components of filters
4.	Understand the basic concept of Image Compression Fundamentals
5.	Understand the basic concept of Image Segmentation.

Course Outcomes

After the completion of this course, students will be:

CO1	Understand the concept of image formation, digitization, and role human visual system plays in perception of image data and spatial filtering techniques for enhancing the appearance of an image.
CO2	Acquire an appreciation for various frequency based filtering techniques for enhancing the appearance of an image, duly applying them in different applications.
CO3	Discern the difference between noise models, gain an insight into assessing the degradation function and realize different spatial and frequency based filtering techniques for reduction and removal of noise.
CO4	Synthesize a solution to image compression using the concept of information theory and lossless and lossy compression techniques.
CO5	Design and create practical solutions using morphological and image segmentation operators for common image processing problems and assess the results.

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Syllabus

Module I:
Introduction to Digital Image Processing, Elements of Visual Perception, Image Sensing & Acquisition, Sampling and Quantization, Basic Relationships between Pixels, Intensity Transformations, Histogram Processing, Spatial Convolution & Correlation, Smoothing Spatial Filters, Sharpening Spatial Filters.

(8L)

Module II: Introduction to the Fourier Transform, Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Image Smoothing using Frequency Domain filters, Image Sharpening using Frequency Domain filters, Selective Filtering, Basics of Fast Fourier Transform, Basics of: Walsh- Hadamard Transform; K-L Transform; Discrete Cosine Transform.

(8L)

Module III:
Model of Image Degradation/Restoration Process, Noise Probability Density Functions, Restoration in presence of Noise only, Periodic Noise Reduction using Frequency Domain filtering, Circulant Matrices, Block Circulant Matrices, Unconstrained Restoration, Constrained Restoration, Basics of Inverse Filtering

(8L)

Module IV:
Image Compression Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria, Image Compression Models– Source Encoder and Decoder, Channel Encoder and Decoder, Elements of Information Theory, Error-Free Compression – Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.Color Fundamentals, Color Models, Basics of Full Color Image Processing.

(8L)

Module V:
Morphological Image Processing-Preliminaries, Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformation, Boundary Extraction, Hole Filling, Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning
Image Segmentation- Fundamentals,Point, Line and Edge Detection, Thresholding, Region Based Segmentation, Segmentation based on color.

(8L)

Text books:

4. Rafael. C. Gonzalez & Richard E. Woods- Digital Image Processing, 3/e Pearson Education, New Delhi - 2009.**(T1)**

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Reference books:

10. W.K.Pratt-Digital Image Processing, 4/e, John Wiley & sons, Inc. 2006..**(R1)**
11. M. Sonka et al. Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007..**(R2)**
12. Jayaraman, Digital Image Processing, Tata McGraw-Hill Education, 2011.**(R3)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching throughresearch papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
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CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: CS524
Course title: SOFT COMPUTING
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 3
Class: M. Tech
Semester / Level: II/5
Branch:Information Technology

Course Objectives

After the completion of this course, students will be:

1.	To understand the concepts of soft computing
2.	To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
3.	To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
4.	To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.
5.	To develop neural network models.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Solve numericals on Fuzzy sets and Fuzzy Reasoning.
CO2	Develop Fuzzy Inference System (FIS).
CO3	Solve problems on Genetic Algorithms
CO4	Explain concepts of neural networks
CO5	Develop neural networks models for various applications.

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SYLLABUS

Module I:

Introduction: Soft Computing vs. hard computing, soft computing paradigms, Basic mathematicsof soft computing, learning and statistical approaches to classification and regression.

Fuzzy Logic: Introduction, Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisprelation & fuzzy relations, Membership functions, fuzzification and defuzzification.

(8L)

Module II:

Fuzzy Rule Base System: Fuzzy propositions, formation, decomposition & aggregation of fuzzyrules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making. **Applications**: Fuzzy logic in modeling and control, image processing

(8L)

Module III:

Neural Networks: Introduction, Biological neural network, learning paradigms. Artificial NeuralNetwork (ANN): Evolution of Basic neuron modeling, Difference between ANN and human brain, McCulloch-Pitts neuron models, Learning paradigms, activation function, Single layer Perceptron, Perceptron learning, Windrow-Hoff/ Delta learning rule, Multilayer Perceptron, Adaline, Madaline, different activation functions, Back propagation network, momentum, limitation, FBFN, Convolution Networks, Kohonen SOM, Hopfield Networks, HebbNet.

(8L)

Module IV:

Genetic Algorithms: Introduction, working principle, Basic operators and Terminologies likeindividual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems such as TSP (Travelling salesman problem),

Applications:Genetic Algorithm based Back propagation Networks.

(8L)

Module V:

Particle Swarm Optimization: Background, Operations of Particle Swarm Optimization, BasicFlow of Particle Swarm Optimization, Comparison between GA and PSO, Applications of PSO.

Ant Colony Optimization: Ant Colony Optimization Algorithm, Ant System, Ant ColonySystem, Basic Flow of Ant colony Optimization, Applications of ACO.

(8L)

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TEXT BOOKS:

4. S.N. Sivanandam,Principle of Soft Computing, Wiley India..**(T1)**

5. Simon Haykins ,"Neural Networks :A Comprehensive Foundation, Pearson Education,2002.**(T2)**

6. Timothy J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997..**(T3)**

REFERENCE BOOKS

4. K.S.Ray ,"Soft Computing and Its application", Vol 1, Apple Academic Press.2015.**(R1)**
5. K.H.Lee ,"First Course on Fuzzy Theory and App.", Adv in Soft Computing Spinger.2005.**(R2)**
6. H.Z.Zimmermann ,"Fuzzy Set Theory and its App " , 4th Ed.Spinger Science,2001.**(R3)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching throughresearch papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
C03	3	3	3	2	1	3
CO4	2	2	3	3	1	2
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6
CO3	CD1, CD2,
CO4	CD1,CD7
CO5	CD1,CD2,

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COURSE INFORMATION SHEET

Course code:IT571
Course title**: Introduction to R Programming**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T:1 P:2
Class schedule per week: 1
Class: M. Tech
Semester / Level:
Branch:

Course Objectives

This course enables the students:

1.	To develop problem solving skills
2.	To learn programming and to solve problems using computers
3.	To learn Data Manipulation, Analysis and Visualization using Computers
4.	To introduce students to the key concepts and ideas of a statistical computing environment
5.	To introduce students to fundamental concepts in (scientific) programming in general.

Course Outcomes

After the completion of this course, students will be to do the following:

1.	Design programs with Interactive Input and Output, utilizing arithmetic expression, repetitions and decision making
2.	Design programs using the fundamental data structures in R
3.	Develop programs in R interfacing files and URLs
4.	Solve Mathematical problems using R
5.	Design graphs and simulations in R

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Syllabus

Module I

Introduction- R reserved words, Variables and Constants, Operators, Operator Precedence

Getting Data in and out of R –Accessing the Keyboard and Monitor, Reading in Larger Datasets

Module II

Control Statements- if ..else, for loop, while loop, repeat loop, break and next

Data Structures- Vectors, Arrays, Matrices, Lists, Data Frames, Factors, Operations on Dates and Times

Module III

Strings: Overview of String Manipulation Functions

Functions: Function Syntax, Environment and Scope, Recursive Function

Interfaces to the Outside World: File Connections, Reading Lines of a Text File Reading From a URL Connection

Module IV

Maths in R- Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations, Set Operations.

Simulation -Generating Random Numbers, Simulating a Linear Model, Random Sampling

Module V

Graphics-Creating Graphs, Customising Graphs

Introduction to Object Oriented Features- Concept of Class and Object

SYLLABUS

List of Programs as Assignments:

17. Lab Assignment No: 1

Objective: To Understand and Implement Data Types

17. Data Types - R Objects and Attributes
18. Data Types - Vectors and Lists
19. Data Types - Matrices
20. Data Types - Factors
21. Data Types - Missing Values
22. Data Types - Data Frames
23. Data Types - Names Attribute
24. Data Types - Summary

18. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

22. Reading Tabular Data
23. Reading Large Tables
24. Textual Data Formats

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25. Connections: Interfaces to the Outside World
26. Subsetting - Basics
27. Subsetting - Lists
28. Subsetting - Matrices
29. Subsetting - Partial Matching
30. Subsetting - Removing Missing Values
31. Vectorized Operations

19. Lab Assignment No: 3

Objective: To Understand and Implement Swirl

7. Workspace and Files
8. Sequences of Numbers
9. Vectors

20. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

21. Lab Assignment No: 5

Objective: To Understand and Implement Control Structures

9. If-else
10. Control Structures - For loops
11. Control Structures - While loops
12. Control Structures - Repeat, Next, Break

22. Lab Assignment No: 6

Objective: To Understand and Implement Functions

9. Functions (part 2)
10. Scoping Rules - Symbol Binding
11. Scoping Rules - R Scoping Rules
12. Scoping Rules - Optimization Example (OPTIONAL)

23. Lab Assignment No: 7 &8

Objective: To Understand and Implement Loop Functions and Debugging

11. Loop Functions - lapply
12. Loop Functions - apply
13. Loop Functions - mapply
14. Loop Functions - tapply
15. Loop Functions – split

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24. Lab Assignment No: 9 & 10

Objective: To Understand and Implement Two-Dimensional Graphics

7. Generating Random Numbers
8. Simulation - Simulating a Linear Model
9. Simulation - Random Sampling

Text books:

2. Matloff Norman, The Art of R Programming– A Tour of Statistical Software Design.(T1)
3. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Orielly, 1st Edition. (T2)

Reference books:

1. Grolemund Garret,Hands-On Programming with R.(R1)
2. Gardener Mark,Beginning R: The Statistical Programming Language.(R2)

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	3
CO2	3	3	2	2	1	2
CO3	2	2	2	3	1	3
CO4	3	1	2	3	1	1
CO5	3	2	1	3	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Head of Department

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COURSE INFORMATION SHEET

Course Code: CS512
Course title: ARTIFICIAL INTELLIGENCE
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits:3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology

Course Objectives
After the completion of this course, students will be able to:

6.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
7.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
8.	An ability to design a system, component or process to meet desired needs within realistic constraints.
9.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
10.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Recall the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
CO2	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
CO3	Understanding the various concepts of knowledge representations and demonstrate working. knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO4	To develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
CO5	Write various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

Head of Department

SYLLABUS

Module I :

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac-Toe Problem.

Intelligent Agents: Agents & Environment, Nature of Environment, Structure of Agents,Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining The Problem as State SpaceSearch, Production System, Problem Characteristics, Issues in The Design of Search Programs.

(8L)

Module II :

Search Techniques: Solving Problems by Searching, Problem Solving Agents, Searching forSolutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory BoundedHeuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search for Constraint Satisfaction Problems.

Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Minimax SearchProcedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

(8L)

Module III :

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping,Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISARelationship, Computable Functions & Predicates, Resolution, Natural Deduction.

Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, LogicProgramming, Forward Versus Backward Reasoning, Matching, Control Knowledge.

(8L)

Module IV :

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, BayesianNetworks, Dempster -Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, HierarchicalPlanning.

Learning: Forms of Learning, Inductive Learning, Explanation Based Learning, Neural NetLearning & Genetic Learning.

(8L)

Module V :

Natural Language Processing: Brief introduction to Syntactic Processing, SemanticAnalysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planninguncertain movements, robotic software architecture, application domains.

(8L)

TEXT BOOK

5. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education..**(T1)**

Head of Department

6. E. Rich & K. Knight, "Artificial Intelligence", 2/e, TMH, New Delhi, 3rd Edition, TMH.**(T2)**

REFERENCE BOOKS:

5. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, New Delhi, 2006..**(R1)**
6. D.W. Rolston, "Principles of AI & Expert System Development", TMH, New Delhi..**(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching throughresearch papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Head of Department

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	1	1
CO5	2	2	2	3	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1,
CO3	CD1, CD2, CD3,
CO4	CD1, CD3
CO5	CD1,CD2, CD7

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COURSE INFORMATION SHEET

Course code:IT516
Course title: DATA MINING AND DATA ANALYSIS
Pre-requisite(s):
Co- requisite(s): None
Credits:3 L:3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

Head of Department

SYLLABUS

Module I :
Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.
(8L)

Module II:
Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.
(8L)

Module III:
Frequent Pattern Mining, Summarizing Itemsets, Itemset Mining, Sequence Mining.
(8L)

Module IV:
Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.
(8L)

Module V:
Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.
(8L)

Text Books:

4. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016.**(T1)**
5. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014.**(T2)**
6. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015.**(T3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations
Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Head of Department

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course Code: CS510
Course title: ADVANCED ALGORITHM LAB
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 2 L:0 T:0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology

Course Objectives

After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behaviour using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Able to know the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations.
CO2	Able to determine the practical implications of asymptotic notations.
CO3	Able to Implement, analyze, and compare algorithms.
CO4	Able to Know the difference between the dynamic programming concept and a greedy approach.
CO5	Able to know and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.

SYLLABUS

List of Programs as Assignments:

10. **Lab Assignment No: 1**
    Programs on Polynomial vs logarithmic running times

11. **Lab Assignment No: 2**
    Programs on Divide-and-conquer algorithms

12. **Lab Assignment No: 3**
    Programs on Greedy and dynamic-programming algorithms

13. **Lab Assignment No: 4**
    Programs on Binary trees
14. **Lab Assignment No: 5**
    Programs on Heaps and priority queues

15. **Lab Assignment No: 7**
    Programs on Binary search trees

16. **Lab Assignment No: 8**
    Programs on Hash tables

17. **Lab Assignment No: 9**
    Programs on Graph traversal

18. **Lab Assignment No: 10**
    Programs on Shortest paths in graphs.

Head of Department

Books recommended:

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001..**(T1)**
2. Sanjoy Dasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, Tata McGraw-Hill, 2008..**(T2)**
3. Jon Kleinberg and ÉvaTardos, Algorithm Design, Pearson, 2005..**(T3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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COURSE INFORMATION SHEET

Course code:IT517
Course title: DATA MINING AND DATA ANALYSIS LAB
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes
After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

Head of Department

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SYLLABUS

List of Programs as Assignments:

13. **Lab Assignment No: 1**
. Build a Data Warehouseand Explore WEKA tool.

14. **Lab Assignment No: 2**
. Demonstration of preprocessingonvariousdatasets.

15. **Lab Assignment No: 3**

Q3.Demonstration of Association rule process on dataset using apriori algorithm.

16. **Lab Assignment No: 4**

Q4.Demonstrate performance of classification on various data sets.

17. **Lab Assignment No: 5**

Q5. Demonstrate performance ofclustering on various data sets.

18. **Lab Assignment No: 6**

Q6. Demonstrate performance ofRegression on various data sets

19. **Lab Assignment No: 7**

Q7. Implement following algorithms for various datasets
J. Apriori Algorithm.
K. FP-Growth Algorithm.
L. K-means clustering.

20. Q8. **Lab Assignment No: 8**

Implement Bayesian Classification for various datasets

21. **Lab Assignment No: 9**

Q9 Implement Decision Tree for various datasets.

22. **Lab Assignment No: 10**

Q10. Implement Support Vector Machines.

Head of Department

23. Lab Assignment No: 11

Q11Applications of classification for web mining.

24. Lab Assignment No: 12

Q12. Case Study on Text Mining or any commercial application

Books recommended:

TEXT BOOKS :

4. Jiawei Han &MichelineKamber - Data Mining Concepts & Techniques Publisher Harcout India. Private Limited..**(T1)**

REFERENCE BOOKS :

10. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006..**(R1)**
11. A. Berson& S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004..**(R2)**
12. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006..**(R3)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution

Head of Department

Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2		1
CO2	3	3	2		1	
CO3	2	3	2	1	1	1
CO4	3				1	1
CO5	3	2	1			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT519
Course title: INTERNET OF THINGS LAB
Pre-requisite(s):
Co-requisite(s):
Credits:2 L:0 T:0 P:4
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Technology

Course Objectives
This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes
After the completion of this course, students will be:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
C03	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

Head of Department

SYLLABUS

List of Programs as Assignments:

34. **Lab Assignment No: 1**
    Glowing LEDs.
    Toggling LED's.
35. **Lab Assignment No: 2**
    Transmitting a string through UART
    Controlling LEDs blinking pattern through UART.
36. **Lab Assignment No: 3**
    Echo each character typed on HyperTerminal
    Digital IO configuration.
    Timer based LED Toggle.
37. **Lab Assignment No: 4**
    Scanning the available SSID's in the range of Wi-FI Mote.
    Connect to the SSID of choice
38. **Lab Assignment No: 5**
    Demonstration of a peer to peer network topology.
    check the connectivity to any device in the same network.
39. **Lab Assignment No: 6**
    Send hello world to TCP server existing in the same network
    Reading of atmospheric pressure value from pressure sensor.
40. **Lab Assignment No: 7**
    I2C protocol study
    Reading Temperature and Relative Humidity value from the sensor.
    Reading Light intensity value from light sensor.
41. **Lab Assignment No: 8**
    Proximity detection with IR LED.
    Generation of alarm through Buzzer.
42. **Lab Assignment No: 9**
    Timestamp with RTC
    IO Expander.
    Relay control.
43. **Lab Assignment No: 10**
    I2C based 12-channel ADC
    EEPROM read and write
44. **Lab Assignment No: 11**
    Transmitting the measured physical value from the UbiSense Over the Air.

Head of Department

Books recommended:

TEXT BOOK

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1stEdition, Academic Press, 2014.**(T1)**
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(T2)**

REFERENCE BOOK

3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
4. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(R2)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
D4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
C03	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

Head of Department

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COURSE INFORMATION SHEET

Course code: IT511
Course title: R PROGRAMMING
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/5
Branch: Information Technology
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring R
2.	Develop basic thinking for data analysis.
3.	To enable the student on how to approach for statistical Analysis
4.	To provide a foundation in use of this software

Course Outcomes

After the completion of this course, students will be able to:

CO1	Manipulate data within R
CO2	Perform basic data analysis procedures
CO3	Create plots
CO4	Implement programming features like accessing R packages, writing R functions
CO5	Simulation & Profiling with R

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SYLLABUS

List of Programs as Assignments:

25. Lab Assignment No: 1

Objective: To Understand and Implement Data Types

25. Data Types - R Objects and Attributes
26. Data Types - Vectors and Lists
27. Data Types - Matrices
28. Data Types - Factors
29. Data Types - Missing Values
30. Data Types - Data Frames
31. Data Types - Names Attribute
32. Data Types - Summary

26. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

32. Reading Tabular Data
33. Reading Large Tables
34. Textual Data Formats
35. Connections: Interfaces to the Outside World
36. Subsetting - Basics
37. Subsetting - Lists
38. Subsetting - Matrices
39. Subsetting - Partial Matching
40. Subsetting - Removing Missing Values
41. Vectorized Operations

27. Lab Assignment No: 3

Objective: To Understand and Implement Swirl

10. Workspace and Files
11. Sequences of Numbers
12. Vectors

28. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

29. Lab Assignment No: 5

Objective: To Understand and Implement Control Structures

13. If-else

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14. Control Structures - For loops
15. Control Structures - While loops
16. Control Structures - Repeat, Next, Break

30. Lab Assignment No: 6

Objective: To Understand and Implement Functions

13. Functions (part 2)
14. Scoping Rules - Symbol Binding
15. Scoping Rules - R Scoping Rules
16. Scoping Rules - Optimization Example (OPTIONAL)

31. Lab Assignment No: 7 &8

Objective: To Understand and Implement Loop Functions and Debugging

16. Loop Functions - lapply
17. Loop Functions - apply
18. Loop Functions - mapply
19. Loop Functions - tapply
20. Loop Functions – split

32. Lab Assignment No: 9 & 10

Objective: To Understand and Implement Two-Dimensional Graphics

10. Generating Random Numbers
11. Simulation - Simulating a Linear Model
12. Simulation - Random Sampling

Books recommended:

TEXT BOOKS

3. Norman Matloff, The Art of R Programming, A Tour of Statistical Software Design 1st Edition, **(T1)**
4. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Orielly, 1st Edition. **(T2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Head of Department

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	2	2	1	1	1
CO4	3	1	1	1	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: CS601
Course title: GRAPH THEORY
Pre-requisite(s): Discrete Mathematics
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/6
Branch: Information Technology

Course Objectives

This course enables the students to:

1.	Learn and become comfortable with graphs and its terminologies
2.	Understand applications of graph theory to practical problems and other branches of mathematics
3.	Understand various graphs algorithms along with its analysis.
4.	Practice creative problem solving and improve skills in this area

Course Outcomes

After the completion of this course, students will be able to:

CO1	Attain knowledge about different types of graphs and their applications in real world.
CO2	Perceive the role of cut-set, cut-vertex and fundamental circuits in network flows.
CO3	Create an awareness of planar and dual graph.
CO4	Understand how to represent graphs in computer system
CO5	Apply the concept of graph coloring and partitioning techniques in NP-problems

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SYLLABUS

Module I:

Introduction: Graphs and its applications, Finite and infinite graphs, incidence and degree, isolated Vertex, pendant Vertex, and Null graph, paths and circuits, isomorphism, sub graphs, walks, paths, and circuits, connected graphs, disconnected graphs and components, Connectivity checking algorithm, Euler graphs, Operations on graphs, more on Euler graphs, Hamiltonian paths and circuits, Travelling Salesman problem.

(8L)

Module II:

Trees and Fundamental circuits: Trees and its properties, Distance and centers in a tree, Algorithm for checking if a graph is Tree, Partial k-trees, Dynamic Programming in partial k-trees, Spanning trees, Spanning trees in a Weighted graph, Prim's and Kruskal's algorithms

Cut set and cut vertices: Properties of a cut set, Fundamental circuits and cut sets, connectivity and separability, Computing connected components, Menger's theorem, Network flows, 1-Isomorphism, 2-Isomorphism.

(8L)

Module III :

Planar and Dual Graphs: Planar graph, Kuratowski's Graphs, Representations of a planar graph, Detection of planarity, Planar Separator Theorem, Geometric Dual, Combinatorial, Duel, Thickness and crossings, Algorithms for finding Clique and maximum clique**.**

(8L)

Module IV :

Matrix Representation of Graphs: Incidence matrix, Adjacency matrix, Adjacency list, Circuits Matrix, Fundamental Circuit Matrix and Rank of B, Cut-set Matrix, Relationships among A *f*, B*f* and C*f*, path Matrix**.**

(8L)

Module V :

Coloring, Covering and partitioning: Chromatic number, Chromatic partitioning, Chromatics polynomial, Coverings, Four colour problem, Algorithm for graph colouring.

Directed Graphs: Digraphs and its types, Digraphs and binary Relations, Directed paths and connectedness, Euler Digraphs, Trees with Directed Edges, Fundamental Circuits in Di graphs, Matrices A, B and C of Digraphs, Adjacency Matrix of a Digraph, Paired Comparisons and Tournaments, Acyclic Di graphs and De-cyclization**.**

(8L)

Text Books:

1. Narasingh Deo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001..**(T1)**

Reference Books:

1. Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002..**(R1)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Head of Department

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
CO3	3	3	3	2	1	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code: CS607
Course title: INTELLIGENT SYSTEMS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/6
Branch: Information Technology

Course Objectives
This course enables the students to:

1.	Understanding basic concepts and principles through case studies, mathematical analysis and computational implementation.
2.	Application of established engineering methods to complex engineering problem solving.
3.	Fluent application of engineering techniques, tools and resources
4.	In-depth understanding of specialist bodies of knowledge within the engineering discipline.
5.	Capable of constructing intelligent systems (in software) that perform useful engineering tasks

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Assemble knowledge of neural networks, fuzzy systems, evolutionary computation as well as some exposure to expert systems
CO2	Demonstrate good knowledge of basic theoretical foundations of the following common intelligent systems methodologies:
CO3	Determine which type of intelligent system methodology would be suitable for a given type of application problem
CO4	Analyse core areas for developing Intelligent systems
CO5	To design and develop an intelligent system for a selected application.

SYLLABUS

Module I:

Biological foundations to intelligent systems I: Artificial neural networks, Back- propagation networks, Radial basis function networks, and recurrent networks.

(8L)

Module II :

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

(8L)

Module III:

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill- climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

(8L)

Module IV:

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architecture.

(8L)

Module V:

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

(8L)

Text Books:

1. Luger G.F. and Stubblefield W.A., "Artificial Intelligence: Structures and strategies for Complex Problem Solving", 6th Edition, Addison Wesley, 2008..**(T1)**

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Reference Books:

1. Russell S. and Norvig P., "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice-Hall, 2009..**(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	1	1
CO2	3	2	2	2	1	1
CO3	3	3	3	3	1	1
CO4	3	3	2	2	1	1
CO5	2	2	1	1	1	1

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code: CS605
Course title: HIGH PERFORMANCE COMPUTER ARCHITECTURE
Pre-requisite(s): Computer Architecture/Organization, Operating System, Parallel Computing
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class: M. Tech
Class schedule per week: 03
Semester / Level: III/6
Branch: Information Technology

Course Objectives
This course enables the students to:

6.	To Explain different terminologies in High Performance Computer Architecture.
7.	To introduce basic concepts of High Performance Computer Architecture
8.	Hands on the different parallel architectures in terms of various parameters.

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9.	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
10.	Provide the students with practice on running complex problem in high performance computing machines.

Course Outcomes

After the completion of this course, students will be:

CO1	Describe different terminologies in High Performance Computer Architecture.
CO2	Demonstrate and Implement the concepts of High Performance Computer Architecture
C03	Compare and differentiate the different parallel architectures in terms of various parameters.
CO4	Evaluate performance metrics and scalability and selection criteria for parallelism and different parallel systems and able to modify it.
CO5	Design effective high-performance systems as per users' criteria with proper justification by self or in a group.

SYLLABUS

Module I:

Parallel Computer Models : The State of Computing, Multiprocessors andMulticomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Program and Network Properties : Conditions for Parallelism, Program Partitioning andScheduling, Program Flow Mechanism, System Interconnect Architectures.

(8L)

Module II:

Program and Network Properties : Conditions for Parallelism, Program Partitioning andScheduling, Program Flow Mechanism, System Interconnect Architectures.

Principles of Scalable Performance: Performance Metrics and Measures, ParallelProcessing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

(8L)

Module III:

Processors and Memory Hierarchy: Advanced Processor Technology, Super Scaler andVector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Weak Consistency Models.

(8L)

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Module IV:

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Non Linear PipelineProcessor, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design

Multiprocessors and Multicomputers: Multiprocessor System Interconnects, Cache Coherence Synchronization Mechanism, Three Generations of Multicomputers, Message-Passing Mechanisms.

(8L)

Module V:

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessor, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5

Scalable, Multithreaded and Data Flow Architecture: Latency-Hiding Techniques,Principle of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures,Data Flow and Hybrid Architectures.

(8L)

Text Book:

3. Hwang K., Jotwani N., Advanced Computer Architecture, 2nd Edition, Tata Mc-Graw Hill, India, 2010.**(T1)**

Reference Book:

3. Stone, H. S., High Performance Computer Architecture, 3rd Edition, Addison Wesley Publishing Company, USA.**(R1)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching throughresearch papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT507
Course title: DATA COMMUNICATION AND COMPUTER NETWORKS
Pre-requisite(s):
Co-requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/05
Branch: Information Technology

Course Objectives

This course enables the students:

1.	To build an understanding of the fundamental concepts of the data communication model and communications architecture.
2.	To study characteristics of communication mediums and the characteristics of signals propagated through different transmission media, including concepts of transmission impairments.
3.	To understand the basic principles of signal encoding techniques, error-detection, and error-correction techniques.
4.	To understand techniques for flow control and multiplexing for maximum utilization of bandwidths in the data communications process.
5.	To understand the various switching techniques and routing techniques for efficient transmission.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand and be able to explain the principles of a layered protocol architecture; be able to identify and describe the system functions in the correct protocol layer and further describe how the layers interact.
CO2	Understand, explain and calculate digital transmission over different types of communication media.
CO3	Understand, explain and solve mathematical problems for data-link and network protocols.
CO4	Describe the principles of access control to shared media and perform performance calculations.
CO5	Understand and explain the principles and protocols for route calculations and be able to perform such calculations.

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SYLLABUS

Module I:

Data Communications and Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture

Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity.

(8L)

Module II:

Guided and Wireless Transmission: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.

Signal Encoding Techniques:

Digital Data Digital Signals, Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals.

(8L)

Module III :

Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing.

Data Link Control: Flow Control, Error Control, High-Level Data Link Control (HDLC).

Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.

(8L)

Module IV :

Circuit Switching and Packet Switching: Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signalling, Soft switch Architecture, Packet-Switching Principles, X.25, and Frame Relay.

(8L)

Module V:

Asynchronous Transfer Model: Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.

Routing in Switched Networks: Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms.

(8L)

TEXT BOOKS:

1. W. Stallings, "Data and Computer Communications", 7th Edition, Pearson Edition/ PHI, New Delhi, 2016..**(T1)**

REFERENCE BOOKS:

1. B. A. Forouzan, "Data Communications and Networking", 4th Edition, TMH, New Delhi 2015..**(R1)**
2. P.C. Gupta, "Data Communications and Computer Networks", PHI, New Delhi 2006..**(R2)**

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Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching throughresearch papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	2	2	1	3	2	1
CO3	3	2	2	1	2	1
CO4	3	2	3	2	3	1
CO5	1	1	1	2	2	1

COURSE INFORMATION SHEET

Course code:IT521
Course title: DATA COMMUNICATION AND COMPUTER NETWORKS Lab
Pre-requisite(s):
Co- requisite(s): DATA COMMUNICATION AND COMPUTER NETWORKSCredits:2
L:0 T:0 P:4
Class schedule per week: 04
Class: M.Tech
Semester / Level: III/05
Branch: Information technology
Name of Teacher:

Course Objectives
This course enables the students to:

1.	To familiarize the student in introducing and exploring various Network topologies and networking protocols
2.	To understand the use of client/server architecture in application
3.	To enable the student on how to approach for networking problems using networking simulation tools.
4.	To Design reliable servers using both TCP and UDP sockets
5.	Familiar with network tools and network programming.

Head of Department

Course Outcome

After the completion of this course, students will be able to:

CO1	Express programming & simulation for networking problems.
CO2	Get a thorough understanding of various aspects of networking devices
CO3	Design and implement simulation of a simple LAN and a WAN that meet a specific set of criteria
CO4	Identify the elements of a communication network
CO5	Simulate various OSI layer protocols using C/C++/ Java

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Q1. To familiarize with the Lab Network Topology, Locating different interfaces, routers and switches. Studying different pools of IP addresses.

   Q2. Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.

   Q3. To learn and observe the usage of different networking commands e.g.PING, TRACEROUTE. Learning remote login using telnet session. Measuringtypical average delays between different locations of the network.

2. **Lab Assignment No: 2**

   Q1. What is the IP of the machine you are using? Compare it with the IP of your neighbors. Are the IPs of your neighbors same? Why or Why not?

   Q2. Ping" is a tool used to determine if a server is responding and to estimate the round trip time of a message sent to that server. Use the ping command for the following URLs and record the success or failure statistics along with the average round trip time.

   a) google.com
   b) facebook.com
   c) bitmesra.ac.in

   Q3. Trace the route that is taken when you try to access:
   a) google.com
   b) facebook.com
   c) bitmesra.ac.in

   Q4. Network Commands on Linux / Unix

Head of Department

3. **Lab Assignment No: 3**

Q1. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC 32.

Q2. Implementation of Sub-netting and Super-netting.

Q3. To study different types of transmission media, various topologies, and configure modem of computer HUB and Switches.

4. **Lab Assignment No: 4**

Q1. Write a C/C++ program to determine if the IP address is in Class A, B, C, D, or E.
Q2. Write a C/C++ program to determine if the IP address is in Class A, B, or C.
Q3. Write a C/C++ program to translate dotted decimal IP address into 32 bit address.
Q4. To implement a routing protocol and check its connectivity in a variable length subnet masked network
Q5. Write a C/C++ program to perform bit stuffing and de-stuffing.

5. **Lab Assignment No: 5**

Q1. Implement Dijkstra's algorithm to compute the Shortest path through a graph.

Q2. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

Q3. Take an example subnet of hosts. Obtain broadcast tree for it.

6. **Lab Assignment No: 6**

Q1. Build implementations of the Internet protocols
Q2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
Q3. Write a code simulating ARP /RARP protocols.

7. **Lab Assignment No: 7**

Q1. Create a socket for HTTP for web page upload and download
Q2. Write a code simulating PING and TRACEROUTE commands.

8. **Lab Assignment No: 8**

Q1. Study and implement model for Socket Programming and Client – Server model.

Q2. Experiments with NS2(or any other simulator) to study behavior (especially performance of) link layer protocols such as Ethernet and802.11 wireless LAN.

Head of Department

9. Lab Assignment No: 9

Q1. Experimental study of applicationprotocolssuch as HTTP, FTP,SMTP, using network packetsniffersand analyzerssuch as**Wireshark**. Small exercisesin socket programming in C/C++/Java..

10. **Lab Assignment No: 10**

Q1. Take a 64 bit playing text and encrypt the same using DES algorithm.
Q2. Write a program to break the above DES coding
Q3. Using RSA algorithm encrypts a text data and Decrypt the samebjective: To Understand and Implement Data Interpolation

11. Lab Assignment No: 11

Q1. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer

Q2. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS

Q3.Echo client and echo server b. Chat c. File Transfer

Books recommended:

TEXT BOOKS

1. William Stallings, Data and Computer Communication, Prentice Hall of India. .**(T1)**
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill. .**(T2)**
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall. .**(T3)**

REFERENCE BOOKS

1. W. Richard Stevens, TCP/IP Illustrated, Volume 1, Addison-Wesley.**(R1)**
2. Douglas Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India..**(R2)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Head of Department

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

Phone : (EPBX) 0651 – 2275444/2275896, 2276002/2276006 FAX : 0651 – 2275401/2275351 Website : www.bitmesra.ac.in

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2		1
CO2	3	3	2		1	
CO3	2	3	2	1	1	1
CO4	3				1	1
CO5	3	2	1			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code:IT603
Course title: PYTHON PROGRAMMINGLAB
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class:M.Tech
Semester / Level: III/6
Branch: Information Technology
Name of Teacher:

Course Objectives
This course enables the students to:

Head of Department

1.	To introducewith fundamentals and grammar of Python programming.
2.	To understand and be able to use basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
3.	To learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
4.	To understand the process and skills necessary to effectively attempt a programming problem and implement it with a specific programming language -- Python.
5.	To understand a python program written by someone else and be able to debug and test the same.

Course Outcomes

After the completion of this course, students will be able to:

CO1	To use their problem solving abilities to implement programs in Python.
CO2	To apply Python in software development, testing and systems administration environments.
CO3	To develop Python applications for a variety of uses
CO4	To understand the fact that there is more than one right solution to a problem.
CO5	Work in industry environment with good enough knowledge about Python programming.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Objective: To Implement basic Python programming.

   Q1. Create a new program called hello world.py. Use this file to write your very First "Hello, world!" program.

   Q2. Write a Python program containing exactly one print statement that produces the following output:

   A
   B
   C
   D
   E
   F

2. **Lab Assignment No: 2**

   Objective: To Understand and Implement the concept of if-else-if statements.

   Q1.Write a Python program that requests five integer values from the user. It then prints one of two things: if any of the values entered are duplicates, it prints "DUPLICATES"; otherwise, it prints "ALL UNIQUE".

Head of Department

Q2. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. Each binary digit should be entered one per line, starting with the leftmost digit, as shown below.

Enter leftmost digit: 1
Enter the next digit: 0
Enter the next digit: 0
Enter the next digit: 1
The value is 9

Q3.Develop and test a program that prompts the user for their age and determines approximately how many breaths and how many heartbeats the person has had in their life. The average respiration (breath) rate of people changes during different stages of development. Use the breath rates given below for use in your program:

	Breaths per Minute
Infant	30–60
1 –4 years	20–30
5 –14 years	15–25
adult	12–20

For heart rate, use an average of 67.5 beats per second.

3. Lab Assignment No: 3

Objective: To Understand and Implement the flow control statements.

Q1. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4... 1/10.

Q2.Write a program using a for loop that calculates exponentials. Your program should ask the user for a base ‘b’ and an exponent ‘exp’, and calculate b^exp.

Q3. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user input a negative number? As a programmer, you should always consider “edge conditions” like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don’t include a condition that catches negative numbers, what will your program do?)

Head of Department

4. **Lab Assignment No: 4**

Objective: To practice drawing patterns

Q1.Write the program to print the following pattern: ex if the user enters 7, the program would print

```
    *
   **
  ***
 ****
*****
******
*******
******
*****
****
***
**
*
```

Q2.Write a program in python to print the following pattern:

```
          1
         1 1
         121
1331
        12641
15101051
1615201561
```

5. **Lab Assignment No: 5**

Objective: To Understand and Implement methods in Python.

Q1.Write a method fact that takes a number from the user and prints its factorial.

Q2. Write a Python function named compare3 that is passed three integers and returns true if the three integers are in order from smallest to largest, otherwise it returns false.

Q3. Write a python function named modCount that is given a positive integer and a second positive integer, m<=n, and returns how many numbers between 1 and n are evenly divisible by m.

6. **Lab Assignment No: 6**

Objective: To Understand and Implement the concept of Recursion

Q1. Write a program to read an integer number. Print the reverse of this number using recursion.

Q2. Write a program that calculates the GCD using recursive functions.

Head of Department

7. **Lab Assignment No: 7**
   Objective: To Understand and Implement Sorting techniques
   Q1.Write a program to sort the list of elements using Insertion sort.
   Q2. Write a program to sort the list of elements using Merge sort.
   Q3.Write a program to multiply the two matrices.
8. **Lab Assignment No: 8**
   Objective: To Understand and Implement the concept of Strings in Python
   Q1. Write a program to check whether string is a palindrome or not.
   Q2. Write a program to implement format method available with string object.
9. **Lab Assignment No: 9**
   Objective: To Understand and Implement Dictionary
   Q1. Program to demonstrate the built in functions within the dictionary.
   Q2. Program to implement dictionary as an associative array
10. **Lab Assignment No: 10**
    Objective: To Understand and Implement File Handling.
    Q1. Program to open the file in the read mode and use of for loop to print each line present in the file.
    Q2. Write a Python program to illustrate Append vs write mode.
    Q3. Write a Program to read and write data from a file.

Books recommended:

TEXT BOOKS

1. Krishna P. R., Object Oriented Programming through JAVA, 1st Edition, Universities Press, 2008..**(T1)**
2. Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi..**(T2)**
3. Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi..**(T3)**

REFERENCE BOOKS

1. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi..**(R1)**
2. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi..**(R2)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Head of Department

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	1	1	3					
CO2	2	1	1	1	3			3		
CO3	1	2	3	3	3					
CO4		1	1	3	2					1
CO5	1	1	2	2				2		3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code:IT604
Course title: WEB APP DEVELOPMENT LAB
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M.Tech
Semester / Level: III/6
Branch: Information Technology
Name of Teacher:

Course Objectives
This course enables the students to:

1.	To get familiar with basics of the Internet Programming.
2.	To acquire knowledge and skills for creation of web site considering both client and server side programming
3.	To gain ability to develop responsive web applications
4.	To explore different web extensions and web services standards

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Analyze a web page and identify its elements and attributes.
CO2	Implement interactive web page(s) using HTML, CSS and JavaScript.
CO3	Demonstrate Rich Internet Application.
CO4	Build Dynamic web sites using server side Programming and Database connectivity.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Objective: To Understand and Implement HTML

   Q1. To create a simple html file to demonstrate the use of different tags.

   Q2. To create an html file to link to different html page which contains images, tables, and also link within a page.

   Q3. To create an html page with different types of frames such as floating frame, navigation frame & mixed frame.

   Q4. To create a registration form as mentioned below.

   Create an html page named as "registration.html"

   a) set background colors

   b) use table for alignment

   c) provide font colors & size

2. **Lab Assignment No: 2**

   Objective: To Understand and Implement CSS

   Q1. To create an html file by applying the different styles using inline, external & internal style sheets.

   1. Create a external style sheet named as "external_css.css" and provide some styles for h2, hr, p & a tags.

   2. Create an html file named as "Style_sheet.html"

   a) Include the external style sheet with necessary tag.

   b) Include the internal style sheet for body tags & also use class name, so that the style can be applied for all tags.

   c) Include a tags with inline style sheet.

3. **Lab Assignment No: 3**

   Objective: To Understand and Implement JavaScript

   Q1. To write a Javascript program to define a user defined function for sorting the values in an array.

   Q2. Create an html page named as "exception.html" and do the following.

Head of Department

1. within the script tag write code to handle exception
a) define a method RunTest() to get any string values(str) from the user and cll the method Areletters(str).
b) In Areletters(str) method check whether str contain only alphabets (a-z, AZ), if not throw exception.
c) Define a exception method Input Exception(str) to handle the exception thrown bythe above method.
2. Within the body tag define a script tag to call Runtest() method defined.
Q3. To display the calendar using javascript code by getting the year from the user.
Q4. To create a html page to display a new image & text when the mouse comes over the existing content in the page.

4. **Lab Assignment No: 4**

Objective: To Understand and Implement ASP
Q1. To create an ASP file to find the no of hits on the page and to have rotating banner content.
Q2. To create a table of content using ASP program & navigate within the pages.
Q3. Create an ASP file named as request.asp
a) Create a simple form to get the first name & last name and a button submit. When the button is clicked the values in the text box are printed by response object by Request.QueryString
b) Create a hyperlink with some values defined in the tag & display the same using request & response object.
Q4.To display all the content in the database using ASP program.

Lab Assignment No: 5

Objective: To Understand and Implement Java Servlets
Q1. To create a simple servlet program to display the date (using Tomcat server).
Q2. To create a servlet program to retrieve the values entered in the html file (Using NetBeans IDE).
Q3. To display the cookie values that are entered in the html page using servlet program. (using NetBean IDE).

Lab Assignment No: 6

Objective: To Understand and Implement XML
Q1. To create a simple catalog using XML file
Q2. To create external style sheet and using the style sheet in xml file.

Lab Assignment No: 7

Objective: To Understand and Implement PHP
Q1. To create a php program to demonstrate the different file handling methods.
Q2. To create a php program to demonstrate the different predefined function in array, Math, Data & Regular Expression.

Head of Department

Books recommended:

TEXT BOOKS

3. Web Technologies: A Computer Science Perspective , Jeffrey C Jackson , Pearson Education , India.
4. Stephen Wynkoop, Running a perfect website, QUE, 1999

REFERENCE BOOKS

1. Eric Ladd, Jim O' Donnel, Using HTML 4, XML and Java, Prentice Hall of India-QUE, 1999
2. Chris Bates, Web Programming - Building Intranet applications, Wiley Publications, 2004
3. Deitel, Deitel& Nieto, Internet and World Wide Web - How to Program, Pearson Education Asia, 2000

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		3			2	
CO2	1	3	3		1	2
CO3	2		1	2	2	1
CO4	1	3	3		1	

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3
CO2	CD2, CD3,CD6
CO3	CD1, CD2, CD3,CD6
CO4	CD3,CD6,CD7

Head of Department

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Syllabus M.Tech IS CBCS

COURSE INFORMATION SHEET

Course code: CS501
Course title: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
Pre-requisite(s): Discrete Mathematics
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives:
This course enables the students to:

1.	Present basic concepts and techniques of linear algebra, probability, statistics and graph theory
2.	Develop mathematical thinking and problem-solving skill
3.	Provide the foundations of probabilistic and statistical analysis
4.	Explain graphs to formulate computational problems

Course Outcomes
After the completion of this course, students will be able to:

CO1	Demonstrate skills in solving mathematical problems
CO2	Apply knowledge of computing and mathematics appropriate to the discipline
CO3	Analyze problems and identify the computing requirements appropriate to its solution
CO4	Understand basic concepts in probability theory and statistical analysis
CO5	Study the advanced courses in Computer science such as Coding Theory, Artificial Intelligence, Numerical Computation, etc.

Head of Department

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SYLLABUS

Module I:
Linear Algebra
Introduction: Matrices and solving set of linear equations, Vector space, Subspace, Linear combination of vectors, Linear dependence and independence of vectors, Bases and dimensions.

(8L)

Module II:
Inner product spaces, Orthogonal vectors and dual vectors, Eigen values and Eigen vectors, Linear programming.

(8L)

Module III:
Probability and Statistics
Frequency distribution and measures of central tendency, mean, median mode, quartiles, measures of dispersions and skewness, standard deviation, mean deviation, coefficient of variation, moments.

(8L)

Module IV:
Probability: definition, Distribution: discrete and continuous, Chi-square test, t-test.

(8L)

Module V:
Graph Theory
Introduction: Graphs and its types, Representation of graphs: Adjacency matrix, Incidence matrix, Adjacency list, Planar graph, Kuratowski's Graphs, Clique and maximum Clique finding algorithms.

(8L)

Books recommended:

TEXT BOOK

1. K. Haffman, and R. Kunze, "Linear Algebra", 2nd Edition, Pearson, 2015.**(T1)**
2. G. Williams, "Linear Algebra with Applications", 4th Edition, John & Bartlett.**(T2)**
3. W. Navidi, "Statistics for Engineers and Scientists", 2nd Edition, TMH, 2008.**(T3)**
4. J.K. Goyal, and J. N. Sharma, "Mathematical Statistics", Krishna Prakashan, 2017**(T4).**

REFERENCE BOOK

1. NarasinghDeo, "Graph Theory with Applications to engineering and Computer Science", Prentice Hall of India, 2001.**(R1)**
2. Douglas B. West, "Introduction to Graph theory", Pearson Education, 2002.**(R2)**

Course Evaluation:
Individual Assignment, Theory (Quiz and End semester) examinations.

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	3	3	1	1	1	1
CO3	2	3	2	1	1	1
CO4	3	2	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS502
Course title: ADVANCED DATA STRUCTURES
Pre-requisite(s): Data Structures, Algorithm Analysis
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2.	Students should be able to understand the necessary mathematical abstraction to solve problems.
3.	To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4.	Student should be able to come up with analysis of efficiency and proofs of correctness.

Head of Department

Course Outcomes

After the completion of this course, students are expected to:

CO1	Understand the implementation of symbol table using hashing techniques.
CO2	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
CO3	Develop algorithms for text processing applications.
CO4	Learn the basic working of advanced heaps.
CO5	Understand the implementation of symbol table using hashing techniques.

SYLLABUS

Module I:

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

(8L)

Module II:

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

(8L)

Module III:

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

(8L)

Module IV:

Heaps: Balanced Search Trees as Heaps, Array-Based Heaps, Heap-Ordered Trees and Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps, Heap-Related Structures with Constant-Time Updates.

(8L)

Module V:

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

(8L)

Head of Department

Books recommended:

TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004.**(T1)**
2. Peter Brass, "Advanced Data Structures," Cambridge University Press, 1stEdition.**(T2)**
3. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002.**(T3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	2	3	3	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6
CO3	CD1, CD2, CD3,CD4
CO4	CD1, CD3,CD6
CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT502
Course title: FUNDAMENTALS OF INFORMATION SECURITY
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives
This course enables the students:

1.	Broad understand of What is security and its terminology
2.	Know about Models for discussing security issues
3.	In depth understanding of Attacks and their counter measures.
4.	Information of how to apply defence in depth
5.	Evaluate available measures to confirm information reliability

Course Outcomes
After the completion of this course, students will be:

CO1	Identify requirements of security and its related terminology
CO2	Classify and compare Attacks and their impact on information security
CO3	Evaluate the types of treats and vulnerabilities in context to the risks associated and their countermeasures.
CO4	Illustrate access control and application of defence against risks and threats.
CO5	Summarize about malware, Malicious code threats, Attack, its prevention and detection

Head of Department

SYLLABUS

Module I:
Basics of Information systems security: Information systems security, Seven domains of it infrastructure, Weak links in security, IT security Policy Framework

(8L)

Module II:
Attacks Threats and Vulnerabilities: Malicious attacks Threats and Vulnerabilities, Attack tools, What is security breach, Malicious softwares, Countermeasures.
Risk management, BIA, BCP and DRP, Assessing risk and Vulnerabilities, Compliance laws, confidentiality of data

(8L)

Module III:
Access Controls basics of access controls, identification methods, authentication processes and requirements, Models and treats to access controls

(8L)

Module IV:
Risk management and information security, risk analysis, evaluating countermeasures, steps to disaster recovery. Types of backups.

(8L)

Module V:
Main types of malware, Malicious code threats, Attack, its prevention and detection, Information security standards.

(8L)

Books recommended:

TEXT BOOK

1. "Fundamentals of Information Systems Security" by David Kim, Michael G. Solomon, 2nd Edition. **(T1)**

REFERENCE BOOK

1. "The Basics of Information Security: Understanding the fundamentals of InfoSec in Theory and practice" by Jason Andres. **(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:
Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	2	1	1
CO2	2	3	3	1	1	2
CO3	2	3	3	2	1	1
CO4	3	1	3	2	1	1
CO5	3	1	1	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

PROGRAM ELECTIVE – I

COURSE INFORMATION SHEET

Course code: IT504
Course title: APPLIED CRYPTOGRAPHY
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives
This course enables the students:

1.	To understand the foundations of cryptographic attacks.
2.	To gain knowledge of encrypting data, and to choose between different algorithms.
3.	To prepare students for research in the area of cryptography and enhance students communication and problem solving skills
4.	To differentiate between the encryption techniques and know their suitability to an application.
5.	To effectively apply their knowledge to the construction of secure cryptosystems.

Course Outcomes
After the completion of this course, students will be able to:

1.	Understand the various types of cryptographic attacks and the mathematics behind cryptography.
2.	Describe the various types of ciphers and hash functions.
3.	Apply the different cryptographic techniques to solve real life problems.
4.	Evaluate different techniques as to their suitability to various applications.
5.	Develop a cryptosystem keeping in view social issues and societal impacts.

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SYLLABUS

Module I:
Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols - Advanced Protocols - Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography.

(8L)

Module II:
Key Length - Key Management – Public Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information.

(8L)

Module III:
Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation - Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab – RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

(8L)

Module IV:
Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design - N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes

(8L)

Module V:
RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes - Ongchnorr-Shamir -Cellular Automata - Feige-Fiat-Shamir -Guillou-Quisquater - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol - IBM Secret-Key Management Protocol - MITRENET - Kerberos - IBM Common Cryptographic Architecture.

(8L)

Books recommended:

TEXT BOOK

4. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", 2nd Edition, John Wiley & Sons, Inc, 1996. **(T1)**
5. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004. **(T2)**
6. AtulKahate, "Cryptography and Network Security", Tata McGrew Hill, 2003. **(T3)**

REFERENCE BOOK

1. William Stallings, "Cryptography & Network Security Principles and Practice", Pearson Education. **(R1)**

Head of Department

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	1
CO2	3	3	3	1	2	2
CO3	2	3	2	2	1	1
CO4	3	1	3	2	1	2
CO5	3	3	2	1	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT505
Course title: MOBILE AND WIRELESS SECURITY
Pre-requisite(s): Data Structures
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives
This course enables the students will be:

1.	Able to understand the internals of the Android mobile OS. Study the Messaging, Graphics, Audio, Video, Camera, GPS, Networking, File System, Touch Sensors, and other subsystems.
2.	Able to understand the combined impact of security on the architecture, design, and security of mobile computing, in the context of Android.

Head of Department

3.	Have a broad knowledge of the state-of-the-art and open problems in mobile and wireless security
4.	Enhance their potential to do research or pursue a career in this rapidly developing area.
5.	Able to be introduced to new, advanced research topics to have hands--on experience with developing security features.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify state-of-the-art and open problems in mobile and wireless security.
2.	Analyse all relevant aspects of security in mobile and wireless networks.
3.	Assess the impact of integrating media services, location services, in the context of mobile messaging devices on privacy and security.
4.	Summarise developing security features in current Wireless and mobile systems.
5.	Design of secure system and applications on Android.

SYLLABUS

Module I:

Introduction to wireless and mobile networks security, Review of Network Security: from Crypto to Security Protocols – Fundamentals of Wireless & Mobile Systems: key features and mechanisms of wireless and mobile systems, Cryptographic Protocols for Mobile and Wireless Networks, Key Management in Mobile and Wireless Computing, Reasoning about Security and Privacy.

(8L)

Module II:

Privacy and Anonymity in Mobile and Wireless Computing, Public Key Infrastructure in Mobile and Wireless Environments, Security Standards in current Wireless & Mobile Systems: WiFi Security (WEP, WPA, WPA-Enterprise); Cellular Security (GSM, 3G, LTE); –Internet of Things / Wireless Sensor Networks / RFID – Emerging Privacy concerns: location, tracking, traffic analysis, mobile and the cloud.

(8L)

Module III:

Security Architectures and Protocols in WLANs and B3G/4G Mobile Networks, Security and Privacy features into Mobile and Wearable devices, Location Privacy, Wireless Ad hoc and Sensor Networks Security, Role of Sensors to Enable Security.

(8L)

Module IV:

Security of Mobile Computing Platforms – Android and iOS security models – Threats and emerging solutions (e.g., side channel attacks) Security and Privacy in Pervasive Computing, Trust Establishment, Negotiation, and Management, Secure PHY/MAC/routing protocols.

Head of Department

(8L)

Module V:
Security under Resource Constraints (bandwidth, memory, energy, and computation constraints).

(8L)

Books recommended:

TEXT BOOK

4. Stefanos Gritzalis (Editor), Tom Karygiannis (Editor), CharalabosSkianis (Editor), "Security and Privacy in Mobile and Wireless Networking (Emerging Communication and Service Technologies)", Paperback – February 15, 2009. **(T1)**
5. Himanshu Dviwedi, Chris Clark and David Thiel, "Mobile Application Security", 1st Edition. **(T2)**

REFERENCE BOOK

6. Noureddine Boudriga, "Security of Mobile Communications", 2009. **(R1)**
7. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security: Private Communication in a Public World", 2nd Edition, Prentice Hall, 2002. **(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	2	1
CO2	3	3	3	1	1	1
CO3	2	3	2	2	1	1
CO4	3	3	3	2	2	1
CO5	2	1	1	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT506
Course title: MULTIMEDIA SECURITY
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students will be able to:

1.	Understand issues related to the protection of digital media.
2.	Know techniques such as selective video encryption for real-time requirements
3.	Identify applications, parameters, and requirements of the digital watermarking
4.	Obtain an understanding for , key management, and streaming media protection
5.	Able to design applications using watermarking and other protection schemes.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify multiple issues related to the protection of digital media, including audio, image, and video content
2.	Analyzes techniques such as selective video encryption for real-time requirements, chaos-based encryption, key management, and streaming media protection
3.	Illustrates lossless data hiding, scalable image and video authentication, and signature-based media authentication
4.	Assess the applications, parameters, and requirements of the digital watermarking framework
5.	Summarize the vulnerabilities of protection schemes in multimedia content.

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SYLLABUS

Module I:
Intro to Multimedia, Basics of digital audio, Basics of digital imaging

(8L)

Module II:
Demands on Info. Security and Protection Demands on Info. Security and Protection, Intellectual property management for digital media

(8L)

Module III:
Secure Delivery of Multimedia Content, Basic cryptography concepts Media encryption techniques/systems "Robust" and secure media hashing, Key management Quantifying security

(8L)

Module IV:
Data Embedding, Basic embedding techniques and theory, Data embedding for various applications, Data embedding for various media types

(8L)

Module V:
Multimedia Fingerprinting: Trace Traitors, Multimedia fingerprinting for tracing traitor, Steganalysis, Non-intrusive forensics, Standardization and Integration, Standardization on media security.

(8L)

Books recommended:

TEXT BOOK

1. Chun-Shien Lu, "Multimedia Security: Steganography and Digital Watermarking Techniques for Protection of Intellectual Property", Hardcover – March 22, 2005. **(T1)**
2. "Multimedia Security: Steganography and Digital Watermarking Techniques for Protection of Intellectual Property", IGI Publishing Hershey, PA, USA ©2004, ISBN: 1591401925. **(T2)**

REFERENCE BOOK

1. BorkoFurht, DarkoKirovski, "Multimedia Security Handbook". **(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Head of Department

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	2	1
CO2	3	2	3	3	1	1
CO3	3	3	2	2	1	1
CO4	3	3	3	2	2	1
CO5	3	2	1	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

OPEN ELECTIVE – I

COURSE INFORMATION SHEET

Course code: CS514
Course title: SOFTWARE METRICS
Pre-requisite(s): Software Engineering, Software Testing
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives

After the completion of this course, students will be:

1.	Provide a basic understanding and knowledge of the software metrics.
2.	Understand the importance of Metrics data collection.
3.	Analysis and Metrics for object-oriented systems.
4.	Understand external product attributes Dynamic Metrics and Resource measurement.

Course Outcomes

After the completion of this course, students will be:

CO1	Able to understand the importance of the software development process.
CO2	Analyze the importance of modeling and modeling language.
C03	Design and develop correct and robust software products.
CO4	Explain the business requirements pertaining to software development.
CO5	Design Metrics for object-oriented systems.

Head of Department

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SYLLABUS

ModuleI:

Basics of measurement : Measurement in software engineering Scope of software metrics Representational theory of measurement Measurement and models Measurement scales Meaningfulness in measurement Goal-based framework for software measurement Classifying software measures Determining what to measure Software measurement validation Empirical investigation Types of investigation Planning and conducting investigations.

(8L)

ModuleII:

Measuring size, Aspects of software size Length, functionality and complexity Measuring structure Types of structural measures Control-flow structure Modularity and information flow attributes Data structures.

(8L)

ModuleIII:

Modeling software quality Measuring aspects of software quality Software reliability Basics of software reliability Software reliability problem Parametric reliability growth models Predictive accuracy Recalibration of software-reliability growth predictions Importance of operational environment Wider aspects of software reliability.

(8L)

ModuleIV:

The intent of object-oriented metrics distinguishing characteristics of object-oriented metrics various object-oriented metric suites LK suite CK suite and MOOD metrics
Runtime Software Metrics Extent of Class Usage Dynamic Coupling Dynamic Cohesion and Data Structure Metrics.

(8L)

ModuleV:

The intent of component-based metrics, distinguishing characteristics of comp.
Measuring productivity, teams, tools, and methods.

(8L)

Books recommended:

TEXT BOOK

7. "Software Metrics: A rigorous and Practical Approach" by Norman E. Fenton and Shari Lawrence P fleeger, International Thomson Computer Press, 2nd Edition, 1997. **(T1)**
8. "Applied Software Measurement" by Capers Jones, McGraw Hill, 2008. **(T2)**

REFERENCE BOOK

3. "Object-Oriented Software Metrics" by Mark Lorenz, Jeff Kidd, Prentice Hall, 1994. **(R1)**
4. "Practical Software Metrics For Project Management And Process Improvement" by Robert B Grady, Hewlett Packard Professional Books, 1st Edition, 2004.**(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	2	2	3	1	1	1
CO3	1	3	3	2	2	2
CO4	3	3	3	2	1	1
CO5	2	1	3	3	3	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS522
Course title: PATTERN RECOGNITION AND APPLICATION
Pre-requisite(s): Linear Algebra, Vector Calculus, Data Structure& Programming
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M.Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Be familiar with both the theoretical and practical aspects Pattern Recognition.
2.	Have described the foundation of pattern formation, measurement, and analysis.
3.	Understand the mathematical and computer aspects of while extracting features of an object.
4.	Learn the techniques of clustering and classification for various applications.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply their knowledge on Real World Problems while converting these problems to computer compatible problems for Pattern Recognition.
CO2	Solve Decision-making model using Statistical and Mathematical Decision Theory.
CO3	Design clusters for various Pattern using classical and Modern clustering techniques.
CO4	Analyzing various Techniques for Pattern Classification and Clustering.
CO5	Develop Model for Pattern classification through Probabilistic or fuzzy.

SYLLABUS

Module I:

Introduction: Feature Vectors, Classifiers, Supervised, Unsupervised, MATLAB Tools. Classifiers Based on Bayesian Theory, Linear Classifiers, Nonlinear Classifiers.

(8L)

ModuleII:

Feature Selection, Feature Generation I: Data Transformation and Dimensionality Reduction, Feature Generation II.

(8L)

Module III:

Template Matching, Context Dependent Classification, Super vised Learning.

(8L)

Module IV:

Clustering Basic Concepts, sequential Algorithms.

(8L)

ModuleV:

Hierarchical algorithms, Fuzzy clustering, probabilistic clustering, Hard Clustering, Optimization.

(8L)

Books recommended:

TEXT BOOK

1. "Pattern Recognition" by S Theodoridis, K Koutroumbas, Elsevier, 5th Edition, 2015.**(T1)**
2. "Pattern Recognition" by N NarshimaMurty, Springer, University press, 2nd Edition, 2015. **(T2)**

REFERENCE BOOK

1. R.O.Duda et.al,"Pattern Classification", 2nd Edition, John Wiley, New York, 2002. **(R1)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT518
Course title: INTERNET OF THINGS
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives
This course enables the students to:

7.	Understand the basic concept and the IoT Paradigm
8.	Know the state of art architecture for IoT applications
9.	Learn the available protocols used for IoT
10.	Design basic IoT Applications.
11.	Evaluate optimal IoT applications.

Course Outcomes

Head of Department

After the completion of this course, students will be able to:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
CO3	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

Module II:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

Module III:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

Module IV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN, Transport Layer TCP, MPTCP, UDP, DCCP, Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

Head of Department

Module V:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

Books recommended:

TEXT BOOK

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

7. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
8. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Head of Department

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
CO3	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% =

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: IT522
Course title: CYBER SECURITY AND DIGITAL FORENSICS
Pre-requisite(s): Computer Basics, Programming and Problem solving
Co-requisite(s):
Credits:3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech.
Semester / Level: I/5
Branch: Information Technology
Name of Teacher:

Course Objectives
This course enables the students:

1.	Know about computer-based crime.
2.	Understand Technical and legal aspects of computer crime investigations
3.	Know the limitations of law and its enforcement agencies.
4.	Learn the procedures of recovering computer evidence and seize process.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Exposure on computer-based crime.
CO2	Technical and legal aspects of computer crime investigations
C03	Know the limitations of law and its enforcement agencies.
CO4	Learn the procedures of recovering computer evidence and seize process.
CO5	Apply techniques for finding, preserving, presenting, and extracting information from the digital devices.

Head of Department

SYLLABUS

ModuleI:
Introduction: Cyberspace and Criminal Behavior, Traditional problems associated with computer-based crime, e cash problems, Computer Technology and History: Computer Language, Hardware, software, operating system, Internet, Network language.

(8L)

ModuleII:
Early Hackers and Theft Components: Phreakers, Hacking, Commodities, Intellectual property. Contempory computer crime: web based criminal activity, money laundering,

(8L)

Module III:
Identity theft and identity fraud: Typologies of internet theft, virtual identity, credit identity. Prevalence and victim logy, physical methods, of identity theft, phishing, spyware, Trojans, insurance and loan fraud, immigration fraud. Terrorism and organized crime: Terror online, criminal activities, organized crime as cyber gangs. Technology used in organized crime. Data piracy.

(8L)

Module IV:
Avenues for Prosecution and Government efforts: Act, Law enforcement agencies, International efforts, Cyber law and its amendments of current state, other legal considerations.

(8L)

ModuleV:
Forensic Terminologies and Developing forensic capabilities, Searching and seizing computer related evidence, Processing of evidence and report preparation.

(8L)

Books recommended:

TEXT BOOK

1. "Computer Forensics and Cyber Crime" by M.T.Britz, Pearson Education, First Impression, 2012.**(T1)**
2. "Computer Crime and investigation" by E Casey, Springer, 1st Edition, 2001. **(T2)**

REFERENCE BOOK

1. "Computer Crime Investigations and Law" by C Easttom&D.J.Taylor, Carenage Learning. **(R1)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Head of Department

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	2	1
CO2	3	3	3	1	1	1
CO3	3	3	3	2	1	1
CO4	2	3	2	2	2	1
CO5	2	3	2	2	2	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS503
Course title: ADVANCED DATA STRUCTURES LAB
Pre-requisite(s):
Co- requisite(s): Advanced Data Structures
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Info Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2.	Students should be able to understand the necessary mathematical abstraction to solve problems.
3.	To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4.	Student should be able to come up with analysis of efficiency and proofs of correctness.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand to implement the symbol table using hashing techniques.
CO2	Develop program for AVL, Red-Black trees, B-trees and Splay trees
CO3	Develop program for text processing applications
CO4	Learn the basic working of advanced heaps
CO5	Understand the implementation of symbol table using hashing techniques

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Write a program to implement a dictionary using the following ADTs. We assume all the entries in the dictionary to be distinct integers.

a) Binary Search Tree (BST)
b) Red Black Tree (RBT)

Each ADT should support five operations, void Insert(val), boolean Delete(val), boolean Search(val), void ClearADT() and void DisplayADT(). Both search and delete operations should respond with a Boolean value indicating whether the search/delete was successful or not. The objective of this assignment is to compare the performance of BST and RBT ADTs. You have to compute the time taken for completion of operations and study how the running times of ADT operations will vary across the two ADT implementations.

2. **Lab Assignment No: 2**

Implement data structures to maintain a list of elements. In particular, implement the list as an array and as a linked list. Write a program to remove duplicates from the list. The code for remove duplicates functionality should remain the same across the two implementation of the list.

Implement the following sequence of operations on the skip list:

a) Remove () b) insert () c) Search () d) Update ()

Assume the coin flips for the first insertion yield two heads followed by tails, and those for the second insertion yield three heads followed by tails.

3. **Lab Assignment No: 3**

Implement different Hashing functions and Collision Resolution Techniques.

4. **Lab Assignment No: 4**

Implement Kruskal's algorithm for finding the minimum spanning tree of a given (positively) weighted (undirected) graph G. You must use the Union-Find data structure that implements both "union by rank" and "path compression" heuristics.

Head of Department

5. **Lab Assignment No: 5 &6**

Implement the following priority queues:

a) Binary Heap b) Binomial Heap c) Fibonacci Heap

Your program should then create an appropriate priority queue object and perform make Heap () method. After that, you should give the user menu options to insert (key), delete (key), extractMin (), findMin (), decrease (key), increase (key) updateKey (current Key, newKey), and display Heap (filename). You may assume that keys will be unique. For display Heap(filename), you must output the tree structure of the priority queue (including linked list edges in Binomial Heap, etc) as a directed tree in the dot language format1 and store it in a file named filename (given as parameter).

6. **Lab Assignment No: 7&8**

Implement Text Processing using Huffman Coding.
Implement the compact representation of the suffix trie for the string "minimize minima".
Implement a standard trie for the following set of strings: {abab, baba, ccccc, bbaaaa, caa, bbaacc, cbcc, cbca }.

7. **Lab Assignment No: 9 &10**

One way to mask a message, *M*, using a version of *Steganography*, is to insert random characters into *M* at pseudo-random locations so as to expand *M* into a larger string, *C*.

For instance, the message,

ILOVEMOM,

could be expanded into

AMIJLONDPVGEMRPIOM.

It is an example of hiding the string, *M*, in plain sight, since the characters in *M* and *C* are not encrypted. As long as someone knows where the random

Books recommended:

TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++," 2nd Edition, Pearson, 2004. **(T1)**
2. Peter Brass "Advanced Data Structures," Cambridge University Press, 1st Edition. **(T2)**
3. M T Goodrich, & Roberto Tamassia, "Algorithm Design," John Wiley, 2002. **(T3)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus:

Head of Department

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	2	2	1	1	1
CO3	2	3	3	2	1	1
CO4	3	1	1	1	1	1
CO5	3	1	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

PROGRAM ELECTIVE LAB –I

COURSE INFORMATION SHEET

Course code: IT509
Course title: MATLAB PROGRAMMING
Pre-requisite(s):
Co- requisite(s):
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Head of Department

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring MATLAB
2.	Develop mathematical thinking and problem-solving skill
3.	To enable the student on how to approach for solving Engineering problems using simulation tools.
4.	To provide a foundation in use of this software for real time app

Course Outcomes

After the completion of this course, students will be able to:

CO1	Express programming & simulation for engineering problems.
CO2	Find importance of this software for Lab Experimentation.
CO3	Analyze problems and write basic mathematical ,electrical ,electronic problems in Matlab
CO4	Implement programming files with GUI Simulink.
CO5	Simulate basic Engineering problems

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To Understand and Implement Matrix Algebra

1. To create sparse matrices using the function sparse.
2. To convert a sparse matrix to full matrix.

2. **Lab Assignment No: 2**

Objective: To Understand and Implement Data Analysis

1. To measure the daily high temperatures in three cities with different color.
2. To solve a different cities temperature do the filter.

3. **Lab Assignment No: 3**

Objective: To Understand and Implement Data Interpolation

1. To Draw 2-D random data.
2. To Draw Threshold of Human Hearing.

Head of Department

4. **Lab Assignment No: 4**

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

5. **Lab Assignment No: 5**

Objective: To Understand and Implement Fourier Analysis

1. To solve the use of the FFT, consider the problem of estimating the continuous Fourier transform of the signal

$f(t)=2e^{-3t}$ $t \geq 0$, where f(t) is given by

$F(\omega)=2/(3+j\ \omega)$

2. To design saw tooth Waveform at arbitrary points.

6. **Lab Assignment No: 6**

Objective: To Understand and Implement Optimization

1. To solve 1-D minimization and maximization.
2. To design Rosenbrock's banana function.

7. **Lab Assignment No: 7**

Objective: To Understand and Implement Differential Equations

1. Design a van der Pol Solution.
2. To solve Jacobian matrix.

8. **Lab Assignment No: 8**

Objective: To Understand and Implement Two-Dimensional Graphics

1. To add new plots to an existing plot by using the hold command.
2. To create new Figure windows, use the figure command in the Command window or the **New Figure** selection from the **File** menu in the Command or Figure window.

9. **Lab Assignment No: 9**

Objective: To Understand and Implement Three- Dimensional Graphics

1. Plot = 2 with 0 5in polar coordinates.
2. Design a Surface plot using the surf function.

10. **Lab Assignment No: 10**

Objective: To Understand and Implement Images, Movies, and Sound

1. To display 8-bit intensity and RGB images.
2. To convert between indexed images and movie frames.

11. **Lab Assignment No: 11**

Objective: To Understand and Implement Graphical User Interfaces

1. Using uigetfile to find the startup.m file on the author's computer.
2. Write a program using the function **guidata,** which stores and retrieves data in the GUI figure **'Application Data'** property.
3. How to put walls by clicking a mouse button to make an arbitrary maze.
4. Design a GUI System.

Head of Department

Books recommended:

TEXT BOOK

4. Duane Hanselman, Bruce Littlefield, Mastering MATLAB 7, Reason edu. 2nd edition, 2008. **(T1)**
5. Sandeep Nagar, Introduction to MATLAB for Engineers and Scientists: Solutions for Numerical Computation and Modeling, A Press, 2017.**(T2)**

REFERENCE BOOK

3. MATLAB Primer by MATHWORKS. **(R1)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Head of Department

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	3	2	1	2	1
CO4	3	3	2	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: IT510
Course title: JAVA PROGRAMMING
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: I/5
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring JAVA.
2.	Knowledge of the structure and model of the Java programming language.
3.	Use the Java programming language for various programming technologies.
4.	To provide a foundation for Java programming language to solve the given problems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Write, compile, and execute Java programs that may include basic data types and control flow constructs using J2SE or other Integrated Development Environments (IDEs)
CO2	Write, compile, and execute Java programs manipulating Strings and text documents.
CO3	Write, compile, execute Java programs that include GUIs and event driven programming
CO4	Create Applets and GUI
CO5	Executing Client server and socket programming

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SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To Understand and Implement COLLECTION FRAMEWORK

1. To create sparse matrices using the function sparse.
2. To convert a sparse matrix to full matrix.

2. **Lab Assignment No: 2**

Objective: To Understand and Implement Generic Programming

1. Write the tasks performed by type erasure?
2. Write a generic method to exchange the positions of two different elements in an array?

3. **Lab Assignment No: 3**

Objective: To Understand and Implement REFLECTION

1. Write a program that finds and displays inheritance hierarchy of a specified class?
2. Write a program that shows all public fields of a specified class?

4. **Lab Assignment No: 4**

Objective: GUI Development with Swing

1. Working with Text Fields
2. Working with Buttons
3. Working with Lists
4. Working with Scroll Panes

5. **Lab Assignment No: 5**

Objective: Implementing Robust Geometric Primitives

1. Java Program to Apply Above-Below-on Test to Find the Position of a Point with respect to a Line
2. Java Program to Compute the Area of a Triangle Using Determinants
3. Java Program to Compute the Volume of a Tetrahedron Using Determinants
4. Java Program to Find the Area of any Polygon Using Triangulation

6. **Lab Assignment No: 6**

Objective: To Understand and Implement examples on “Convex Hull”

1. Java Program to Implement Graham Scan Algorithm to Find the Convex Hull
2. Java Program to Implement Gift Wrapping Algorithm in Two Dimensions
3. Java Program to Implement Jarvis March to Find the Convex Hull

7. **Lab Assignment No: 7**

Objective: To Understand and Implement examples on “Nearest Neighbor Search”

1. Java Program to Find the Nearest Neighbour Using K-D Tree Search
2. Java Program to Find Nearest Neighbour Using Voronoi Diagram

Head of Department

8. Lab Assignment No: 8

Objective: To Understand and Implement Network Programming

1. Working with URLs
2. Socket Server Programming
3. Client Server Programming

9. Lab Assignment No: 9

Objective: To Understand and Implement SOCKET PROGRAMMING

1.Write a java socket program to get the resource http://www.google.com/index.html using HTTP protocol?

2. Write a program how do you get the IP address of a machine from its hostname

10. Lab Assignment No: 10

Objective: To Understand and Implement Java Web Applications

1. Simple Servlet
2. Java Web Applications - Get Request
3. Java Web Applications - Post Request

11. Lab Assignment No: 11

Objective: To Understand and Implement Advanced Java Input/output (NIO)

1. File Copying With NIO
2. Working with Buffers
3. Working with File Data

Books recommended:

TEXT BOOKS

1. Uttam K Roy, Advanced JAVA Programming, Oxford University Press, 1st Edition , 2015 **(T1)**
2. HeerbertSchildt, Java: A Beginner's Guide, SeventhEdition,Oracle Press, 2014 **(T2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Head of Department

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	3	2	2	2	2	1
CO4	3	2	3	2	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

ALGORITHM
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Security

Course Objectives
After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behavior using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO 1	Analyse and compare different approaches of computer algorithm for different practical application.
CO 2	Student should understand the concept of NP-hard and NP-complete and reducibility.
CO 3	Student should develop basic knowledge of a wide range of advanced algorithm design techniques, approximation algorithms, randomized algorithms and parallel algorithm.
CO 4	Student should develop basic advanced algorithm analysis skills for analysing the approximation ratio of approximation algorithms and the probability of randomized algorithms.
CO 5	Students should gain a good understanding on a wide range of advanced algorithmic problems, their relations and variants, and application to real-world problems.

SYLLABUS

Module I:
Design Paradigms
Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.

(8L)

Module II:
Theory of NP- Hard and NP-Complete Problems
P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; other complexity classes.

(8L)

Module III:
ApproximationAlgorithms
Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms.

(8L)

Module IV :
Parallel Algorithms
Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

(8L)

Module V:
Probabilistic Algorithms & Randomized Algorithms
Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems

(8L)

Head of Department

Text Books:

1. T.H. Cormen, C.E.Leiserson, and R.L. Rivest, "Introduction to Algorithms".
2. G.Brassard, and P.Bratley, "Fundamentals of Algorithmics".
3. Vijay V.Vazirani, "Approximation Algorithms".

Reference Books:

1. D.Harel, "Algorithmics: The spirit of computing".
2. R. Motwani& P. Raghavan, "Randomized Algorithms," Cambridge University Press, 1995.

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Head of Department

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	1	2
CO2	3	3	3	1	3	1
CO3	2	3	3	3	2	1
CO4	3	3	3	3	1	1
CO5	2	2	3	2	1	1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

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COURSE INFORMATION SHEET

Course code: IT514
Course title: CRYPTOGRAPHY
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Security

Course Objectives
This course enables the students:

1.	To understand the various types of cryptographic attacks and the mathematics behind cryptography.
2.	To gain knowledge of symmetric and asymmetric ciphers, and hash functions.
3.	Prepare students for research in the area of cryptography and enhance students communication and problem solving skills
4.	To differentiate between the encryption standards, and know their suitability to an application.
5.	To effectively apply their knowledge to the construction of secure cryptosystems.

Course Outcomes
After the completion of this course, students will be able to:

1.	Understand the various types of cryptographic attacks and the mathematics behind cryptography.
2.	Describe the various types of ciphers and hash functions.
3.	Apply the different cryptographic techniques to solve real life problems.
4.	Evaluate different techniques as to their suitability to various applications.
5.	Develop a cryptosystem keeping in view social issues and societal impacts.

Head of Department

SYLLABUS

Module I:
Overview of Cryptography: Security goals, Cryptographic attacks, Mathematics of cryptography.
(8L)

Module II:
Symmetric-Key Cryptography: Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers. Modern Block and Stream Ciphers, Data Encryption Standard (DES) – Structure, Analysis, Security. Advanced Encryption Standard, AES Ciphers.
(8L)

Module III:
Asymmetric-Key Encipherment: Primality Testing, Factorization, RSA Cryptosystem, Rabin Cryptosystem, ElGamal Cryptosystem.
(8L)

Module IV:
Cryptographic Hash Functions: Introduction, Description of MD Hash family, Digital Signature Schemes, Variations and Applications.
(8L)

Module V:
Entity Authentication: Passwords, Challenge-Response, Zero-Knowledge, Biometrics.
(8L)

Text Books:
1. Behrouz A. Forouzan and D. Mukhopadhyay, "Cryptography & Network Security", McGraw Hill, New Delhi.
2. Wade Traple, "Lawrence C. Washington-Introduction to Cryptography with Coding Theory", Pearson Education.

Reference Books:
1. William Stallings, "Cryptography & Network Security Principles and Practice", Pearson Education.

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3		2	
CO2	3		1	1	2	1
CO3		3	2		1	
CO4			3	2		2
CO5	1	3		1		1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

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COURSE INFORMATION SHEET

Course code: IT515
Course title: DIGITAL FORENSICS
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Security

Course Objectives

This course enables the students:

1.	Broad understand of What is digital forensic and its terminology
2.	Know about ethical hacking and Incidence Response Process and issues
3.	In depth understanding of Attacks and their counter measures.
4.	Information of how to apply Defence through data analysis and file system analysis
5.	Understand the basics of network, e-mail hacking methods tools, and their avoidance

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify requirements of digital forensics its related terminology
2.	Classify and compare hacking methodology and their counter measures
3.	Evaluate the types of hacking and vulnerabilities in context to the risks associated
4.	Illustrate forensic analysis and data analysis on file systems
5.	Summarize Network Intrusions and Attacks, email, mobile hacking issues.

Head of Department

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SYLLABUS

Module I:
Basics of Information Systems Security

Digital Forensic, Introduction to Digital Forensic, History of Forensic, Rules of Computer/Digital Forensic, Digital Forensic as a Discipline, Definition of Digital Forensic, Digital Forensic Investigations, Goal of Digital Forensic Investigation, Various DFI Process/Models/Framework, Ethical Issues

Digital Evidences, Introduction, What is Digital Evidence, Rules of Digital Evidence, Characteristics of Digital Evidence, Types of Evidence, Challenges in Evidence Handling, Volatile Evidence, Evidence Handling Procedures, Ethical Issues/Legal Principles of Digital Evidence, Digital Evidence and Metadata

(8L)

Module II:
Attacks Threats and Vulnerabilities

Ethical Hacking Methodology and Tools, Introduction, Types of Hackers, Reason for Hacking, Preventions from Hackers, Impact of Hacking, Steps Performed by Hackers, What is Ethical Hacking, Who is an Ethical Hacker, Ethical Issues, Ethical Hacking Process, Working of an Ethical Hacker, Identifying Types of Ethical Hacks, Different Tools for Ethical Hacking

Incidence Response Process Introduction, Goals of Incident Response, People Involved in Incident Response Process, Incident Response Methodology, Activities in Initial Response, Phases after Detection of an Incident.

(8L)

Module III:
Forensic Duplication Introduction to Forensic Duplication, Rules of Forensic Duplication (Thumb Rule), Necessity of Forensic Duplication, Forensic Duplicates as Admissible Evidence, Important Terms in Forensic Duplicate, Forensic Duplication Tool Requirements, Creating a Forensic Duplicate of a Hard Drive, Creating a Qualified Forensic Duplicate of a Hard Drive.

(8L)

Module IV:
File Systems File Systems, Various Types of File Systems, Introduction to Storage Layers, Hard Disk Drive, Forensic Analysis of File Systems

Data Analysis Preparation Steps for Forensic Analysis, Investigating Windows Systems, Investigating UNIX Systems, Hacker Tools

Network Forensic Introduction to Intrusion Detection System, Types of Intrusion Detection System, Advantages and Disadvantages of IDS, Understanding Network Intrusions and Attacks, Recognizing Pre-Intrusion/Attack Activities, Port Scans, Address Spoofing 10.8 Attacking with Trojans, Viruses, and Worms, Understanding Password Cracking, Understanding Technical Exploits, Collecting Network-Based Evidence, Investigating Routers, Network Protocols.

Head of Department

(8L)

Module V:

E-Mail Forensic Introduction, Working of E-Mail, Steps in the E-Mail Communication, E-Mail Service Protocols, Internet Fraud, Securing Your E-Mail Account, IP Tracking, E-Mail Recover, E-Mail Forensics Analysis Steps, E-Mail Forensic Tools

Mobile Phone Forensics Mobile Hacking ŚSMS and Call Forging, Mobile Phone Forensics, Forensic Procedures, Android Forensics, Mobile Forensic Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Various Computer/Digital Forensic Tools

(8L)

Text Books:

1. Digital Forensic: The Fascinating World of Digital Evidences Author : Dr. Nilakshi Jain, Dr. Dhananjay R. Kalbande

Reference Books:

1. The Basics of Digital Forensics 1st Edition The Primer for Getting Started in Digital Forensics Author:John Sammons.

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Head of Department

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	2	2	1
CO2	3		2		2	
CO3		3	2		1	
CO4	1	1	3	2		2
CO5		3		1		1

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Head of Department

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

COURSE INFORMATION SHEET

Course code:IT601
Course title: CLOUD SECURITY
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students:

1.	An ability to apply knowledge of mathematics and advanced computing & networking technologies for solving problems.
2.	An ability to design and conduct experiments to analyze and interpret data related to software and hardware design solutions.
3.	An ability to design a system, component or process to meet desired needs within realistic constraints.
4.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
5.	An ability to identify, formulate and solve security issues based on the fundamental understanding of concepts related to data communication and computer networks.
6.	Acquire Knowledge of contemporary issues in the field of information security.
7.	An ability to use the techniques, skill and modern engineering tools necessary for employing security practices in the field of computer science.

Head of Department

Course Outcomes:

After the completion of this course, students will be able to:

1.	Understand the basic concepts of security systems and cryptographic protocols, which are widely used in the design of cloud security.
2.	Compare modern security concepts as they are applied to cloud computing.
3.	Assess the security of virtual systems.
4.	Evaluate the security issues related to multi-tenancy.
5.	Appraise compliance issues that arise from cloud computing.

SYLLABUS

Module I:

Security Concepts

Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; Cryptographic Systems- Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.

(8L)

Module II:

Multi-tenancy Issues

Isolation of users/VMs from each other. How the cloud provider can provide this; Virtualization System Security Issues- e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware.

(8L)

Module III:

Virtualization System-Specific Attacks

Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.

(8L)

Module IV:

Technologies for Virtualization-Based Security Enhancement

IBM security virtual server protection, virtualization-based sandboxing; Storage Security- HIDPS, log management, Data Loss Prevention. Location of the Perimeter.

(8L)

Module V:

Legal and Compliance Issues

Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

Head of Department

(8L)

Text Books:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1 edition [ISBN: 0596802765], 2009.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security" [ISBN: 0470589876], 2010.

Reference Books:

1. John Rittinghouse, James Ransome, "Cloud Computing" CRC Press; 1 edition [ISBN: 1439806802], 2009.
2. J.R. ("Vic") Winkler, "Securing the Cloud" Syngress [ISBN: 1597495921] 2011.
3. Cloud Security Alliance, "Security Guidance for Critical Areas of Focus in Cloud Computing" 2009. 6

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	1	1	2
CO2	3	3	3	3	3	2
CO3	1	3	1	3	2	3
CO4	1	3	2	3	1	2
CO5	2	3	1	3	2	2

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets	CO5	CD5

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COURSE INFORMATION SHEET

Course code: IT516
Course title: DATA MINING AND DATA ANALYSIS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L: 0 T: 0 P: 3
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

Head of Department

SYLLABUS

Module I :
Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.

(8L)

Module II:
Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.

(8L)

Module III:
Frequent Pattern Mining, Summarizing Item sets, Item set Mining, Sequence Mining.

(8L)

Module IV:
Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.

(8L)

Module V:
Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.

(8L)

Text Books:

1. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016
2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014
3. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

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POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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COURSE INFORMATION SHEET

Course code: IT518
Course title: INTERNET OF THINGS
Pre-requisite(s):
Co-requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Security

Course Objectives
This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes
After the completion of this course, students will be:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
C03	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

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SYLLABUS

Module I:

IoT-An Architectural Overview

An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

(8L)

ModuleII:

IoT Architecture-State of the Art

State of the art, Reference Model and architecture, IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

(8L)

Module III:

Sensor Technology, RFID Technology, WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M CoAP, REST, Zigbee, Bluetooth

(8L)

Module IV:

Transport & Session Layer Protocols

Mobile IPv6 technology for IoT, 6LoWPAN, Transport Layer TCP, MPTCP, UDP, DCCP,

Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(8L)

ModuleV:

Layer Protocols & Security

Introduction, Technical Design constraints. Implementation Examples. Security and Interoperability.

(8L)

Head of Department

Books recommended:

TEXT BOOK

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(T2)**

REFERENCE BOOK

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(R2)**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
D4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and
Outcomes Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
C03	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT570
Course title: **Basics of Python programming**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T:1 P:2
Class schedule per week: 1
Class: M. Tech
Semester / Level:
Branch:

Course Objectives

This course enables the students:

1.	To facilitate skills required to Install and run the Python interpreter
2.	To facilitate skills required to Create and execute Python programs
3.	To introduce the Understanding the concepts offile I/O
4.	To provide skills to read data from a text file using Python
5.	To discover the interesting patterns using appropriate Python visualization libraries

Course Outcomes

After the completion of this course, students will be able to do the following:

1.	Understand how to convert the problems into algorithms
2.	Analyse and develop the algorithms to Python programs.
3.	Design programs with Interactive Input and Output, utilizing arithmetic expression repetitions, decision making, arrays.
4.	Develop modular Python programs using functions
5.	Design programs using file Input and Output.

Syllabus

Module I

Problem Analysis-Formal Definition of a Problem, Algorithms, Flowcharts, Examples for Algorithms and Flowcharts

Introduction to Python- Variables, Operators, Expressions, Evaluation of Expressions, String Operations, Input and Output functions

Module II

Control Statements- Decision making statements, Iterative Statements, Loop Control Statements

Strings and Lists- String Operations, Tuples and Dictionaries-Operations

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and Examples

Module III

Functions- Function Definition and Call, Mathematical functions, User defined Functions, Parameters and Arguments, Type Conversion and Coercion

Module IV

Files – Different File Operations, File Object Attributes, Directories

Exceptions- Except clause, Exception with arguments, Raising an Exception, User Defined Exceptions

Module V

Introduction to Classes and Objects- Object Oriented Features, Attributes, Instances, Garbage Collection

SYLLABUS

List of Programs as Assignments:

74. Lab Assignment No: 1

Objective: ToImplement basic Python programming.

Q1. Create a new program called hello world.py. Use this file to write your very First "Hello, world!" program.

Q2. Write a Python program containing exactly one print statement that produces the following output:

A
B
C
D
E
F

75. Lab Assignment No: 2

Objective: To Understand and Implement the concept of if-else-if statements.

Q1.Write a Python program that requests five integer values from the user. It then prints one of two things: if any of the values entered are duplicates, it prints "DUPLICATES"; otherwise, it prints "ALL UNIQUE".

Q2. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. Each binary digit should be entered one per line, starting with the leftmost digit, as shown below.

Enter leftmost digit: 1
Enter the next digit: 0
Enter the next digit: 0
Enter the next digit: 1
The value is 9

Head of Department

Q3.Develop and test a program that prompts the user for their age and determines approximately how many breaths and how many heartbeats the person has had in their life. The average respiration (breath) rate of people changes during different stages of development. Use the breath rates given below for use in your program:

	Breaths per Minute
Infant	30–60
1 –4 years	20–30
5 –14 years	15–25
adult	12–20

For heart rate, use an average of 67.5 beats per second.

76. Lab Assignment No: 3

Objective: To Understand and Implement the flow control statements.

Q1. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4... 1/10.

Q2. Write a program using a for loop that calculates exponentials. Your program should ask the user for a base 'b' and an exponent 'exp', and calculate b^exp.

Q3. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user input a negative number? As a programmer, you should always consider "edge conditions" like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don't include a condition that catches negative numbers, what will your program do?)

77. Lab Assignment No: 4

Objective: To practice drawing patterns

Q1.Write the program to print the following pattern: ex if the user enters 7, the program would print

```
      *
     **
    ***
   ****
  *****
 ******
*******
 ******
  *****
   ****
    ***
     **
      *
```


Head of Department

Q2.Write a program in python to print the following pattern:

```
    1
   1 1
   121
 1331
  12641
 15101051
1615201561
```

78. Lab Assignment No: 5

Objective: To Understand and Implement methods in Python.

Q1.Write a method fact that takes a number from the user and prints its factorial.

Q2. Write a Python function named compare3 that is passed three integers and returns true if the three integers are in order from smallest to largest, otherwise it returns false.

Q3. Write a python function named modCount that is given a positive integer and a second positive integer, m<=n, and returns how many numbers between 1 and n are evenly divisible by m.

79. Lab Assignment No: 6

Objective: To Understand and Implement the concept of Recursion

Q1. Write a program to read an integer number. Print the reverse of this number using recursion.

Q2. Write a program that calculates the GCD using recursive functions.

80. Lab Assignment No: 7

Objective: To Understand and Implement Sorting techniques

Q1. Write a program to sort the list of elements using Insertion sort.

Q2. Write a program to sort the list of elements using Merge sort.

Q3.Write a program to multiply the two matrices.

81. Lab Assignment No: 8

Objective: To Understand and Implement the concept of Strings in Python

Q1. Write a program to check whether string is a palindrome or not.

Q2. Write a program to implement format method available with string object.

82. Lab Assignment No: 9

Objective: To Understand and Implement Dictionary

Q1. Program to demonstrate the built in functions within the dictionary.

Q2. Program to implement dictionary as an associative array

83. Lab Assignment No: 10

Objective: To Understand and Implement File Handling.

Head of Department

Q1. Program to open the file in the read mode and use of for loop to print each line present in the file.
Q2. Write a Python program to illustrate Append vs write mode.
Q3. Write a Program to read and write data from a file.

Text book:

1. Downey A.,How to think like a computer scientist: Learning with Python.

Reference books:

1.JoseJeeva, Taming Python by Programming, Khanna Publishing House.
2. Jose J. Introduction to Computing and Problem Solving with Python, (ISBN: 978-93-82609-810).

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Head of Department

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	3
CO2	3	3	2	2	1	3
CO3	2	2	2	1	2	1
CO4	3	1	1	3	2	2
CO5	3	2	1	3	1	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT523
Course title: BIOMETRIC SECURITY
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Security

Head of Department

Course Objectives

This course enables the students to:

1.	To understand the brief functioning of biometric system.
2.	To know the different types of biometric and their accuracy.
3.	To increase the likelihood that biometric technologies, when deployed, will be as protective of personal and informational privacy as possible.
4.	To raise awareness of privacy issues for end users and for students.
5.	To increase security of the system as well as data.

Course Outcomes

After the completion of this course, students will be able to:

1.	Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2.	Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
3.	Developing new advanced authentication algorithms.
4.	Analyze the accurate discrimination between individuals.
5.	Illustrate the two factor authentication system.

SYLLABUS

Module I:
Biometrics- Introduction- benefits of biometrics over traditional authentication systems -benefits of biometrics in identification systems-selecting a biometric for a system –Applications - Key biometric terms and processes - biometric matching methods -Accuracy in biometric systems.

(8L)

Module II:
Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern.

(8L)

Module III :
Technical description – characteristics - strengths – weaknesses – deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.

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(8L)

Module IV:
signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.

(8L)

Module V:
Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation plan.

(8L)

TEXT BOOKS :

4. Samir Nanavathi, Michel Thieme, and Raj Nanavathi : "Biometrics -Identity verification in a network", 1st Edition, Wiley Eastern, 2002.
5. John Chirillo and Scott Blaul : "Implementing Biometric Security", 1st Edition, Wiley Eastern Publication, 2005.

REFERENCE BOOKS:

1. John Berger: "Biometrics for Network Security", 1st Edition, Prentice Hall, 2004.

Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Head of Department

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	3	3	3	2	1
2	3	3	3	2	1	1
3	3	2	2	3	1	1
4	3	3	2	1	3	1
5	2	1	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT504
Course title: APPLIED CRYPTOGRAPHY
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Security

Course Objectives

This course enables the students:

1.	To understand the foundations of cryptographic attacks.
2.	To gain knowledge of encrypting data, and to choose between different algorithms.
3.	Prepare students for research in the area of cryptography and enhance students communication and problem solving skills
4.	To differentiate between the encryption techniques and know their suitability to an application.
5.	To effectively apply their knowledge to the construction of secure cryptosystems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand the various types of cryptographic protocols and the mathematics behind cryptography.
CO2	Describe the various types of ciphers and hash functions.
CO3	Apply the different cryptographic techniques to solve real life problems.
CO4	Evaluate different techniques as to their suitability to various applications.
CO5	Develop a cryptosystem keeping in view social issues and societal impacts.

Head of Department

SYLLABUS

Module I:
Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols - Advanced Protocols - Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography.

(8L)

Module II:
Key Length - Key Management – Public Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information.

(8L)

Module III:
Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation - Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab – RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

(8L)

Module IV:
Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design - N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes

(8L)

Module V:
RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes - Ongchnorr-Shamir -Cellular Automata - Feige-Fiat-Shamir -Guillou-Quisquater - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol - IBM Secret-Key Management Protocol - MITRENET - Kerberos - IBM Common Cryptographic Architecture.

(8L)

TEXT BOOKS:

1. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C" John Wiley & Sons, Inc, 2nd Edition, 1996. **(T1)**
2. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004. **(T2)**
3. Atul Kahate, "Cryptography and Network Security", Tata McGrew Hill, 2003.

(T3) REFERENCE BOOKS:

1. William Stallings- Cryptography & Network Security Principles and Practice, Pearson Education. **(R1)**

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Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	1	2	
CO2	3	3	3		2	
C03		3	2		1	
CO4			3	2		2
CO5		3		1		1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

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COURSE INFORMATION SHEET

Course code: IT524
Course title: IMAGE PROCESSING TECHNIQUES
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 3
Class: M. Tech
Semester / Level: II/5
Branch: Information Security

Course Objectives

This course enables the students:

1.	Understand the basic concept of Digital Image Processing
2.	To Learn the Fourier Transform & its application
3.	Understand the basic components of filters
4.	Understand the basic concept of Image Compression Fundamentals
5.	Understand the basic concept of Image Segmentation.

Course Outcomes

After the completion of this course, students will be:

1.	Understand the concept of image formation, digitization, and role human visual system plays in perception of image data and spatial filtering techniques for enhancing the appearance of an image.
2.	Acquire an appreciation for various frequency based filtering techniques for enhancing the appearance of an image, duly applying them in different applications.
3.	Discern the difference between noise models, gain an insight into assessing the degradation function and realize different spatial and frequency based filtering techniques for reduction and removal of noise.
4.	Synthesize a solution to image compression using the concept of information theory and lossless and lossy compression techniques.
5.	Design and create practical solutions using morphological and image segmentation operators for common image processing problems and assess the results.

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Syllabus

Module I:
Introduction to Digital Image Processing, Elements of Visual Perception, Image Sensing & Acquisition, Sampling and Quantization, Basic Relationships between Pixels, Intensity Transformations, Histogram Processing, Spatial Convolution & Correlation, Smoothing Spatial Filters, Sharpening Spatial Filters.

(8L)

Module II:
Introduction to the Fourier Transform, Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Image Smoothing using Frequency Domain filters, Image Sharpening using Frequency Domain filters, Selective Filtering, Basics of Fast Fourier Transform, Basics of: Walsh- Hadamard Transform; K-L Transform; Discrete Cosine Transform.

(8L)

Module III:
Model of Image Degradation/Restoration Process, Noise Probability Density Functions, Restoration in presence of Noise only, Periodic Noise Reduction using Frequency Domain filtering, Circulant Matrices, Block Circulant Matrices, Unconstrained Restoration, Constrained Restoration, Basics of Inverse Filtering

(8L)

Module IV:
Image Compression Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria, Image Compression Models– Source Encoder and Decoder, Channel Encoder and Decoder, Elements of Information Theory, Error-Free Compression – Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.Color Fundamentals, Color Models, Basics of Full Color Image Processing.

(8L)

Module V:
Morphological Image Processing- Preliminaries, Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformation, Boundary Extraction, Hole Filling, Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning
Image Segmentation- Fundamentals, Point, Line and Edge Detection, Thresholding, Region Based Segmentation, Segmentation based on color.

(8L)

Text books:

1. Rafael. C. Gonzalez & Richard E. Woods- Digital Image Processing, 3/e Pearson Education, New Delhi - 2009

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Reference books:

1. W.K.Pratt-Digital Image Processing, 4/e, John Wiley & sons, Inc. 2006.
2. M. Sonka et al. Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007.
3. Jayaraman, Digital Image Processing, Tata McGraw-Hill Education, 2011

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3			1	2	1
CO2	3	3		1	1	1
C03	3	3	3			1
CO4	2	3			2	1
CO5	2	3	2			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

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Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	1	2	3	4	5	6
1	3	2	2	1	2	1
2	2	2	3	3	2	2
3	2	3	2	1	1	2
4	2	2	2	2	2	1
5	2	1	3	2	3	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

COURSE INFORMATION SHEET

Course code: CS524
Course title: SOFT COMPUTING
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 3
Class: M. Tech
Semester / Level: II/5
Branch: Information Security

Head of Department

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Course Objectives

After the completion of this course, students will be:

1.	To understand the concepts of soft computing
2.	To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
3.	To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
4.	To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.
5.	To develop neural network models.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Solve numerical on Fuzzy sets and Fuzzy Reasoning.
CO2	Develop Fuzzy Inference System (FIS).
C03	Solve problems on Genetic Algorithms
CO4	Explain concepts of neural networks
CO5	Develop neural networks models for various applications.

Head of Department

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SYLLABUS

Module I:

Introduction: Soft Computing vs. hard computing, soft computing paradigms, Basic mathematics of soft computing, learning and statistical approaches to classification and regression.

Fuzzy Logic: Introduction, Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Membership functions, fuzzification and defuzzification.

(8L)

Module II:

Fuzzy Rule Base System: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making. **Applications**: Fuzzy logic in modeling and control, image processing

(8L)

Module III:

Neural Networks: Introduction, Biological neural network, learning paradigms. Artificial Neural Network (ANN): Evolution of Basic neuron modeling, Difference between ANN and human brain, McCulloch-Pitts neuron models, Learning paradigms, activation function, Single layer Perceptron, Perceptron learning, Windrow-Hoff/ Delta learning rule, Multilayer Perceptron, Adaline, Madaline, different activation functions, Back propagation network, momentum, limitation, FBFN, Convolution Networks, Kohonen SOM, Hopfield Networks, HebbNet.

(8L)

Module IV:

Genetic Algorithms: Introduction, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems such as TSP (Travelling salesman problem), Applications:Genetic Algorithm based Back propagation Networks.

(8L)

Module V:

Particle Swarm Optimization: Background, Operations of Particle Swarm Optimization, Basic Flow of Particle Swarm Optimization, Comparison between GA and PSO, Applications of PSO.

Ant Colony Optimization: Ant Colony Optimization Algorithm, Ant System, Ant Colony System, Basic Flow of Ant colony Optimization, Applications of ACO.

(8L)

TEXT BOOKS:

Head of Department

1. S.N. Sivanandam,Principle of Soft Computing, Wiley India.
2. Simon Haykins ,"Neural Networks :A Comprehensive Foundation, Pearson Education,2002
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997.

REFERENCE BOOKS

1. K.S.Ray ,"Soft Computing and Its application", Vol 1, Apple Academic Press.2015
2. K.H.Lee ,"First Course on Fuzzy Theory and App.", Adv in Soft Computing Spinger.2005
3. H.Z.Zimmermann ,"Fuzzy Set Theory and its App " , 4th Ed.Spinger Science,2001

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	1	1
CO2	3	2	3	3	1	1
C03	3	3	3	2	1	3
CO4	2	2	3	3	1	2
CO5	2	3	3	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6
CO3	CD1, CD2,
CO4	CD1,CD7
CO5	CD1,CD2,

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COURSE INFORMATION SHEET

Course code:IT571
Course title**: Introduction to R Programming**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T:1 P:2
Class schedule per week: 1
Class: M. Tech
Semester / Level:
Branch:

Course Objectives
This course enables the students:

1.	To develop problem solving skills
2.	To learn programming and to solve problems using computers
3.	To learn Data Manipulation, Analysis and Visualization using Computers
4.	To introduce students to the key concepts and ideas of a statistical computing environment
5.	To introduce students to fundamental concepts in (scientific) programming in general.

Course Outcomes
After the completion of this course, students will be to do the following:

1.	Design programs with Interactive Input and Output, utilizing arithmetic expression, repetitions and decision making
2.	Design programs using the fundamental data structures in R
3.	Develop programs in R interfacing files and URLs
4.	Solve Mathematical problems using R
5.	Design graphs and simulations in R

Syllabus

Module I

Introduction- R reserved words, Variables and Constants, Operators, Operator Precedence
Getting Data in and out of R –Accessing the Keyboard and Monitor, Reading in Larger Datasets

Module II

Control Statements- if ..else, for loop, while loop, repeat loop, break and next
Data Structures- Vectors, Arrays, Matrices, Lists, Data Frames, Factors, Operations on Dates and Times

Module III

Strings: Overview of String Manipulation Functions
Functions: Function Syntax, Environment and Scope, Recursive Function

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Interfaces to the Outside World: File Connections, Reading Lines of a Text File Reading From a URL Connection

Module IV

Maths in R- Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations, Set Operations.

Simulation -Generating Random Numbers, Simulating a Linear Model, Random Sampling

Module V

Graphics-Creating Graphs, Customising Graphs

Introduction to Object Oriented Features- Concept of Class and Object

SYLLABUS

List of Programs as Assignments:

33. Lab Assignment No: 1

Objective: To Understand and Implement Data Types

33. Data Types - R Objects and Attributes
34. Data Types - Vectors and Lists
35. Data Types - Matrices
36. Data Types - Factors
37. Data Types - Missing Values
38. Data Types - Data Frames
39. Data Types - Names Attribute
40. Data Types - Summary

34. Lab Assignment No: 2

Objective: To Understand and Implement Data Analysis

42. Reading Tabular Data
43. Reading Large Tables
44. Textual Data Formats
45. Connections: Interfaces to the Outside World
46. Subsetting - Basics
47. Subsetting - Lists
48. Subsetting - Matrices
49. Subsetting - Partial Matching
50. Subsetting - Removing Missing Values
51. Vectorized Operations

35. Lab Assignment No: 3

Objective: To Understand and Implement Swirl

13. Workspace and Files
14. Sequences of Numbers
15. Vectors

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36. Lab Assignment No: 4

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

37. Lab Assignment No: 5

Objective: To Understand and Implement Control Structures

17. If-else
18. Control Structures - For loops
19. Control Structures - While loops
20. Control Structures - Repeat, Next, Break

38. Lab Assignment No: 6

Objective: To Understand and Implement Functions

17. Functions (part 2)
18. Scoping Rules - Symbol Binding
19. Scoping Rules - R Scoping Rules
20. Scoping Rules - Optimization Example (OPTIONAL)

39. Lab Assignment No: 7 &8

Objective: To Understand and Implement Loop Functions and Debugging

21. Loop Functions - lapply
22. Loop Functions - apply
23. Loop Functions - mapply
24. Loop Functions - tapply
25. Loop Functions – split

40. Lab Assignment No: 9 & 10

Objective: To Understand and Implement Two-Dimensional Graphics

13. Generating Random Numbers
14. Simulation - Simulating a Linear Model
15. Simulation - Random Sampling

Text books:

2. Matloff Norman, The Art of R Programming– A Tour of Statistical Software Design.(T1)
3. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Orielly, 1st Edition. (T2)

Reference books:

1. Grolemund Garret,Hands-On Programming with R.(R1)
2. Gardener Mark,Beginning R: The Statistical Programming Language.(R2)

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Head of Department

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	3
CO2	3	3	2	2	1	2
CO3	2	2	2	3	1	3
CO4	3	1	2	3	1	1
CO5	3	2	1	3	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Head of Department

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COURSE INFORMATION SHEET

Course Code: CS512
Course title: ARTIFICIAL INTELLIGENCE
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/5
Branch: Information Security

Course Objectives
After the completion of this course, students will be able to:

1.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
2.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
3.	An ability to design a system, component or process to meet desired needs within realistic constraints.
4.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
5.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Recall the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
CO2	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
CO3	Understanding the various concepts of knowledge representations and demonstrate working. knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO4	To develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
CO5	Write various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

Head of Department

SYLLABUS

Module I :

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature of Environment, Structure of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining The Problem as State Space Search, Production System, Problem Characteristics, Issues in The Design of Search Programs.

(8L)

Module II :

Search Techniques: Solving Problems by Searching, Problem Solving Agents, Searching for Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search for Constraint Satisfaction Problems.

Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Minimax Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.

(8L)

Module III :

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, Natural Deduction.

Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.

(8L)

Module IV :

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster -Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning.

Learning: Forms of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning.

(8L)

Module V :

Natural Language Processing: Brief introduction to Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planning uncertain movements, robotic software architecture, application domains.

(8L)

Head of Department

TEXT BOOKS:

- S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education.
- E. Rich & K. Knight, "Artificial Intelligence", 2/e, TMH, New Delhi, 3rd Edition, TMH

REFERENCE BOOKS:

- Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, New Delhi, 2006.
- D.W. Rolston, "Principles of AI & Expert System Development", TMH, New Delhi.

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Head of Department

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	1	1
CO5	2	2	2	3	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1,
CO3	CD1, CD2, CD3,
CO4	CD1, CD3
CO5	CD1,CD2, CD7

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COURSE INFORMATION SHEET

Course code:IT516
Course title: DATA MINING AND DATA ANALYSIS
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 L:3 T: 0 P: 0
Class schedule per week: 03
Class: M. Tech
Semester / Level: II/05
Branch: Information Security
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes
After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining applications .
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

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SYLLABUS

Module I :
Data Analysis foundation, Numeric and Categorical attributes, Dimensionality reduction.
(8L)

Module II:
Data Warehouse: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization.
(8L)

Module III:
Frequent Pattern Mining, Summarizing Itemsets, Itemset Mining, Sequence Mining.
(8L)

Module IV:
Classification: Naïve Bayes, KNN, Decision Tree, Classification Performance measures, Classifier evaluation.
(8L)

Module V:
Clustering: K-Means, Agglomerative, Hierarchical, DBSCAN, Spectral and Graph Clustering. Anomaly detection, Statistical, distance and density-based approaches.
(8L)

Text Books:

1. Mohammed J. Zaki, and Wagner Meira Jr., "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2016
2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson, 2014
3. Jiawei Han, and Micheline Kamber, "Data Mining Concepts & Techniques", 3rd Edition, Publisher Elsevier India Private Limited, 2015

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations
Gaps in the syllabus (to meet Industry/Profession requirements):
POs met through Gaps in the Syllabus:
Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Head of Department

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course Code: CS510
Course title: ADVANCED ALGORITHM LAB
Pre-requisite(s): Design and Analysis of Algorithms, Data Structures
Co- requisite(s): None
Credits: 2 L:0 T:0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/05
Branch: Information Security

Course Objectives

After the completion of this course, students will be able to:

1.	Able to create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2.	Able to create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behaviour using UML class, object, and sequence diagrams.
3.	Able to comprehend enough Java to see how to create software the implements the OO designs modelled using UML.
4.	Able to comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5.	Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

CO1	Able to know the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations.
CO2	Able to determine the practical implications of asymptotic notations.
CO3	Able to Implement, analyze, and compare algorithms.
CO4	Able to Know the difference between the dynamic programming concept and a greedy approach.
CO5	Able to know and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford.

SYLLABUS

List of Programs as Assignments:

2. **Lab Assignment No: 1**
   Programs on Polynomial vs logarithmic running times
3. **Lab Assignment No: 2**
   Programs on Divide-and-conquer algorithms
4. **Lab Assignment No: 3**
   Programs on Greedy and dynamic-programming algorithms
5. **Lab Assignment No: 4**
   Programs on Binary trees
6. **Lab Assignment No: 5**
   Programs on Heaps and priority queues
7. **Lab Assignment No: 7**
   Programs on Binary search trees
8. **Lab Assignment No: 8**
   Programs on Hash tables
9. **Lab Assignment No: 9**
   Programs on Graph traversal
10. **Lab Assignment No: 10**
    Programs on Shortest paths in graphs.

Head of Department

Books recommended:

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001.
2. Sanjoy Dasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, Tata McGraw-Hill, 2008.
3. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcome

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2		3	2
CO2	3	3		2	2	
CO3	2	3	3	2	3	1
CO4		2	3		2	3
CO5	1	2	3	3	2	3

If satisfying and < 34% = L, 34-66% = M, > 66% = H

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5	CD1
CD2	Laboratory experiments/teaching aids		
CD3	Industrial/guest lectures		
CD4	Industrial visits/in-plant training		
CD5	Self- learning such as use of NPTEL materials and internets		

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COURSE INFORMATION SHEET

Course code: IT517
Course title: Data Mining and data analysis lab
Pre-requisite(s):
Co- requisite(s): None
Credits:2 L: 0 T: 0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/05
Branch: Inform Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Explain about the necessity of preprocessing and its procedure.
2.	Generate and evaluate Association patterns
3.	Solve problems using various Classifiers
4.	Learn the principles of Data mining techniques and various mining algorithms.
5.	Learn about traditional and modern data driven approach and problem solving techniques for various datasets

Course Outcomes

After the completion of this course, students will be able to:

CO1	Understand Data Warehousing and Data Mining and its applications and challenges and Create mini data warehouse.
CO2	Apply the association rules for mining application.
CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

Head of Department

SYLLABUS

List of Programs as Assignments:

7. **Lab Assignment No: 1**
   Q1. Build a Data Warehouse and Explore WEKA tool.

8. **Lab Assignment No: 2**
   Q2. Demonstration of pre processing on various datasets.

9. **Lab Assignment No: 3**

   Q3.Demonstration of Association rule process on dataset using a priori algorithm.

10. **Lab Assignment No: 4**

    Q4.Demonstrate performance of classification on various data sets.

11. **Lab Assignment No: 5**

    Q5. Demonstrate performance of clustering on various data sets.

12. **Lab Assignment No: 6**

    Q6. Demonstrate performance of Regression on various data sets

13. **Lab Assignment No: 7**

    Q7. Implement following algorithms for various datasets
    A. A priori Algorithm.
    B. FP-Growth Algorithm.
    C. K-means clustering.

14. Q8. **Lab Assignment No: 8**

    Implement Bayesian Classification for various datasets

15. **Lab Assignment No: 9**

    Q9 Implement Decision Tree for various datasets.

16. **Lab Assignment No: 10**

    Q10. Implement Support Vector Machines.

Head of Department

17. **Lab Assignment No: 11**

Q11 Applications of classification for web mining.

18. **Lab Assignment No: 12**

Q12. Case Study on Text Mining or any commercial application

Books recommended:

TEXT BOOKS:

1. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques Publisher Harcourt India. Private Limited.

REFERENCE BOOKS :

1. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.
2. A. Berson & S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004.
3. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Head of Department

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2		1
CO2	3	3	2		1	
CO3	2	3	2	1	1	1
CO4	3				1	1
CO5	3	2	1			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: IT519
Course title: INTERNET OF THINGS LAB
Pre-requisite(s):
Co-requisite(s):
Credits:2 L:0 T:0 P:4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/05
Branch: Information Security

Course Objectives

This course enables the students:

1.	Understand the basic concept and the Iot Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes

After the completion of this course, students will be:

CO1	Identify the IoT Components and its capabilities
CO2	Explain the architectural view of IoT under real world constraints
C03	Analyse the different Network and link layer protocols
CO4	Evaluate and choose among the transport layer protocols
CO5	Design an IoT application

Head of Department

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SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Glowing LEDs.
   Toggling LED's.
2. **Lab Assignment No: 2**
   Transmitting a string through UART
   Controlling LEDs blinking pattern through UART.
3. **Lab Assignment No: 3**
   Echo each character typed on HyperTerminal
   Digital IO configuration.
   Timer based LED Toggle.
4. **Lab Assignment No: 4**
   Scanning the available SSID's in the range of Wi-FI Mote.
   Connect to the SSID of choice
5. **Lab Assignment No: 5**
   Demonstration of a peer to peer network topology.
   check the connectivity to any device in the same network.
6. **Lab Assignment No: 6**
   Send hello world to TCP server existing in the same network
   Reading of atmospheric pressure value from pressure sensor.
7. **Lab Assignment No: 7**
   I2C protocol study
   Reading Temperature and Relative Humidity value from the sensor.
   Reading Light intensity value from light sensor.
8. **Lab Assignment No: 8**
   Proximity detection with IR LED.
   Generation of alarm through Buzzer.
9. **Lab Assignment No: 9**
   Timestamp with RTC
   IO Expander.
   Relay control.
10. **Lab Assignment No: 10**
    I2C based 12-channel ADC
    EEPROM read and write
11. **Lab Assignment No: 11**
    Transmitting the measured physical value from the UbiSense Over the Air.

Head of Department

Books recommended:

TEXT BOOK

3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.**(T1)**
4. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI. **(T2)**

REFERENCE BOOK

3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer. **(R1)**
4. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6". **(R2)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
D4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	3	3	3	2	1	1
C03	3	2	2	3	1	1
CO4	3	3	2	1	3	1
CO5	2	1	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6, CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2, ,CD5,CD7

Head of Department

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COURSE INFORMATION SHEET

Course code: IT511
Course title: R PROGRAMMING
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M. Tech
Semester / Level: II/5
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring R
2.	Develop basic thinking for data analysis.
3.	To enable the student on how to approach for statistical Analysis
4.	To provide a foundation in use of this software

Course Outcomes

After the completion of this course, students will be able to:

CO1	Manipulate data within R
CO2	Perform basic data analysis procedures
CO3	Create plots
CO4	Implement programming features like accessing R packages, writing R functions
CO5	Simulation & Profiling with R

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Objective: To Understand and Implement Data Types

1. Data Types - R Objects and Attributes
2. Data Types - Vectors and Lists
3. Data Types - Matrices
4. Data Types - Factors
5. Data Types - Missing Values
6. Data Types - Data Frames
7. Data Types - Names Attribute
8. Data Types - Summary

Head of Department

2. **Lab Assignment No: 2**

Objective: To Understand and Implement Data Analysis

1. Reading Tabular Data
2. Reading Large Tables
3. Textual Data Formats
4. Connections: Interfaces to the Outside World
5. Subsetting - Basics
6. Subsetting - Lists
7. Subsetting - Matrices
8. Subsetting - Partial Matching
9. Subsetting - Removing Missing Values
10. Vectorized Operations

3. **Lab Assignment No: 3**

Objective: To Understand and Implement Swirl

1. Workspace and Files
2. Sequences of Numbers
3. Vectors

4. **Lab Assignment No: 4**

Objective: To Understand and Implement Cubic Splines

1. To design Spline differentiation and Integration.
2. To design interpolated Spiral Y=f(X).

5. **Lab Assignment No: 5**

Objective: To Understand and Implement Control Structures

3. If-else
4. Control Structures - For loops
5. Control Structures - While loops
6. Control Structures - Repeat, Next, Break

6. **Lab Assignment No: 6**

Objective: To Understand and Implement Functions

1. Functions (part 2)
2. Scoping Rules - Symbol Binding
3. Scoping Rules - R Scoping Rules
4. Scoping Rules - Optimization Example (OPTIONAL)

7. **Lab Assignment No: 7 &8**

Objective: To Understand and Implement Loop Functions and Debugging

1. Loop Functions - lapply
2. Loop Functions - apply
3. Loop Functions - mapply
4. Loop Functions - tapply
5. Loop Functions – split

8. **Lab Assignment No: 9 & 10**

Objective: To Understand and Implement Two-Dimensional Graphics

1. Generating Random Numbers
2. Simulation - Simulating a Linear Model
3. Simulation - Random Sampling

Head of Department

Books recommended:

TEXT BOOKS

1. Norman Matloff, The Art of R Programming, A Tour of Statistical Software Design 1st Edition, **(T1)**
2. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Orielly, 1st Edition. **(T2)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Head of Department

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	1	1
CO2	3	3	2	2	1	1
CO3	2	2	2	1	1	1
CO4	3	1	1	1	1	1
CO5	3	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT507
Course title: DATA COMMUNICATION AND COMPUTER NETWORKS
Pre-requisite(s):
Co-requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/05
Branch: Information Security

Course Objectives

This course enables the students:

1.	To build an understanding of the fundamental concepts of the data communication model and communications architecture.
2.	To study characteristics of communication mediums and the characteristics of signals propagated through different transmission media, including concepts of transmission impairments.
3.	To understand the basic principles of signal encoding techniques, error-detection, and error-correction techniques.
4.	To understand techniques for flow control and multiplexing for maximum utilization of bandwidths in the data communications process.
5.	To understand the various switching techniques and routing techniques for efficient transmission.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand and be able to explain the principles of a layered protocol architecture; be able to identify and describe the system functions in the correct protocol layer and further describe how the layers interact.
2.	Understand, explain and calculate digital transmission over different types of communication media.
3.	Understand, explain and solve mathematical problems for data-link and network protocols.
4.	Describe the principles of access control to shared media and perform performance calculations.
5.	Understand and explain the principles and protocols for route calculations and be able to perform such calculations.

SYLLABUS

Module I:

Data Communications and Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture

Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity.

(8L)

Module II:

Guided and Wireless Transmission: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.

Signal Encoding Techniques:

Digital Data Digital Signals, Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals.

(8L)

Module III :

Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing.

Data Link Control: Flow Control, Error Control, High-Level Data Link Control (HDLC).

Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.

(8L)

Module IV :

Circuit Switching and Packet Switching: Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signalling, Soft switch Architecture, Packet-Switching Principles, X.25, and Frame Relay.

(8L)

Head of Department

Module V:

Asynchronous Transfer Model: Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.

Routing in Switched Networks: Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms.

(8L)

Text Books:

W. Stallings, "Data and Computer Communications", 7th Edition, Pearson Edition/ PHI, New Delhi, 2016.

Reference Books:

1. B. A. Forouzan, "Data Communications and Networking", 4th Edition, TMH, New Delhi 2015.
2. P.C. Gupta, "Data Communications and Computer Networks", PHI, New Delhi 2006.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	1
CO2	2	2	1	3	2	1
CO3	3	2	2	1	2	1
CO4	3	2	3	2	3	1
CO5	1	1	1	2	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: IT520
Course title: NETWORK SECURITY
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/6
Branch: Information Security

Course Objectives

This course enables the students:

1.	Able to understand the fundamentals of security algorithms currently
2.	Able to understand E-mail security, PEM& S/MIME, PGP, Firewalls.
3.	Have a broad knowledge of the state-of-the-art and open problems in network security
4.	Enhance their potential to do research or pursue a career in this rapidly developing area.
5.	Able to be introduced to new developing security features.

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify state-of-the-art and open problems in network security
2.	Analyse all relevant aspects of security in networks like E-mail security, PEM& S/MIME, PGP, Firewalls.
3.	Assess the impact of Modes of Operation and problems in network
4.	Summarise developing security features in networking systems and Real time communication security
5.	Design of secure system and applications

Head of Department

SYLLABUS

Module I:
Introduction to networking: OSI Reference model, Active vs Passive attacks, Layers and cryptography, multilevel model of security.

(8L)

Module II:
Modes of Operation: encrypting large messages, Generating MAC's, Multiple Encryption DES, Hash and message digest: Using Hash for encrypting, MD2, MD4, MD5, SHA1.

(8L)

Module III:
Authentication Systems, Password authentication systems, authentication protocols, tructed intermediates, session key establishment.
Security handshake pitfalls: mutual authentication, Integrity / encryption of data, mediated authentication, strong password protocols.

(8L)

Module IV:
Real time communication security: Session key establishment, perfect forward secrecy, DOS, clogging protection, Arranging for parallel computation, session resumption, data steam protection, plausible deniability.

(8L)

Module V:
E mail security, PEM& S/MIME, PGP, Firewalls.

(8L)

Text Books:

1. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security: Private Communication in a Public World", 2nd Edition, Prentice Hall, 2002.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Head of Department

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	2	1
CO2	3	3	3	1		1
CO3	2	3	2		2	
CO4	3	2	2	3	2	
CO5	2	1	1	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT602
Course title: **CYBER SECURITY**
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: M. Tech
Semester / Level: III/6
Branch: Information Security

Course Objectives
This course enables the students:

1.	Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2.	Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes
3.	Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
4.	E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Course Outcomes
After the completion of this course, students will be able to:

1.	Understand relevant legislation and codes of ethics.
2.	Apply Computer forensics and digital detective and various processes, policies and procedures.
3.	Understand E-discovery, guidelines and standards, E-evidence, tools and environment.
4.	Learn the techniques of Email and web forensics and network forensics tools.
5.	Integrate techniques to recover data from computer and hand held devices.

Head of Department

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SYLLABUS

Module I:
Introduction to Cybercrime, Classifications of Cyber Crimes, Local and Global perspectives on Cybercrime, Cyber offences, Cyberstalking, Cyber crime and cloud computing, cyber crimes through hand held devices.

(8L)

Module II:
Tools and Methods used in Cybercrime, phishing, steganography, attacks on wireless network. The legal perspectives of Cybercrime and cybersecurity

(8L)

Module III :
Understanding Digital forensic, Forensics science, computer forensics, and digital forensics. Criminalistics, Analysis of cyber-criminalistics area, Holistic approach to cyber-forensics.

(8L)

Module IV:
Case studies Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation., specific tools and techniques, Forensic auditing.

(8L)

Module V:
Computer forensic tools, Forensics of Hand held devices, tools for hand held device forensics., intellectual property in the cyberspace, The ethical dimension of Cybercrimes

(8L)

Text Books:

1. Cyber Security by Nina Godbole, Sunit Belapure Wiley Indian Print 2014
2. John Sammons, The Basics of Digital Forensics, Elsevier
3. A Practical Guide to computer forensics Investigations by D.R.Hyaes, Person IT education 2014.

Reference Books:

4. Guide to Computer Forensics and Investigations: Processing Digital evidence by Bil Nelson, A Philips, Christopher Stuarts. Cengage Learning Fifth Edition 2015.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
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CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	2	1
CO2	3	3	2		1	
CO3	2	1	2	2		
CO4	3	3	3	2	2	
CO5	2	1		2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code:IT521
Course title: DATA COMMUNICATION AND COMPUTER NETWORKS Lab
Pre-requisite(s):
Co- requisite(s): DATA COMMUNICATION AND COMPUTER NETWORKS Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M.Tech
Semester / Level: III/05
Branch: Information security
Name of Teacher:

Course Objectives
This course enables the students to:

1.	To familiarize the student in introducing and exploring various Network topologies and networking protocols
2.	To understand the use of client/server architecture in application
3.	To enable the student on how to approach for networking problems using networking simulation tools.
4.	To Design reliable servers using both TCP and UDP sockets
5.	Familiar with network tools and network programming.

Head of Department

Course Outcomes :

After the completion of this course, students will be able to:

CO1	Express programming & simulation for networking problems.
CO2	Get a thorough understanding of various aspects of networking devices
CO3	Design and implement simulation of a simple LAN and a WAN that meet a specific set of criteria
CO4	Identify the elements of a communication network
CO5	Simulate various OSI layer protocols using C/C++/ Java

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

Q1. To familiarize with the Lab Network Topology, Locating different interfaces, routers and switches. Studying different pools of IP addresses.

Q2. Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.

Q3. To learn and observe the usage of different networking commands e.g.PING, TRACEROUTE. Learning remote login using telnet session. Measuringtypical average delays between different locations of the network.

2. **Lab Assignment No: 2**

Q1. What is the IP of the machine you are using? Compare it with the IP of your neighbors. Are the IPs of your neighbors same? Why or Why not?

Q2. Ping" is a tool used to determine if a server is responding and to estimate the round trip time of a message sent to that server. Use the ping command for the following URLs and record the success or failure statistics along with the average round trip time.

a) google.com
b) facebook.com
c) bitmesra.ac.in

Q3. Trace the route that is taken when you try to access:
a) google.com
b) facebook.com
c) bitmesra.ac.in

Q4. Network Commands on Linux / Unix

Head of Department

3. **Lab Assignment No: 3**

Q1. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC 32.
Q2. Implementation of Sub-netting and Super-netting.
Q3. To study different types of transmission media, various topologies, and configure modem of computer HUB and Switches.

4. **Lab Assignment No: 4**

Q1. Write a C/C++ program to determine if the IP address is in Class A, B, C, D, or E.
Q2. Write a C/C++ program to determine if the IP address is in Class A, B, or C.
Q3. Write a C/C++ program to translate dotted decimal IP address into 32 bit address.
Q4. To implement a routing protocol and check its connectivity in a variable length subnet masked network
Q5. Write a C/C++ program to perform bit stuffing and de-stuffing.

5. **Lab Assignment No: 5**

Q1. Implement Dijkstra‘s algorithm to compute the Shortest path through a graph.

Q2. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

Q3. Take an example subnet of hosts. Obtain broadcast tree for it.

6. **Lab Assignment No: 6**

Q1. Build implementations of the Internet protocols
Q2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
Q3. Write a code simulating ARP /RARP protocols.

7. **Lab Assignment No: 7**

Q1. Create a socket for HTTP for web page upload and download
Q2. Write a code simulating PING and TRACEROUTE commands.

8. **Lab Assignment No: 8**

Q1. Study and implement model for Socket Programming and Client – Server model.
Q2. Experiments with NS2(or any other simulator) to study behavior (especially performance of) link layer protocols such as Ethernet and 802.11 wireless LAN.

9. **Lab Assignment No: 9**

Q1. Experimental study of application protocols such as HTTP, FTP,SMTP, using network packet sniffers and analyzers such as **Wireshark**. Small exercises in socket programming in C/C++/Java..

Head of Department

10. **Lab Assignment No: 10**

Q1. Take a 64 bit playing text and encrypt the same using DES algorithm.
Q2. Write a program to break the above DES coding
Q3. Using RSA algorithm encrypts a text data and Decrypt the same bjective: To Understand and Implement Data Interpolation

11. **Lab Assignment No: 11**

Q1. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer
Q2. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
Q3. Echo client and echo server b. Chat c. File Transfer

Books recommended:

TEXT BOOKS

1. William Stallings, Data and Computer Communication, Prentice Hall of India.
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill.
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.

REFERENCE BOOKS

2. W. Richard Stevens, TCP/IP Illustrated, Volume 1, Addison-Wesley
3. Douglas Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India.

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

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Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2		1
CO2	3	3	2		1	
CO3	2	3	2	1	1	1
CO4	3				1	1
CO5	3	2	1			1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: IT603
Course title: PYTHON PROGRAMMING LAB
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M.Tech
Semester / Level: III/6
Branch: Information Security
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To introducewith fundamentals and grammar of Python programming.
2.	To understand and be able to use basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
3.	To learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
4.	To understand the process and skills necessary to effectively attempt a programming problem and implement it with a specific programming language -- Python.
5.	To understand a python program written by someone else and be able to debug and test the same.

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Course Outcomes

After the completion of this course, students will be able to:

CO1	To use their problem solving abilities to implement programs in Python.
CO2	To apply Python in software development, testing and systems administration environments.
CO3	To develop Python applications for a variety of uses
CO4	To understand the fact that there is more than one right solution to a problem.
CO5	Work in industry environment with good enough knowledge about Python programming.

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Objective: ToImplement basic Python programming.

   Q1. Create a new program called hello world.py. Use this file to write your very First "Hello, world!" program.

   Q2. Write a Python program containing exactly one print statement that produces the following output:

   A
   B
   C
   D
   E
   F

2. **Lab Assignment No: 2**

   Objective: To Understand and Implement the concept of if-else-if statements.

   Q1.Write a Python program that requests five integer values from the user. It then prints one of two things: if any of the values entered are duplicates, it prints "DUPLICATES"; otherwise, it prints "ALL UNIQUE".

   Q2. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. Each binary digit should be entered one per line, starting with the leftmost digit, as shown below.

   Enter leftmost digit: 1
   Enter the next digit: 0
   Enter the next digit: 0
   Enter the next digit: 1
   The value is 9

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Q3.Develop and test a program that prompts the user for their age and determines approximately how many breaths and how many heartbeats the person has had in their life. The average respiration (breath) rate of people changes during different stages of development. Use the breath rates given below for use in your program:

	Breaths per Minute
Infant	30–60
1 –4 years	20–30
5 –14 years	15–25
adult	12–20

For heart rate, use an average of 67.5 beats per second.

3. **Lab Assignment No: 3**

Objective: To Understand and Implement the flow control statements.

Q1. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4... 1/10.

Q2.Write a program using a for loop that calculates exponentials. Your program should ask the user for a base 'b' and an exponent 'exp', and calculate b^exp.

Q3. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user input a negative number? As a programmer, you should always consider "edge conditions" like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don't include a condition that catches negative numbers, what will your program do?)

4. **Lab Assignment No: 4**

Objective: To practice drawing patterns

Q1.Write the program to print the following pattern: ex if the user enters 7, the program would print

```
      *
     **
    ***
   ****
  *****
 ******
*******
 ******
  *****
   ****
    ***
     **
      *
```


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Q2.Write a program in python to print the following pattern:

1
1 1
121
1331
12641
15101051
1615201561

5. **Lab Assignment No: 5**

Objective: To Understand and Implement methods in Python.

Q1.Write a method fact that takes a number from the user and prints its factorial.

Q2. Write a Python function named compare3 that is passed three integers and returns true if the three integers are in order from smallest to largest, otherwise it returns false.

Q3. Write a python function named modCount that is given a positive integer and a second positive integer, m<=n, and returns how many numbers between 1 and n are evenly divisible by m.

6. **Lab Assignment No: 6**

Objective: To Understand and Implement the concept of Recursion

Q1. Write a program to read an integer number. Print the reverse of this number using recursion.

Q2. Write a program that calculates the GCD using recursive functions.

7. **Lab Assignment No: 7**

Objective: To Understand and Implement Sorting techniques

Q1.Write a program to sort the list of elements using Insertion sort.

Q2. Write a program to sort the list of elements using Merge sort.

Q3.Write a program to multiply the two matrices.

8. **Lab Assignment No: 8**

Objective: To Understand and Implement the concept of Strings in Python

Q1. Write a program to check whether string is a palindrome or not.

Q2. Write a program to implement format method available with string object.

9. **Lab Assignment No: 9**

Objective: To Understand and Implement Dictionary

Q1. Program to demonstrate the built in functions within the dictionary.

Q2. Program to implement dictionary as an associative array.

10. **Lab Assignment No: 10**

Objective: To Understand and Implement File Handling.

Q1. Program to open the file in the read mode and use of for loop to print each line present in the file.

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Q2. Write a Python program to illustrate Append vs write mode.
Q3. Write a Program to read and write data from a file.

Books recommended:

TEXT BOOKS

1. Krishna P. R., Object Oriented Programming through JAVA, 1st Edition, Universities Press, 2008.
2. Patrick Naghton& H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.
3. Dietel,Dietel - Java How to program , 7th edition; Pearson Education , New Delhi.

REFERENCE BOOKS

1. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi.
2. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi.

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	1	1	3					
CO2	2	1	1	1	3			3		
CO3	1	2	3	3	3					
CO4		1	1	3	2					1
CO5	1	1	2	2				2		3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: IT604
Course title: WEB APP DEVELOPMENT LAB
Pre-requisite(s):
Co- requisite(s): None
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: M.Tech
Semester / Level: III/6
Branch: Information Security
Name of Teacher:

Course Objectives
This course enables the students to:

1.	To get familiar with basics of the Internet Programming.
2.	To acquire knowledge and skills for creation of web site considering both client and server side programming
3.	To gain ability to develop responsive web applications
4.	To explore different web extensions and web services standards

Course Outcomes
After the completion of this course, students will be able to:

CO1	Analyze a web page and identify its elements and attributes.
CO2	Implement interactive web page(s) using HTML, CSS and JavaScript.
CO3	Demonstrate Rich Internet Application.
CO4	Build Dynamic web sites using server side Programming and Database connectivity.

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SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**
   Objective: To Understand and Implement HTML
   Q1. To create a simple html file to demonstrate the use of different tags.
   Q2. To create an html file to link to different html page which contains images, tables, and also link within a page.
   Q3. To create an html page with different types of frames such as floating frame, navigation frame & mixed frame.
   Q4. To create a registration form as mentioned below.
   Create an html page named as "registration.html"
   a) set background colors
   b) use table for alignment
   c) provide font colors & size
2. **Lab Assignment No: 2**
   Objective: To Understand and Implement CSS
   Q1. To create an html file by applying the different styles using inline, external & internal style sheets.
   1. Create a external style sheet named as "external_css.css" and provide some styles for h2, hr, p & a tags.
   2. Create an html file named as "Style_sheet.html"
   a) Include the external style sheet with necessary tag.
   b) Include the internal style sheet for body tags & also use class name, so that the style can be applied for all tags.
   c) Include a tags with inline style sheet.
3. **Lab Assignment No: 3**
   Objective: To Understand and Implement JavaScript
   Q1. To write a Javascript program to define a user defined function for sorting the values in an array.
   Q2. Create an html page named as "exception.html" and do the following.
   1. within the script tag write code to handle exception
   a) define a method RunTest() to get any string values(str) from the user and cll the method Areletters(str).
   b) In Areletters(str) method check whether str contain only alphabets (a-z, AZ), if not throw exception.
   c) Define a exception method Input Exception(str) to handle the exception thrown bythe above method.
   2. Within the body tag define a script tag to call Runtest() method defined.
   Q3. To display the calendar using javascript code by getting the year from the user.
   Q4. To create a html page to display a new image & text when the mouse comes over the existing content in the page.

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4. **Lab Assignment No: 4**

Objective: To Understand and Implement ASP

Q1. To create an ASP file to find the no of hits on the page and to have rotating banner content.

Q2. To create a table of content using ASP program & navigate within the pages.

Q3. Create an ASP file named as request.asp

a) Create a simple form to get the first name & last name and a button submit. When the button is clicked the values in the text box are printed by response object by Request.QueryString

b) Create a hyperlink with some values defined in the tag & display the same using request & response object.

Q4.To display all the content in the database using ASP program.

Lab Assignment No: 5

Objective: To Understand and Implement Java Servlets

Q1. To create a simple servlet program to display the date (using Tomcat server).

Q2. To create a servlet program to retrieve the values entered in the html file (Using NetBeans IDE).

Q3. To display the cookie values that are entered in the html page using servlet program. (using NetBean IDE).

Lab Assignment No: 6

Objective: To Understand and Implement XML

Q1. To create a simple catalog using XML file

Q2. To create external style sheet and using the style sheet in xml file.

Lab Assignment No: 7

Objective: To Understand and Implement PHP

Q1. To create a php program to demonstrate the different file handling methods.

Q2. To create a php program to demonstrate the different predefined function in array, Math, Data & Regular Expression.

Books recommended:

TEXT BOOKS

1. Web Technologies: A Computer Science Perspective , Jeffrey C Jackson , Pearson Education , India.
2. Stephen Wynkoop, Running a perfect website, QUE, 1999

REFERENCE BOOKS

1. Eric Ladd, Jim O' Donnel, Using HTML 4, XML and Java, Prentice Hall of India-QUE, 1999
2. Chris Bates, Web Programming - Building Intranet applications, Wiley Publications, 2004
3. Deitel, Deitel & Nieto, Internet and World Wide Web - How to Program, Pearson Education Asia, 2000

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Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		3			2	
CO2	1	3	3		1	2
CO3	2		1	2	2	1
CO4	1	3	3		1	

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3
CO2	CD2, CD3,CD6
CO3	CD1, CD2, CD3,CD6
CO4	CD3,CD6,CD7

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Syllabus MCA CBCS

COURSE INFORMATION SHEET

Course code: MA430
Course title: DISCRETE MATHEMATICAL STRUCTURE
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Study methods to solve algebraic, transcendental equations and linear system of equations
2.	Know techniques o find the numerical solution of initial value problems
3.	Apply concepts in discrete mathematics and its properties.
4.	Understand Graph Terminologies and their representation, Connected & Disconnected graphs

Course Outcomes

After the completion of this course, students will be able to:

CO1	Solve algebraic structures and linear system of equations using an appropriate techniques.
CO2	Analyse Recurrence Relations, Classification of Recurrence Relations and their solutions.
CO3	Apply Mathematical logic and Mathematical Reasoning to solve real time problems
CO4	Evaluate Graph Terminologies and their representation, Connected & Disconnected graphs

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SYLLABUS

Module I:
Mathematical logic and Mathematical Reasoning, Compound Statements, Propositional Equivalences, Predicates and Quantifiers, Methods of Proof, Mathematical Induction, Well-ordering principle, Recursive Definition and Algorithms.

(8L)

Module II:
Relations, Properties/Classification of Relations, Closure operations on Relations, Matrix representation of Relations, Digraphs, Partial ordered set, Linearly Ordered Set,Hasse Diagram, Isomorphism, Isomorphic Ordered Sets, Supremum, Infimum, Well ordered set.

(8L)

Module III:
Recurrence Relations, Classification of Recurrence Relations and their solutions by Characteristic Root method, Generating function and their various aspects, Utility of Generating function in solving Recurrence Relations

(8L)

Module IV:
Binary Operations, Groups, Product and Quotients of Groups, Semi group, Products and Quotients of Semi groups, Permutation Group, Composition of Permutation, Inverse Permutation, Cyclic Permutation, Transposition, Even and Odd Permutation, Coding of Binary Information and Error Correction, Decoding and Error Correction.

(8L)

Module V:
Introduction to Graph, Graph Terminologies and their representation, Connected & Disconnected graphs, Isomorphic Graph, Euler & Hamilton graphs.
Introduction to Trees, Versatility of Trees, Tree traversal, Spanning Trees, Minimum Spanning Tree.

(8L)

Books recommended:

TEXT BOOK

1. Mott, Abraham & Baker, "Discrete Mathematics for computer scientist & mathematicians", PHI, 2nd Edition, 2002. **(T1)**
2. ROSS & WRIGHT, "Discrete Mathematics", PHI, 2nd Edition, 1988. **(T2)**
3. Swapan Kumar Chakraborty and BikashKantiSarkar, "Discrete Mathematics", Oxford Univ. Publication, 2010. **(T3)**
4. Kolman, Rusby, Ross, "Discrete Mathematics Structures", PHI, 5th Edition, 2005. **(T4)**

REFERENCE BOOK

1. BikashKanti Sarkar and Swapan Kumar Chakraborty, "Combinatorics and Graph Theory", PHI, 2016. **(R1)**
2. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", Shaum's outlines, 2003. **(R2)**
3. C. L. LIU, "Elements of Discrete Maths", McGraw Hill, 2nd Edition, 2001. **(R3)**

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4. Johnsonbaugh, R., "Discrete Mathematics", 6th Edition, Maxwell, Macmillan International. **(R4)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4
Continuous Internal Assessment	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8

Head of Department

CO1	1	1	3	1	2	1	1	2
CO2	3	2	2	2	2	2	1	1
CO3	3	3	1	2	1	1	1	1
CO4	2	2	1	2	1	2	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: MA428
Course title: NUMERICAL AND STATISTICAL METHODS
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Derive appropriate numerical methods to solve algebraic, transcendental equations and linear system of equations
2.	Approximate a function using various interpolation techniques, to find the numerical solution of initial value problems
3.	Apply concepts in probability theory, the properties of probability distributions
4.	Estimation of mean, variance and proportion, the concepts of statistical hypothesis

Course Outcomes

After the completion of this course, students will be able to:

Head of Department

CO1	Solve algebraic, transcendental equation and linear system of equations using an appropriate numerical method arising in various engineering problems
CO2	Evaluate derivative at a value using an appropriate numerical method in various research problems, solve differential equation numerically
CO3	Learn basic probability axioms, rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
CO4	Find the point and interval estimates, analyse data statistically and interpretation of the results

SYLLABUS

Module I:
Errors and their computation: absolute, relative and percentage. Solution of algebraic & transcendental equations: Bisection method, False position method, Secant method, Newton's Raphson method, Iterative method, Error analysis and convergence study.

(8L)

Module II:
Interpolation with equal & unequal intervals: Introduction, finite differences-forward, backward & central difference tables, Newton's formula for interpolation, Gauss's central difference interpolation formula, divided difference and their properties- Newton's divided differences formula, Lagrange's interpolation formula, Inverse interpolation. Numerical solution of linear system of equations: Direct Method-Gauss elimination, Gauss-Jordan, LU decomposition methods. Iterative Methods-Gauss-Jacobi and Gauss Seidel methods.

(8L)

Module III:
Numerical differential & integration: Introduction, derivatives using forward and backward difference formula, Numerical Integration-Trapezoidal rule, Simpson's 1/3 & 3/8 rules, Weddle's rule. Numerical solution of ordinary differential equations: Taylor Series method, Euler's method, Modified Euler's method, Runge-Kutta methods of 2nd and 4th order.

(8L)

Module IV:
Concepts of Probability:Experiment and Sample Space, Events and Operations with Events, Probability of an Event, Basic Probability Rules, Applications of Probability Rules, Conditional Probability, random variable:continuous and discrete**,** Mean, Variance and Standard Deviation of a Random Variable. Binomial Experiments:Structure of a Binomial Experiment, Binomial Probability Distribution, Use of Binomial Probability Table. Properties of a Normal Curve, Normal Probability Distribution, Areas Under a Normal Curve. Approximating a Binomial Probability, The Normal Theorem and the Central Limit Theorem.

(8L)

Module V:
Estimation of Population Parameters:Parameter and Statistic, Point and Interval Estimation, Interval Estimation of Three Common Parameters. Hypothesis Testing for a Single Population:Concept of a Hypothesis, Tests Involving a Population Mean,
Tests Involving a Population Proportion, Tests Involving a Population

Head of Department

Standard Deviation. Concepts of a Bivariate Data Set, Correlation Coefficient, The Regression line.

(8L)

Books recommended:

TEXT BOOK

1. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI, Private Ltd., New Delhi.**(T1)**
2. N.Pal& S. Sarkar, "Statistics: Concepts and Applications", PHI, New Delhi, 2005.**(T2)**

REFERENCE BOOK

1. R.V.Hogg et.al, "Probability and Statistical Inpane", 7th Edition, Pearson Education, New Delhi, 2006. **(R1)**
2. R.L.Burden&J.D.Faires, "Numerical Analysis", Thomson Learning-Brooks/Cole, Indian Reprint, 2005. **(R2)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4
Continuous Internal Assessment	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

Head of Department

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	2	1	2	1	1	2
CO2	3	2	2	2	2	2	1	1
CO3	3	3	1	2	1	1	1	1
CO4	2	2	1	2	1	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: MT123
Course title: BUSINESS COMMUNICATION
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 2 T: 0 P: 2
Class schedule per week: 03
Class: MCA
Semester / Level: I/1
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives
This course enables the students to:

Head of Department

1.	Analyze and demonstrate writing and speaking processes through invention, organization, drafting, revision, editing, and presentation.
2.	Understand the importance of specifying audience and purpose and to select appropriate communication choices.
3.	Interpret and appropriately apply modes of expression, i.e., descriptive, expositive, Narrative, scientific, and self-expressive, in written, visual, and oral communication
4.	Participate effectively in groups with emphasis on listening, critical and reflective thinking, and responding.
5.	Develop the ability to research and write a documented paper and/or to give an oral presentation.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Apply business communication strategies and principles to prepare effective communication for domestic and international business situations.
CO2	Utilize analytical and problem-solving skills appropriate to business communication.
CO3	Participate in team activities that lead to the development of collaborative work skills.
CO4	Select appropriate organizational formats and channels used in developing and presenting business messages
CO5	Communicate via electronic mail, Internet, and other technologies and deliver an effective oral business presentation.

SYLLABUS

Module I:
Introduction to Business Communication:
Importance and Objectives of Business communication, Process of communication, Barriers to effective communication, Techniques of effective communication. Forms of communication (Written, Oral, audio-visual communication).

(8L)

Module II:
Managing Business Communication:
Formal and Informal communication, Non- verbal communication (Body language, Gestures, Postures, Facial expressions). The cross-cultural dimensions of business communication. Techniques to effective listening, methods and styles of reading.

(8L)

Module III:
Other aspects of communication:
Vocabulary:
Single word substitution, Idioms and phrases, Precis writing, Comprehension.

Head of Department

Group Discussions, Extempore, Principles of effective speech and presentations, Role-playing. **(8L)**

Module IV:
Introduction to managerial writing:
Business letters: Inquiries, Circulars, Quotations, Orders, Acknowledgement, Claims & adjustments, Collection letters, Sales letters, Drafting of different resumes, Covering letters Applying for a job, Social correspondence, Invitation to speak.
Official Correspondence: Memorandum, Notice, Agenda, Minutes, Circular letters. **(8L)**

Module V:
Report writing and Technical Proposals:
Business reports, Types, Characteristics, Importance, Elements of structure, Process of writing, Order of writing, the final draft, checklists for reports.
Technical proposals, Definitions, types and format. **(8L)**

Books recommended:

TEXT BOOK
1. "Communication Skills", Sanjay Kumar &PushpLata, Oxford University Press. **(T1)**
2. "Business Correspondence and Report Writing", R.C.Sharma, Krishna Mohan, McGraw Hill. **(T2)**
3. "Communication for Business", Shirley Taylor, V. Chandra, Pearson. **(T3)**

REFERENCE BOOK
1. "Business Communication", HorySankar Mukherjee, Oxford University Press. **(R1)**
2. "Basic Business Communication", Lesikar I Flatley, McGraw Hill. **(R2)**
3. "Business Communication Today", Bovee, Thill and Chaterjee, Pearson. **(R3)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution

Head of Department

3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	2	1	2	2	1	2
CO2	3	1	2	1	1	2	1	1
CO3	3	3	1	2	1	1	1	1
CO4	2	2	1	2	1	1	2	1
CO5	2	1	1	3	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1,CD2,CD3
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD3
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini projects/Projects	CO4	CD1,CD2,CD3,CO4 CD5
CD5	Laboratory experiments/teaching aids		
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

Head of Department

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COURSE INFORMATION SHEET

Course code: MT114
Course title: FUNDAMENTALS OF MANAGEMENT & ORGANIZATION BEHAVIOUR
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/1
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To understand the concept of management principles and practices, as a discipline, as an art or a science, management and administration, managerial skills, roles of a manager and levels of management .
2.	To compare and contrast various development of management thought such as early classical approaches, administrative management, neo-classical approaches, behavioural approaches, modern approaches, business ethics and social responsibility.
3.	To classify the type of plans and to critically examine different types of planning and select the types of decisions for further growth of the organization.
4.	To create an organizational structure-formal and informal organization to point out span of control, authority, responsibility, accountability, delegation of authority, Departmentation, decentralization and can design a plan for manpower planning, job design, recruitment and selection, training and development and performance appraisal.

Head of Department

5.	To develop the core of leadership, directing function, motivational theories, communication process and different types of control system to facilitate change for the development of the organization.

Course Outcomes

After the completion of this course, students will be able to:

CO1	To Debate management principles and practices as an art or a science, classify managerial skills and roles being played by a manager and recommend appropriate organisational structure.
CO2	To identify factors affecting Decision-making and Planning activity at all levels in an organization.
CO3	To Explain the key decisions related to the various Staffing functions in an organisation.
CO4	To analyse leadership styles, Communication and Motivation strategies adopted by managers and comment on their appropriateness. vis a vis nature of the organisation.

SYLLABUS

Module I:

Introduction: Concepts, Function or Process, Management Discipline, as an Arts or Science, Understanding Management and Administration, Managerial Skills, Roles of a Manager, Levels of Management.

Development of Management Thought: Classical Approaches- Scientific Management, Administrative Management: Bureaucracy, Behavioural Approach.

(8L)

Module II:

Planning: Nature and significance of Planning, Types of plans, Process of Planning, **Organizing:** Process of Organizing, Forms of Organizational Structure, Formal and informal organization

(8L)

Module III:

Staffing: Concept, Manpower Planning, Process of Manpower planning, Recruitment & Selection, Training & Development, Performance Appraisal.

Motivating: Significance of Motivation**,** Motivation process, Theories of Motivation and their application

(8L)

Module IV:

Leading: Concept of Leadership, Leadership Style, Theories of Leadership

Communication: Process, Importance of Communication, Communication Channels, Barriers to Communication.

(8L)

Module V:

Controlling: Definition, Importance of controlling, Characteristics of control, Control process, Types of Control System, Introduction to CSR and Sustainable Development.

(8L)

Head of Department

Books recommended:

TEXT BOOK

1. "Management", Stoner and Freeman, Prentice Hall of India. **(T1)**
2. "Essentials of Management", Koontz and Heinz Weihrich, McGraw Hill. **(T2)**
3. "Management", Robbins &Coulter, Prentice Hall of India. **(T3)**

REFERENCE BOOK

1. "Principles of Management", Gilbert, Mc Graw Hill. **(R1)**
2. "Principles and Practices", T. N. Chhabra, Dhanpat Rai and Sons Pvt. Ltd. **(R2)**
3. "Management: A Global and Entrepreneurial Perspective", Weihrich Heinz &Koontz Harold, Mc Graw Hill. **(R3)**
4. "Principles of Management", P.C.Tripathi and P.N.Reddy, Mc Graw Hill. **(R4)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4
Continuous Internal Assessment	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	2	1	2	2	1	2
CO2	3	1	2	1	1	2	1	1
CO3	3	3	1	2	1	1	1	1
CO4	2	2	1	2	1	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1
CD2	Tutorials/Assignments	CO2	CD1 and CD2
CD3	Seminars	CO3	CD1 and CD2
CD4	Mini projects/Projects	CO4	CD 1,CD2
CD5	Laboratory experiments/teaching aids		
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		

COURSE INFORMATION SHEET

Course code: CA401
Course title: PROGRAMMING WITH C
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Understand how they can solve real life problems using computers.
2.	Analyze real life problems for finding solutions to them.
3.	Design mechanisms for developing the solution in computer understandable form.
4.	Implement the solution with C programming language
5.	Able to implement the algorithms designed by them using C-programming language

Course Outcomes

After the completion of this course, students will be able to:

CO1	Develop basic understanding of computers, the concept of algorithm and algorithmic thinking.
CO2	Develop efficient algorithms for solving a problem. .
CO3	Use the basic C language for solving engineering or other real-life problems.

Head of Department

CO4	Design an algorithmic solution for a given problem.
CO5	Implement the algorithms designed by them using C-programming language and shall be capable of explaining the various concepts like decision making, looping, branching, arrays, functions, recursion, structures, pointers, unions and files of C language .

SYLLABUS

Module I: Problem

Solving and Programming Concepts: Problem Solving in Everyday Life, Types of Problem, Problem Solving with Computers- Algorithms & Flow-Charts,Data Storage and Communication with Computer, Organizing the Problem, Computer Software and Software Development Method.

(8L)

Module II:

Overview of C: C Language Elements, Variable Declaration, Data Types, Expressions, Data Files.

Top-Down Design with Functions: Top-Down Design and Structure Charts, Functions without Arguments, Functions with Input Arguments.

Selection Structures: Problem Solving with Decisions, Control Structures, Conditions, All kinds of if statements, Switch statement.

Repetition and Loop Statements: Problem Solving with Loops, Repetition in Programs, while Statement, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement and Flag Controlled Loops.

(8L)

Module III:

Modular Programming: Functions with Simple Output Parameters, Multiple Calls to a Function with Input/Output Parameters, Scope of Names, Formal Output Parameters as Actual Arguments.

Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Using Array Elements as Function Arguments, Array Arguments, Multidimensional Arrays.

(8L)

Module IV:

Strings: String Basics, String Comparison, Arrays and Pointers, Arrays of Pointers, Character Operations, String-to-Number and Number-to-String Conversions.

Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters, Problem Solving with Recursion.

(8L)

Module V:

Structure and Union Types: User-Defined Structure types, Structure Type Data as Input and Output Parameters, Functions Whose Result Values are Structured, Problem Solving with Structure Types, Union types.

File Processing and Programming in the Large: Input and Output Files, Binary Files, Using Abstraction to Manage Complexity, Header Files, Implementation Files, Storage Classes, Macros, Command Line Arguments.

(8L)

Head of Department

Books recommended:

TEXT BOOK

1. Sprankle M., "Problem Solving and Programming Concepts", 7th Edition, Pearson Education, New Delhi, 2006.**(T1)**
2. Hanly J.R.,&Koffman E.B., "Problem Solving and Program Design in C", 4thEdition, Pearson Education, New Delhi, 2004.**(T2)**

REFERENCE BOOK

1. Venugopal K R, Prasad S R "Mastering C", Tata McGraw Hill, New Delhi,2007.**(R1)**
2. Balagurusamy E. "Programs in ANSI C", 3rd Edition, TMH, New Delhi-2004.**(R2)**
3. Frozen B.A. &Gilberg R.F. "Computer Science: A structured Programming Approach Using C", 2nd Edition, Brooks/Cole- Thomson Learning, Indian Reprint, 2003. **(R3)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars

Head of Department

CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	2	2	1
CO2	3	3	3	3	1	3	2	2
CO3	3	3	3	3	2	2	2	1
CO4	3	3	3	2	3	2	1	1
CO5	3	1	2	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CA403
Course title: COMPUTER ORGANIZATION AND ARCHITECTURE
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Head of Department

Phone : (EPBX) 0651 – 2275444/2275896, 2276002/2276006 FAX : 0651 – 2275401/2275351 Website : www.bitmesra.ac.in

Course Objectives

This course enables the students to:

1.	To provide knowledge of Computer Architecture
2.	Employ knowledge of various Digital Logic Circuits, Data Representation, Register and Processor level Design and Instruction Set architecture
3.	To develop the logical ability to Determine which hardware blocks and control lines are used for specific instructions
4.	Understand memory organization, I/O organization and its impact on computer cost/performance.
5.	Know merits and pitfalls in computer performance measurements.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Describe the merits and pitfalls in computer performance measurements and analyze the impact of instruction set architecture on cost-performance of computer design
CO2	Explain Digital Logic Circuits, Data Representation, Register and Processor level Design and Instruction Set architecture
CO3	Solve problems related to computer arithmetic and Determine which hardware blocks and control lines are used for specific instructions
CO4	Design a pipeline for consistent execution of instructions with minimum hazards
CO5	Explain memory organization, I/O organization and its impact on computer cost/performance.

SYLLABUS

Module I:

INTRODUCTION

Digital Logic Design: Axioms and laws of Boolean algebra, Reduction of Boolean expressions, conversion between canonical forms, Karnaugh map (4 variable), Half Adder, full adder, 4-bit parallel parity bit generator, checker circuit, Decoder, Encoder, Multiplexer, IC RAM, ROM, Memory Organization, Sequential Circuits, State transistors, Flip-flop, RS, JK, D-Latch, Master-slave.

(8L)

Module II:

INSTRUCTION SET ARCHITECTURE

Memory Locations and Addresses: Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Instructions and Instruction

Head of Department

Sequencing, Addressing Modes, Assembly Language, Subroutines, Additional Instructions, dealing with 32-Bit Immediate Values.

(8L)

Module III:
BASIC PROCESSING UNIT & PIPELINING

Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors.

Pipelining: Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Pipeline Performance Evaluation.

(8L)

Module IV:
MEMORY ORGANIZATION

Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage

(8L)

Module V:
INPUT OUTPUT & PARALLEL PROCESSING

Basic Input Output: Accessing I/O Devices, Interrupts, Input Output Organization: Bus Structure, Bus Operation, Arbitration, Interface, Interconnection Standards.

Parallel Processing: Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling.

(8L)

Books recommended:

TEXT BOOK

1. Hamacher Carl, et. al, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill,New Delhi, 2011.**(T1)**
2. Patterson David A., "Computer Organization and Design: The Hardware Software / Interface", 5thEdition, 1994.**(T2)**
3. Mano M. Morris, "Computer System Architecture", Revised 3rdEdition, Pearson Education.**(T3)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment

Head of Department

Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	3	3	2	2	1
CO2	3	3	3	3	1	3	1	1
CO3	3	3	3	3	2	2	2	1
CO4	3	3	3	2	3	2	1	1
CO5	3	1	2	2	1	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CA402
Course title: PROGRAMMING LAB IN C
Pre-requisite(s):
Co- requisite(s): Programming for Problem Solving
Credits: 1.5 L: 0 T: 0 P: 3
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students:

1.	To learn computer language.
2.	To Learn coding for problems.
3.	To learn the problem-solving process through computer.
4.	To know the limitations of system during program execution.
5.	To know the practical application of various programming techniques.

Course Outcomes

Head of Department

After the completion of this course, students will be able:

CO1	To formulate simple algorithms for arithmetic and logical problems.
CO2	To translate the algorithms to programs.
CO3	To test and execute the programs and correct syntax and logical errors.
CO4	To apply programming to solve simple numerical method problems, differentiation of function and simple integration.
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

SYLLABUS

List of Programs as Assignments:

1. Write an interactive program that will read in a +ve integer value and determine the following
   i) If the integer is a prime number ii) If the integer is a Fibonacci number
2. WAP in C to compute sinx = $x - x^3/3! + x^5/3! - x^7/7!$ ….. Continue adding successive terms in the series until the value of the next term becomes smaller (in magnitude) than 10^{-5}. Test the program for x = 1, x = 2, and x = 3. In each case display the number of terms used to obtain the final answer.
3. WAP to generate every 3rd integer beginning with I = 2 and continue for all integers that are less than 150. Calculate the sum of those integers that are evenly divisible by 5.
4. WAP to find whether a given year is a leap year or not. Modify it to generate a list of leap years between two year limits given by user.
5. WAP to display the following pattern:

```
                11
            11  10  11
        11  10  9   10  11
    11  10  9   8   9   10  11
```


Head of Department

6. Using Ternary / Conditional operator find the greatest among 3 numbers.

7. WAP to convert a decimal number into an equivalent number of the input base. Test your program for base 2,8,10 & 16.
8. WAP to read a number n, and print it out digit-by-digit, as a series of words. For e.g. 123 would be printed as "one two three".
9. WAP to check whether any input +ve integer is palindrome or not.
10. WAP to simulate a simple calculator (+ - / * %) that takes two operands and an operator as input and displays the result.
11. WAP to find the GCD of two input +ve integer numbers.
12. WAP to swap the values of two variables without using a third variable.
13. Read a line of mixed text, and then write it out with all lower case and uppercase letters reversed, all digits replaced by 0s and all other characters (non-letters and non-digits) replaced by '*'.
14. WAP to find the product of two matrices A and B. Display the source matrices and product matrix C in matrix format.
15. WAP to find whether a given matrix is a triangular matrix or not.
16. WAP to find the transpose of a matrix. Display the source and the transposed matrix in matrix format.
17. Implement Prob. No. – 14 to 16 using functions for reading, manipulating and displaying the corresponding matrices in matrix form.
18. WAP to sort a list of strings alphabetically using a 2-dim. Character array.
19. WAP to display the row sum and the column – sum of an input 2- dim. Matrix. Display the source matrix with row and column sum.
20. Write a recursive function to calculate S = 2 + 4 + 6 + 8 + …… +2N. Implement the function in a complete C program.
21. Write a function that accepts two arguments an array and its size n. It performs Bubble up sort on the array elements. Using indirection operator '*' implement this in a complete C program. Display the source and the sorted array.
22. Using pointer, write a function that receives a character string and a character as argument. Delete all occurrences of this character in the string. The function should return corrected string with no holes.
23. Write a function for reading character string using pointer. Calculate the length of the string (without using strlen ()). Finally print the string in reverse order, using pointer.
24. Implement prob. No. 14 using pointers representation of 2 – dim. array.
25. Implement prob. No. 15 using pointer representation of 2 dim. array.
26. Implement prob. No. 16 using pointer representation of 2 dim. array.
27. WAP to sort a list of strings into alphabetical order using array of pointers.
28. Create records of 60 students, where each record has fields-name, roll, gpa and fees. Write a function update () to reduce the fees of those students who have obtained gpa greater than 8.5 by 25% of the original fees. Write a complete program to

Head of Department

exercise this function in the main program and display all the records before and after updation.

29. Define a structure that describes a hotel. It should have members that include the name, address, grade, average room charge and number of rooms. Write a function to perform the following operations:
   a) To print out hotels of a given grade in order of charges.
   b) To print out hotels with room charges less than a given value.

30. WAP to concatenate the contents of two files into a third file.

31. WAP to copy the content of one file into another file. Names of both the files are to be input as command line arguments

Books recommended:

TEXT BOOK

1. Jery R Hanly, "Problem solving and Program design in C", Paerson Education, 7th Edition. **(T1)**
2. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill. **(T2)**
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill. **(T3)**
4. R.G.Dromey, How to Solve it by Computer, Pearson Education. **(T4)**

REFERENCE BOOK

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall India Learning Private Limited. **(R1)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30

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Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	2	1	2	1
CO2	3	3	3	3	2	1	2	2
CO3	3	3	3	3	2	1	2	1
CO4	3	3	3	3	1	1	1	1
CO5	3	3	3	3	2	1	1	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

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Phone : (EPBX) 0651 – 2275444/2275896, 2276002/2276006 FAX : 0651 – 2275401/2275351 Website : www.bitmesra.ac.in

Course code: MA429
Course title: NUMERICAL AND STATISTICAL METHODS LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 1.5 L: 0 T: 0 P: 3
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Derive appropriate numerical methods to solve algebraic, transcendental equations and linear system of equations
2.	Approximate a function using various interpolation techniques, to find the numerical solution of initial value problems
3.	Apply concepts in probability theory, the properties of probability distributions
4.	Estimation of mean, variance and proportion, the concepts of statistical hypothesis

Course Outcomes

After the completion of this course, students will be able to:

CO1	Solve algebraic, transcendental equation and linear system of equations using an appropriate numerical method arising in various engineering problems
CO2	Evaluate derivative at a value using an appropriate numerical method in various research problems, solve differential equation numerically
CO3	Learn basic probability axioms, rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
CO4	Find the point and interval estimates, analyse data statistically and interpretation of the results

SYLLABUS

List of Programs as Assignments:

1. Find a simple root of $f(x)=0$ using bisection method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
2. Find a simple root of $f(x)=0$ using Regula-Falsi method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.

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3. Find a simple root of $f(x)=0$ using Newton Raphson method. Read any initial approximation x_0, maximum number of iterations n and error tolerance eps.
4. Solution of a system of $n \times n$ linear equations using Gauss elimination method with partial pivoting.
5. Matrix inversion and solution of $n \times n$ system of equations using Gauss-Jordan method.
6. Program to solve a system of equation using Gauss-Seidel iteration method. Order of the matrix is n, maximum number of iterations *niter*, error tolerance is eps and the initial approximation to the solution vector is x_0.
7. Program for Lagrange and Newton divided difference interpolation.
8. Program for Newton's forward and backward interpolation.
9. Program for Gauss's central difference interpolation (both backward and forward).
10. Program to evaluate the integral of $f(x)$ between the limits a to b using Trapezoidal rule of integration based on n subintervals or $n+1$ nodal points. The values of a,b and n are to be read. The program is tested for $f(x)=1/(1+x)$.
11. Program to evaluate the integral of $f(x)$ between the limits a to b using Simpson's rule of integration based on $2n$ subintervals or $2n+1$ nodal points. The values of a,b and n are to be read and the integrand is written as a function subprogram. The program is tested for $f(x)=1/(1+x)$.
12. Program to solve an IVP, $dy/dx=f(x), y(x_0)=y_0$ using Euler method. The initial value x_0, y_0 the final value x_f and the step size h are to be read. The program is tested for $f(x,y)=-2xy^2$.
13. Program to solve an IVP, $dy/dx=f(x), y(x_0)=y_0$ using the classical Runge-Kutta fourth order method with step size h, $h/2$ and also computes the estimate of the truncation error. Input parameters are: initial point, initial value, number of intervals and the step length h. Solutions with h, $h/2$ and the estimate of the truncation error are available as output. The right hand side The program is tested for $f(x,y)=-2xy^2$.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	1	1
CO2	2	3	3	1	2	2	2	2
CO3	1	1	2	2	3	1	2	1
CO4	3	1	2	1	2	1	1	1
CO5	2	2	1	2	2	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: CA455
Course title: FUNDAMENTALS OF DATA STRUCTURES
Pre-requisite(s): High Level languages like C, C++, Java or Python
Co- requisite(s): Data Structures Lab
Credits:4 L: 3 T: 1 P: 0
Class schedule per week: 4
Class: MCA
Semester / Level: II/4
Branch: MCA

Course Objectives
This course enables the students:

A.	To provide knowledge of practical implementations and usage of Data Structures and Algorithms.
B.	Employ knowledge of various data structures during construction of a program.
C.	To develop the logical ability to store and retrieve data efficiently.
D.	To develop an appreciation of graph theory-based solutions for real life problems.

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E.	Design and construct object-oriented software with an appreciation for data abstraction.

Course Outcomes

After the completion of this course, students are expected to

1.	Identify various data structures and their usages.
2.	Apply data structures in the modelling of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design.
3.	Demonstrate the usage of optimal trees, heaps and priority queues.
4.	Implement sorting algorithms.
5.	Develop programs using algorithms in graph theory.

SYLLABUS

MODULE I

Fundamental Data Structures: Using Arrays, Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Asymptotic Analysis.

(8L)

MODULE II

Stacks, Queues, Dequeues: The Stack, Queue, Dequeue ADTs, Simple Array Based Stack, Queue, Dequeue Implementation, Implementing Stack, Queue with Singly Linked List, Reversing an Array using Stack, Matching Parenthesis and HTML tags, A Circular Queue.**(8L)**

MODULE III

Trees: General Trees, Binary Trees, Implementing Trees, Tree Traversal Algorithms, BinarySearch Trees, AVL Trees, B Trees.

(8L)

MODULE IV

Sorting: Merge sort, Quick sort, Studying sorting through algorithmic lens, Comparing SortingAlgorithms. **(8L)**

Heap: Priority Queues, Array Implementation of Heaps, Construction of Heaps, Heap Sort.

MODULE V

Head of Department

Graphs: Data Structures for graphs, Graph Traversals, Transitive Closure, Directed Acyclic Graphs, Shortest Paths, Minimum Spanning Trees. **(8L)**

Text book:

1. Goodrich Michael T., Tamassia Roberto, Goldwasser Michael H. "Data Structures and Algorithms in Java", Wiley, 6th Edition, 2014.
2. Klein Shmuel Tomi, Basic Concepts in Data Structures, Cambridge University Press, 1st Edition, 2016.

Reference books:

1. YedidyahLangsam, Moshe Augenstein J., Tenenbaum Aaron M. "Data Structures using JAVA", Pearson Education, 2009.
2. Brass Peter "Advanced Data Structures", Cambridge University Press, 1st Edition.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

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1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	1	1
CO2	2	3	3	1	2	2	2	2
CO3	1	1	2	2	3	1	2	1
CO4	3	1	2	1	2	1	1	1
CO5	2	2	1	2	2	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: BT417
Course title: Bioinformatics
Pre-requisite(s): Biological Science,Data Structure
Co- requisite(s): None

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Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: MCA.
Semester / Level: II/4
Branch: MCA

Course Objectives
After the completion of this course, students will be:

A.	Developing computer skills to solve computational problems in biology
B.	Using the biological databases to retrieve various biological information
C.	Applying the tools to do biological analysis
D.	Identifying and solving various biological challenges
E.	Able to predict the secondary and tertiary structures of protein sequences.

Course Outcomes
After the completion of this course, students will be:

1.	Describe the contents and properties of the most important bioinformatics databases.
2.	Analyze and discuss the results of sequence-based searches in light of molecular biological knowledge.
3.	Explain the principle for, and execute pairwise sequence alignment by dynamic programming.
4.	Illustrate the major steps in pairwise and multiple sequence alignment.
5.	Perform text- and sequence-based searches.

SYLLABUS

Module 1:
Major Information Resources & Databases in Bioinformatics: Information Resources: NCBI, EBI, ExPasy, Entrez, Derived (Secondary) Databases of Sequences, Different

Head of Department

Bio-sequence File Formats.
(8L)

Module 2:
Sequence Analysis: Homology, Gap Penalty, Scoring matrices (PAM, BLOSUM), Dot matrix method, Dynamic programming using Needleman-Wunschalgorithm,Scoring methods of MSA (Sum of Pair), BLAST and FASTA.**(8L)**

Module 3:
Phylogenetic Analysis: Molecular Phylogenetics: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based).**(8L)**

Module 4:
Molecular Modeling and Molecular Docking: Structure alignment: superimposition and RMSD calculations, DALI, Classification of 3-D structures of proteins,SCOP, CATH, Structure Prediction of Protein Structure (Chou-Fasman), Homology modelling. **(8L)**

Module 5:
Applications of Bioinformatics: Cheminformatics, Bigdata analysis, Microarray - Data analysis, Theory and Algorithms, motif analysis and presentation.**(8L)**

Textbook

1. **Bioinformatics: Sequence and Genome Analysis,** David W Mount, Cold Spring Harbor Laboratory Press, New York (September 2004)
2. ***Guidebook on Molecular Modeling In Drug Design (Illustrated),*** J. G. Vinter, Mark Gardner (Editor), J. G. Vinter (Editor), CRC Press (May 1994) ISBN: 0849377722
3. **Binformatics: a practical guide to the analysis of genes and proteins,** Baxevanis A., Ouellette F.B.F., John Wiley and Sons, New York.

Reference books:
1. Fundamental Concepts of Bioinformatics, Dan E Krane, Michael L Raymer, Benjamin-Cummings Pub Co (Sept 2002, ISBN 0805346333)

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)

Head of Department

Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	1	2	2	1	1	1
CO2	3	2	3	2	2	3	1	1
CO3	3	2	1	1	2	2	1	1
CO4	3	2	1	3	3	1	2	2
CO5	2	1	2	2	1	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

Head of Department

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO5	CD2,CD3,CD5

COURSE INFORMATION SHEET

Course code: CA457
Course title: OPERATING SYSTEM
Pre-requisite(s): Data Structure, Computer System Architecture, Basic Course on Computer Programming
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: II/4
Branch: MCA

Course Objectives
This course enables the students to:

1.	Present the main components of OS and their working
2.	Introduce the concepts of process and thread and their scheduling policies
3.	Introduce the various memory management techniques.
4.	Analyze the different techniques for managing memory, I/O, disk and files.
5.	Introduce the security and protection features of an Operating System.

Course Outcomes
After the completion of the course student will be able to:

1.	Describe the main components of OS and their working
2.	Explain the concepts of process and thread and their scheduling policies

Head of Department

3.	Explain the various memory management techniques.
4.	Compare the different techniques for managing memory, I/O, disk and files.
5.	Explains the security and protection features of an Operating System.

SYLLABUS

MODULE: I

Overview of Operating Systems: OS and the Computer System, Efficiency, System Performance and User Convenience, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems, Distributed Operating Systems, Modern Operating Systems.**(8L)**

MODULE: II

Processes and Threads: Processes and Programs, Programmer view of Processes, OS view of Processes, Threads, Case studies of Processes and Threads.**(8L)**

Scheduling: Preliminaries, Non-preemptive Scheduling Policies, Preemptive Scheduling Policies, Scheduling in Practice, Real Time Scheduling, Scheduling in Unix, Scheduling in Linux, Scheduling in Windows, Performance Analysis of Scheduling Policies.

MODULE: III

Memory Management: Managing the Memory Hierarchy, Static and Dynamic Memory Allocation, Memory Allocation to a Process, Reuse of Memory, Contiguous Memory Allocation, Noncontiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Kernel Memory Allocation, A Review of Relocation, Linking and Program Forms.**(8L)**

Virtual Memory: Virtual Memory Basics, Demand Paging, Page Replacement Policies, Memory Allocation to a Process, Shared Pages, Memory Mapped Files, Unix Virtual Memory, Linux Virtual Memory, Virtual Memory using Segmentation.**(8L)**

MODULE: IV

File Systems: File System and IOCS, Files and File Operations, Fundamental File Organizations, Directory Structures, File Protection, Interface between File System and IOCS, Allocation of Disk Space, Implementing File Access, File Sharing Semantics, File System Reliability, Virtual File System, Unix File System, Linux File System, Windows File System, Performance of File Systems.**(8L)**

MODULE: V

Head of Department

Security and Protection: Overview of Security and Protection, Goals of Security and Protection, Security Attacks, Formal and Practical aspects of Security, Encryption, Authentication and Password Security, Access Descriptors and the Access Control Matrix, Protection Structures, Capabilities, Unix Security, Linux Security, Windows Security.**(8L)**

Text Book:

1. Dhamdhere D.M., "Operating Systems: A Concept-Based Approach", 2nd Edition, TMH, New Delhi, 2006.

Reference Books:

1. SilberschatzA.,Galvin Peter B.,Greg Gagne, "Operating System Concepts", 6th Edition, John Wiley, Indian Reprint, 2003.
2. Crowley C., "Operating Systems: A Design-Oriented Approach", TMH, New Delhi, 2002.
3. Deitel H.M., "Operating Systems", 2nd Edition, Pearson Education, 2003.
4. Tanenbaum A.S., "Operating System: Design and Implementation", PHI, New Delhi, 2002.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	1	1
CO2	2	3	3	1	2	2	2	2
CO3	1	1	2	2	3	1	2	1
CO4	3	1	2	1	2	1	1	1
CO5	2	2	1	2	2	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Head of Department

Course code: CA459
Course title: OBJECT ORIENTED DESIGN AND PROGRAMMING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 3
Class: MCA
Semester / Level:II/4
Branch: MCA

Course Objectives
This course enables the students:

A.	The course shall allow students to understand the basic tenets of OOP.
B.	The course will exemplify the basic syntax and constructs of C++.
C.	The course will help students understand the application OOP principles in various use cases.
D.	The course will explain basic C++ characteristics and their working.
E.	The course aims to expose students to newer C++ constructs like NIO, Lambdas etc.

Course Outcomes
After the completion of this course, students will be:

1.	Identify the difference between procedural and OO programming.
2.	Construct programs using various OOP principles.
3.	Design programs using C++
4.	Operate on files and strings in real life scenarios.
5.	Analyze thread performance and inter thread communication issues

SYLLABUS

MODULE: I

Computing and the Object-Oriented Design Methodology: Basic Computing Terminology, Software, Engineering Software, Object-Oriented Design.
C++ -The Fundamentals: Program Organization, A First Program, A Second Program, Comments, Assigning a Value, Fundamental C++ Objects, Constants, Names, Definitions, Expressions, Output Statements, Computing Average Velocity.**(8L)**

MODULE: II

Modifying Objects: Assignment, Const Definitions, Input Statements, Computing the Number of Molecules in a Hydrocarbon, Compound Assignment, Increment and Decrement, Estimating Yearly Savings of Change, The String Class, EzWindows, Moving Lawns.**(8L)**

Control Constructs: Boolean Algebra, A Boolean Type, Conditional Execution Using the if Statement, Conditional Execution Using the switch

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Statement, Computing a Requested Expression, Validating a Date, Iteration Using the while Statement, Simple String and Character Processing, Iteration Using the for Statement, Simple Data Visualization, Solving the Lazy Hobo Riddle, Iteration Using the do Construct.**(8L)**

MODULE: III

Functions Usage Basics and Libraries: Function Basics, The Preprocessor, Using Software Libraries, The iostream Library, The iomanip Library, The fstream Library, The math Library, Library ctype, The assert macros.

Programmer-Defined Functions: Basics, A Tasty Problem, Some Useful Functions, Integrating a Quadratic Polynomial, The Logic Scope, Displaying a Price-Interval Chart, Recursive Functions.

Advanced Parameter Passing: Reference Parameters, Passing Objects by Reference, Validating Telephone Access Codes, Constant Parameters, Default Parameters, Casting of Function Parameters, Function Overloading, Random Numbers, A Factory Automation Trainer. **(8L)**

MODULE: IV

The Class Construct and Object-Oriented Design: Introducing a Parameter-Defined Data Type, The Rectangle Shape Class, Using the Rectangle Shape Class, Constructors, Building a Kaleidoscope, Object-Oriented Analysis and Design.

Pointers and Dynamic Memory: Lvalues and Rvalues, Pointer Basics, Constant Pointers and Pointers to Constants, Arrays and Pointers, Character String Processing, Program Command-line Parameters, Pointers to Functions, Dynamic Objects, A Simple ADT for Representing Lists of Integer Values.**(8L)**

MODULE: V

Inheritance: Object-Oriented Design Using Inheritance, Reuse via Inheritance, A Hierarchy of Shapes, Protected Members and Inheritance, Controlling Inheritance, Multiple Inheritance, A Prettier Kaleidoscope.

Templates and Polymorphism: Generic actions and Types, Function Templates, Class Templates, A Simple List Class Using a Class Template, Sequential Lists, Polymorphism, Virtual Function Nuances, Abstract Base Classes, Virtual Multiple Inheritance.**(8L)**

Text Book:

1. Cohoon J.P. & Davidson J.W., "C++ Program Design: An Introduction to Programming and
Object-Oriented Design", 2nd Edition, TMH Education, New Delhi, 2000.

Head of Department

Reference Book:

1. Friedman F.L. &Koffman E.B., "Problem Solving, Abstraction, and Design Using C++", 4th Edition, Pearson Education, Inc. 2004.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures

Head of Department

CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	1	3	2	1
CO2	3	2	3	3	1	3	1	2
CO3	1	3	3	3	2	2	2	1
CO4	2	1	2	2	3	2	1	1
CO5	1	1	2	2	1	1	1	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CA461
Course title: DATABASE MANAGEMENT SYSTEM
Pre-requisite(s):
Co-requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 4
Class: MCA
Semester / Level:II/4
Branch: MCA

Course Objectives
This course enables the students:

Head of Department

A.	To observe that how the real world data is stored, retrieved, and communicate under the DBMS environment
B.	To design a logical model which having the unique relation between the Data.
C.	To apply the query for the modification of the system.
D.	To develop a conceptual design which allows as to avoid anomalies in superior's data.
E.	To discuss a system which allows to restrict the uncontrolled exaction and provide rigorous variation of the task.

Course Outcomes

After the completion of this course, students will be able to:

1.	Describe various data models and schemas used in database management systems.
2.	Explain the fundamental concepts, data definitions and query processing tasks in relational querylanguages.
3.	Recognize database design theory, and evaluate functional dependencies and normal forms indatabases.
4.	Formulate the operations of transaction and concurrent query processing tasks to obtain the correctresults even under strict time constraints.
5.	Interpret the foundational concepts of distributed databases. Illustrate several techniques related totransaction management and query processing in distributed database management systems.

SYLLABUS

MODULE - I

Introduction and Conceptual Modelling: Purpose of Database Systems, Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database languages, Database Architecture, Classification of DBMS, relational database, Database users and Administrators, Advantages of DBMS. Entities and Entity Sets, Relationships and Relationship Sets, Keys, Mapping, Constraints, ER Diagram, Reducing ER Diagram to tables, Generalization and Specialization, Aggregation.**(8L)**

MODULE - II

Relational Model: Concepts, Constraints, Languages, Design and Programming: Relational database Schemas, Relational Algebra, Relational Calculus (Tuple Relational calculus and Domain Relational calculus), Update operations, Transactions, Dealing with constraint violations. Binary Relational operation: JOIN and DIVISION,
SQL, More complex SQL Queries, Security & Integrity violations,

Head of Department

authorization and views, integrity constants, encryption, Statistical databases **(8L)**

MODULE - III

Database Design Theory and Methodology: Pitfalls in relational database design, Functional Dependencies, Decomposition Using Functional Dependencies. Normalization using functional Dependencies, General Definition of First, Second, Third and Forth Normal Form. Boyce-Codd Normal Form(BCNF), Multivalued and join dependencies, DKNF, Atomic values, Data-base Design Process. Modeling Temporal Data, Alternative approaches to database design. **(8L)**

MODULE - IV

Transaction Processing Concepts and Concurrency Control Techniques: Transaction Processing, Desirable Properties of Transactions, Transaction State, Characterizing Schedules based on Recoverability and Serializability. Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Deadlock Handling, Recovery and Atomicity, Log-Based Recovery.**(8L)**

MODULE - V

Distributed Databases and Client-Server Architectures: Concepts and Types of Distributed databases, data fragmentation, Replication and Allocation Techniques for Distributed Database Design, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, An Overview of 3-Tier Client-Server Architecture.**(8L)**

Text Book:

1. ElmasriRamez, &Navathe S.B., "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2006.

Reference Book:

1. Silberschatz A., &Korth H., "Database Systems Concepts", 5th Edition, McGraw Hill Higher Education, 2005.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10

Head of Department

Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	2	1
CO2	3	3	1	2	1	3	1	2
CO3	2	2	3	3	2	2	2	1
CO4	3	1	2	2	3	2	1	1
CO5	1	2	2	2	1	1	1	2

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Head of Department

Course code: MT117

Course title: Basics of Financial Accounting and Management

Pre-requisite(s): NIL

Co- requisite(s): NIL

Credits: 3 L:3 T:0 P:0

Class schedule per week: 3

Semester/Level: II/4

Branch:MCA

Name of Teacher:

Course Objectives

This course enables the students:

A.	To impart knowledge about the scope of financial management and accounting with understanding the concept of financial functions and decision making.
B.	To give knowledge about the various sources of finance
C.	To impart knowledge on capital budgeting decision making with a basic concept of different techniques to appraise business projects
D.	To impart knowledge of working capital management and its policies.
E.	To give knowledge on management of cost and various techniques of cost management.

Course Outcomes

After the completion of this course, students will be able to:

1.	Apply the concepts of financial management as well as accounting and analyse the statements with the help of Ratio Analysis.
2.	Identify and implement long and short term sources of finance through capital market and money market.
3.	Applydiverse appraisal techniques including Non-Discounting and Discounting factors like, Pay Back, ARR, NPV, IRR, Profitability Index etc
4.	Analyse and implement various techniques of working capital management and its policy implications.

Head of Department

5.	Explain conceptual framework on management of cost and various techniques of cost management.

SYLLABUS

Module I

Introduction to Financial Management, Accounting Concept Concept, Finance Functions, Role of Finance Manager, Decision Making. Principles and conventions, Double Entry System, Accounting Statements, Analysis of Financial Statement: Ratio Analysis.**(8L)**

Module II

Sources of Finance: -Short term &Long term, Stock Market: Primary Market & Secondary Market, Shares: Equity Shares & Preference Shares, Debenture: Definition & Types, Venture Capital, Mutual Fund, Bank Loan: Working Capital Loan & Term Loan.**(8L)**

Module III

Capital Budgeting: -Definition, Concept, Objective, Methods of appraisal; Payback Period, ARR, NPV, IRR, Benefit Cost Ratio.**(8L)**

Module IV

Working Capital Management: -Working Capital:Definition, Gross Working Capital, Net Working Capital, Importance, influencing factors, Working Capital Cycle, Working CapitalPolicies, Working Capital Financing Policies.**(8L)**

Module 5

Cost Management- Cost:Definition, Concept, Classification, Cost Centre: Concept and Types, Cost Sheet. Marginal Costing: Definition, Importance, CVP Analysis: Break Even Analysis, Margin of Safety, Angle of incidence, Graphical Representation, Limitations. **(8L)**

Text/Reference Books:-

1. Financial Management by I.M. Pandey. Vikas Publication.
2. An Introduction to Financial Accounting by S.N. Maheshwari, Vikas Publication.
3. Cost & Management Accounting by M.N.Arora, Vikas Publication
4. Financial Management: Theory & Practices by Chandra Prasanna, TMH Publication

Gaps in the syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design
POs met through Topics beyond syllabus/Advanced topics/Design

Head of Department

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
End Sem Examination Marks	50
Mid Sem Examination Marks	25
Quiz (s)	20
Independent Teaching Assessment	5

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD4

Head of Department

CD3	Seminars	CO3	CD1
CD4	Mini projects/Projects	CO4	CD1, CD2, CD5, CD8
CD5	Laboratory experiments/teaching aids	CO5	CD1, CD2, CD3, CD4, CD6, CD8
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

COURSE INFORMATION SHEET

Course code: CA456
Course title: DATA STRUCTURES LAB
Pre-requisite(s): High Level languages like C, C++, Java or Python
Co- requisite(s): Data Structures Lab
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level: II/4
Branch: MCA

Course Objectives
This course enables the students:

A.	To assess how the choice of data structures and algorithm design methods impact the performance of programs.
B.	To choose the appropriate data structure and algorithm design method for a specified application.

Head of Department

C.	To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.
D.	Analyse and compare the different algorithms

Course Outcomes

After the completion of this course, students will be able to:

1.	Choose an appropriate data structure given a computational problem
2.	Design and analyze the time and space efficiency of various data structures
3.	Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and quick sort
4.	Have practical knowledge on the applications of data structures
5.	Justify the choice of data structure for a given problem

SYLLABUS

1. Program to Find the Number of Elements in an Array
2. Develop and Implement a menu driven program in C for the following Array operations
    a. Creating Array of N Integer elements.
    b. Display of Array elements with suitable headings.
    c. Inserting an element (ELEM) at a given valid position (POS).
    d. Deleting an element at a given valid position (POS).
    e. Exit
3. Programs for Stack, Queues and Circular Queues using Arrays
4. Program to convert an Infix Expression into Postfix and Postfix Evaluation
5. Program to implement stack using arrays
6. Program to implement stack using linked list
7. Program to implement multiple stack in a single array
8. Program to convert infix notation to postfix notation using stacks
9. Program to implement queue using arrays
10. Program to implement queue using pointers
11. Program to reverse elements in a queue
12. Program to implement circular queue using arrays
13. Program to create add remove & display element from single linked list
14. Program to create add remove & display element from double linked list
15. Program to count number of nodes in linear linked list
16. Program to create add remove & display element from circular linked list
17. Programs to implement stack & queues using linked representation
18. Program to concatenate two linear linked lists
19. Program to accept a singly linked list of integers & sort the list in ascending order.
20. Program to reverse linked list
21. Program to represent polynomial using linked list
22. Program to add two polynomials using linked list
23. Program for the creation of binary tree, provide insertion & deletion in c
24. Program for pre-order, post-order & in-order traversals of a binary tree using non reccursive.

Head of Department

25. Program to count no, of leaves of binary tree
26. Program for implementation of B-tree (insertion & deletion)
27. Program for implementation of multi-way tree in c
28. Program for implementation of AVL tree
29. Program to implement bubble sort program using arrays
30. Program to implement merge sort using arrays
31. Program to implement selection sort program using arrays
32. Program to implement insertion sort program using arrays
33. Program to implement topological sort using arrays
34. Program to implement heap sort using arrays
35. Program to implement heap sort using pointers
36. Program to implement bubble sort program using pointers
37. Program to implement linear search using pointers
38. Program to implement binary search using pointers
39. Program to implement linear search using arrays
40. Program to implement binary search using arrays

Text books:

1. Baluja G S, "Data Structure through C", Ganpat Rai Publication, New Delhi, 2015.
2. Pai G A V, "Data Structures and Algorithms: Concepts, Techniques and Applications", 2nd Edn, Tata McGraw-Hill, 2008.
3. Horowitz E., Sahni S., Susan A., "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2010.

Reference books:

4. Tremblay J. P., Sorenson P. G, "An Introduction to Data Structures with Applications", 2nd Edn, McGraw-Hill, Inc. New York, NY, USA.
5. Lipschutz Seymour, "Data Structures", 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
6. Drozdek Adam, "Data Structures and Algorithms in C++", Thomson Learning, New Delhi – 2007.
7. Feller J., Fitzgerald B., "Understanding Open Source Software Development", Pearson Education Ltd. New Delhi

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60

Head of Department

Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	2	1	2	1
CO2	3	3	3	3	2	1	2	2
CO3	3	3	3	3	2	1	2	1
CO4	3	3	3	3	1	1	1	1
CO5	3	3	3	3	2	1	1	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7

Head of Department

CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CA458
Course title: OPERATING SYSTEM LAB
Pre-requisite(s): Data Structure, Computer System Architecture, Basic Course on Computer Programming
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level:II/4
Branch: MCA

Course Objectives
This course enables the students to:

1.	Present the main components of OS and their working
2.	Introduce the concepts of process and thread and their scheduling policies
3.	Introduce various memory management techniques.
4.	Analyze the different techniques for managing memory, I/O, disk and files.
5.	Introduce the security and protection features of an Operating System.

Course Outcomes
After the completion of the course student will be able to:

1.	Describe the main components of OS and their working
2.	Explain the concepts of process and thread and their scheduling policies
3.	Explain the various memory management techniques.
4.	Compare the different techniques for managing memory, I/O, disk and files.
5.	Explains the security and protection features of an Operating System.

Head of Department

1. Implement in C the following UNIX commands using System calls : cat and mv
2. WAP in C to Determine the size of a file using the lseek command.
3. WAP to calculate the number of blocks assigned for the file.
4. Write a C program that deletes a directory with all its subfolders. The name of the directory should be read from the command line.

5. Write a program that deletes every 5th byte from a file, but without using a temporary file or allocating a buffer in the memory.
6. WAP in C to implement FCFS CPU scheduling Algorithm.
7. WAP in C to implement SJF CPU scheduling Algorithm.
8. WAP in C to implement Priority CPU scheduling Algorithm.
9. WAP in C to implement Round Robin (RR) CPU scheduling Algorithm.
10. WAP in c to read from the buffer & produce desired output.
11. WAP ii C to create Userid& Password.
12. WAP in c to implement and find how many Users currently login in NetWork.
13. WAP in c to create your won system call just like a copy.
14. WAP in c to create your won system call just like a delete.
15. WAP in c to find the Disk Space.
16. WAP In C to find The number of pages in the process.
17. WAP In C to find The number of frames allocated to the process.
18. WAP in c to find the no. of blocks occupied by a file.
19. WAP in c to create your won system call just like a delete.
20. WAP in c to create your won system call just like a ls.
21. WAP in c to find a PID no. of any Process.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution

Head of Department

Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	2	1
CO2	3	3	1	2	1	3	1	2
CO3	2	2	3	3	2	2	2	1
CO4	3	1	2	2	3	2	1	1
CO5	1	2	2	2	1	1	1	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Head of Department

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A Deemed University u/s 3 of UGC Act, 1956
MESRA, RANCHI – 835 215 (INDIA)

Phone : (EPBX) 0651 – 2275444/2275896, 2276002/2276006 FAX : 0651 – 2275401/2275351 Website : www.bitmesra.ac.in

COURSE INFORMATION SHEET

Course code: CA460
Course title: C++ PROGRAMMING LAB
Pre-requisite(s):
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level:II/4
Branch: MCA

Course Objectives

This course enables the students to:

1.	Introduce the concepts ofobject-oriented programming and features of object-oriented programming languages.
2.	To learn advanced features of the C++ programming language as a continuation of the previous course.
3.	To learn the characteristics of an object-oriented programming language: data abstraction and information hiding, inheritance, and dynamic binding of the messages to the methods
4.	To learn the basic principles of object-oriented design and software engineering in terms of software reuse and managing complexity.
5.	To enhance problem solving and programming skills in C++ with extensive programming projects

Course Outcomes

After the completion of this course, students will be able to:

CO1	Explain basic concepts of object-oriented programming.
CO2	Use the characteristics of an object-oriented programming language in a program.
CO3	Use the basic object-oriented design principles in computer problem solving
CO4	Develop their own Applications /Projects using C++
CO5	Simulate the problem in the subjects like Operating system, Computer networks and real world problems.

Head of Department

SYLLABUS

List of Programs as Assignments:

Objective: To Understand and Implement basic OOP features

1.Write a Program to design a class having static member function named showcount() which has the property of displaying the number of objects created of the class.

2. Write a Program which creates & uses array of object of a class.(for eg. implementing the list of Managers of a Company having details such as Name, Age, etc..).

Objective: To Understand and Implement special types of functions like friend function

3. Write a Program to swap private data members of classes named as class_1, class_2 using friend function.

4.Write an inline function to find largest of three number

Objective: To Understand and Implement the concept of constructors

5. Write a Program using copy constructor to copy data of an object to another object.

6. Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imag parts to equal values and third which takes two argument is used to initialized real and imag to two different values.

Objective: To Understand and Implement the concept of Polymorphism

7. Write a program for overloading operator++ and operator—using friend functions

8. Write a program for developing a matrix class which can handle integer matrices of different dimensions. Also overload the operator for addition, multiplication & comparison of matrices.

9.Writea C++ program to compute area of right angle triangle, equilateral triangle, isosceles triangle using function overloading concept.

Objective: To Understand and Implement the concept of Inheritance

10.Write a Program to design a student class representing student roll no. and a test class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sports and test class should be inherited by a result class having the functionality to add the scores and display the final result for a student.

11.Write a Program illustrating how the constructors are implemented and the order in which they are called when the classes are inherited. Use three classes named alpha, beta, gamma such that alpha, beta are base class and gamma is derived class inheriting alpha & beta.

Objective: To Understand and Implement exception handling

Head of Department

12. Write a program to raise an exception if any attempt is made to refer to an element whose index is beyond the array size.

Objective: To Understand and Implement File Operations

13.Write a program to read the class object of student info such as name , age ,sex ,height and weight from the keyboard and to store them on a specified file using read() and write() functions. Again the same file is opened for reading and displaying the contents of the file on the screen.

14.Write a program to perform the deletion of white spaces such as horizontal tab, vertical tab, space ,linefeed ,new line and carriage return from a text file and store the contents of the file without the white spaces on another file.

Books recommended:

TEXT BOOKS

1. J.P.Cohoon&J.W.Davidson- C++ Program Design: An Introduction to Programming and Object-Oriented Design, 2nd Edn, TMH Edn, New Delhi-2000.

REFERENCE BOOKS

1. F.L.Friedman&E.B.Koffman- Problem Solving, Abstraction, and Design Using C++, 4th Edn, Pearson Education, Inc. 2004.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Head of Department

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	3	3	2	1	1	1
CO2	3	3	3	2	1	2	2	2
CO3	2	3	3	1	1	2	1	1
CO4	2	3	2	3	3	1	2	1
CO5	2	3	2	3	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA412
Course title: RDBMS LAB
Pre-requisite(s):
Co-requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester/Level: II/4
Branch: MCA

Course Objectives

This course enables the students:

A.	To observe that how the real world data is stored, retrieved, and communicate under the DBMS environment
B.	To design a logical model which having the unique relation between the Data.
C.	To apply the query for the modification of the system.
D.	To develop a conceptual design which allows as to avoid anomalies in superior's data.
E.	To discuss a system which allows to restrict the uncontrolled exaction and provide rigorous variation of the task.

Course Outcomes

After the completion of this course, students will be able to:

1.	Describe various data models and schemas used in database management systems.
2.	Explain the fundamental concepts, data definitions and query processing tasks in relational querylanguages.
3.	Recognize database design theory, and evaluate functional dependencies and normal forms indatabases.
4.	Formulate the operations of transaction and concurrent query processing tasks to obtain the correctresults even under strict time constraints.
5.	Interpret the foundational concepts of distributed databases. Illustrate several techniques related totransaction management and query processing in distributed database management systems.

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Consider the following tables:

emp(empno,ename,job,mgr,hiredate,sal,comm,deptno,gr),

dept(deptno,dname,loc)

Write the following queries:

1. List all information about all department from emp table.
2. List all employee names along with their salaries from emp table.
3. List all department numbers, employee numbers and their managers numbers in descending order of deptno from emp table.
4. List department names and locations from the dept table.
5. List the employees belonging to the department 20.
6. List the name and salary of the employees whose salary is more than 1000.
7. List the names of the clerks working in the department 20.
8. List the names of analysts and salesmen.
9. List the details of the employees who have joined before the end of September 81.
10. List the names of employees who are not managers.
11. List the names of employees whose employee number are 7369, 7521, 7839, 7934, 7788.
12. List the employee details not belonging to the department 10, 30, and 40.
13. List the employee name and salary, whose salary is between 1000 and 2000.
14. List the employee names, who are not eligible for commission.(salary having >15,000 eligible for commission)
15. List the employees who are eligible for commission.
16. List the details of employees, whose salary is greater than 2000 and commission is NULL.
17. List the employees whose names start with an “S” (not”s”).
18. List the name, salary and PF amount of all the employees(PF is calculated as 10% of salary).
19. List the empno, ename, sal in ascending order of salary.
20. List the employee name, salary, job and Department no descending order of Department No and salary.
21. List the employee details in ascending order of salary.
22. List the employee details in descending order of salary
23. Display name, and sal and commission of all employees whose monthly salary is greater than their commission.
24. Select SMITH HAS WORKED IN THE POSITION OF CLERK IN DEPT 20.Display result in this format.
25. Generate a statement which prompts the user at runtime. The intention is to display employees hired between 2 given dates.
26. Define a variable representing an expression used to calculate total annual remuneration. Use the variable in a statement which finds all employees who earn $30000 a year or more.
27. List all the employees name and salaries increased by 15% and expressed as a whole number of dollars.

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28. Produce the following

EMPLOYEE AND	**JOB**
SMITH	CLERK
ALLEN	SALESMAN

29. Produce the following output:

SMITH (Clerk)

ALLEN (Salesman)

30. Do a case sensitive search for a list of employees with a job that the user enters.
31. It has been discovered that the sales people in dept. 30 are not all male. Please produce thefollowingoutput.

ENAME	**DEPTNO**	**JOB**
ALLEN	30	Sales Person

32. Display each employees name and hiredate of dept 20.
33. Display each employees name, hiredate and salary review date. Assume salary review date

is one year fromhiredate. Output should be in ascending review date.

34. Print list of employees displaying just salary, if more than 1500. If exactly 1500 display " On Target". If less than 1500 display " Below 1500".
35. Write a query which returns DAY of the week (i.e. MONDAY) for any date entered in the

format DD/MM/YY.

36. Write a query to calculate length of service of each employee.
37. Find the minimum salary of all employees.
38. Find the maximum, minimum, and average salaries of all employees.
39. List the maximum and minimum salary of each job type.
40. Find how many managers are in each dept.
41. Find the average salary and average total remuneration of each job type. Remembers sales man earn commission.
42. Find out the difference between highest and lowest salary.
43. Find all department s which have more than three employees.
44. Check whether all employee nos are unique. (No Duplicate)
45. List lowest paid employee working for each Manager. Exclude any groups where the minimum salary is less than 1000. Sort the output by salary.
46. Produce a list showing employees 'salary grade'.(> 10000 A, >10000 &<20000 B, >20000 C)

Head of Department

47. Show only employee on Grade C.
48. .Show all employee in Dallas.
49. List the employees name, job, salary, grade and department for everyone in the company except clerks. Sort on salary, displaying the highest first.
50. List the following details of employees who earn $36000 a year or who are clerks.

Ename Job Annual Sal Dept no Dname Grade

51. Display all employees who earn less than their managers.
52. Display all employees by name and eno along with their managers name and number.
53. Modify above spoliation to display KING who has no MANAGER.
54. Find the job that was files in the first half of 1983 and the name job that was filled in the same period in 1984.
55. Find all employees who have joined before their manager.

EMPLOYEE HIREDATE MANAGER HIREDATE

56. Find the employees who earn the highest salary in each job, type, sort in descending order

of salary.

57. Find the employees who earn the minimum salary for their job, Display the result in descending order of salary

58. Find the most recently hired employees in the department. Order by hiredate.
59. Show the details of any employee who earns a salary greater than the average for their department. Sort in department number order.
60. List all department where there are no employees.

Text book:

1. SQL, PL/SQL the programming Language of Oracle, Ivan Bayross, 4th edition

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

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Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	1	3	2	2	1
CO2	3	3	1	2	1	1	1	2
CO3	2	2	3	1	2	3	3	1
CO4	1	1	1	2	3	2	1	1
CO5	3	2	1	2	1	1	1	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: CA501
Course title: JAVA PROGRAMMING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 3
Class: MCA
Semester / Level: III/5
Branch: MCA

Course Objectives:
This course enables the students:

A.	Help students realize the advanced features in JAVA.
B.	Establish the relationship between the core and advanced JAVA frameworks.
C.	Understand problems where Advanced JAVA is required.
D.	Evaluate the advantages and short comings of advanced JAVA
E.	Understand how frameworks and APIs are designed.

Course Outcomes:
After the completion of this course, students will be able to:

1.	Learn the architecture of advanced swing components and design GUIs using them.
2.	Learn to interface with external data sources with Java.
3.	Leverage Java to create and deploy network programs.
4.	Use Java to design enterprise level Web sites.
5.	Understand Java's component based programming model.

SYLLABUS

MODULE: I

Fundamentals of Java Programming: Data in Java Programs, Arithmetic Operators and Expressions, Simple Program Input and Output.**(8L)**

Making Decisions with Java: Comparing Numbers in Java, Comparing Strings in Java, Logical (Boolean) Operators and Order of Precedence, Selection Structures in Java.

MODULE: II
Repeating Program Statements: The **while** Statement, The**for** Statement, The **do…while** Statement, Nested Loops, **break**, and **continue**.
Methods and Classes: Predefined Java Methods, Programmer-Defined Methods.
Arrays: The One-Dimensional Array, Multidimensional Arrays, Other Array Topics.**(8L)**

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MODULE: III
Characters, Strings, and Formatting: Working with Characters, Working with Strings, Formatting Data for Output.

Exceptions and Assertions: Exception Handling, Assertions**(8L)**

MODULE: IV
File Input and Output: Inputting Data from a Text File, Outputting Data to a Text file, Performing Input and Output with Binary Files.**(8L)**

MODULE: V
Graphical User Interfaces: Creating User Interfaces, Overview of a Java GUI, Developing a Java GUI, Adding Functionality to a GUI, Improving GUI Layout.**(8L)**

Text Book:
1. Johnson Richard A., "An Introduction to Java Programming and Object-Oriented Application Development", 1st Edition, Thomson Learning, New Delhi, 2007.

Reference Books:
1. Dietel&Dietel, "Java How to Program", 5th Edition, Pearson Education, New Delhi, 2006.
2. Balagurusamy E. "JAVA Programming", 3rd Edition, TMH, New Delhi, 2005.
3. Sleek James M. Sleek "Programming and Problem Solving with JAVA", Thomson Learning, Indian Edition, 2007.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10

Head of Department

Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
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CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	2	1
CO2	3	3	1	2	1	3	1	2
CO3	2	2	3	3	2	2	2	1
CO4	3	1	2	2	3	2	1	1
CO5	1	2	2	2	1	1	1	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: CA503
Course title: COMPUTER ALGORITHM DESIGN
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P: 0
Class schedule per week: 04
Class: MCA
Semester / Level: III/5
Branch: MCA

Course Objectives
After the completion of this course, students will be:

1.	Understand different notions of asymptotic complexity
2.	Find about and infer the practical implications of asymptotic notations
3.	know and use basic and advanced graph algorithms
4.	Analyse the difference between the dynamic programming concept and a greedy approach
5.	Implement, analyze, and compare algorithm

Course Outcomes
After the completion of this course, students will be able to:

1.	Identify the different notions of asymptotic complexity and determine the asymptotic complexity of algorithms including the solving of recurrence relations
2.	Able to determine the practical implications of asymptotic notations.
3.	Describe and use basic and advanced graph algorithms including DFS, BFS, and Bellman Ford
4.	Analyse the difference between the dynamic programming concept and a greedy approach
5.	Implement, analyze, and compare various algorithms

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SYLLABUS

MODULE: I

Elementary Algorithmic: Introduction, Problems and instances, The efficiency of algorithms, Average and worst-case analyses, What is an elementary operation, why look for efficiency.
Asymptotic Notation: Introduction, A notation for "the order of", Other asymptotic notation, Conditional asymptotic notation, Conditional asymptotic notation, Asymptotic notation with several parameters, Operations on asymptotic notation. **(8L)**

MODULE: II

Analysis of Algorithm: Introduction, Analyzing control structures, Using a barometer, Supplementary examples, Average-case analysis, Amortized analysis, Solving recurrences.

Greedy Algorithms: General characteristics of greedy algorithms, Graphs: Minimum spanning trees, Shortest paths, The knapsack problem, scheduling. **(8L)**

MODULE: III

Divide-and-conquer: Introduction: Multiplying large integers, The general template, Binary search, Sorting, Finding the median, Matrix Multiplication, Exponentiation. **(8L)**

MODULE: IV

Dynamic Programming: Calculation the binomial coefficient, The World Series, Making change, The principle of optimality, The knapsack problem, Shortest paths, Chained matrix multiplication. **(8L)**

MODULE: V

Exploring Graphs: Graphs and games: An introduction, Traversing trees, Depth-first search: Undirected graphs, Depth-first search: directed graphs, Breadth-first search, Backtracking, Branch-and-bound, the minimax principle.

Probabilistic Algorithms: Introduction, Probabilistic does not imply uncertain, Expected versus average time, Pseudorandom generation, Numerical probabilistic algorithms, Monte Carlo algorithms, Las Vegas algorithms.
(8L)

Text Book:

1. Brassard G. & Bratley P., "Fundamentals of Algorithms", New Delhi, 2005.

Reference Books:

1. E.Horowitz. et.al., "Fundamentals of Computer Algorithms", Galgotia Publication Pvt. Ltd.,New Delhi, 2004.
2. Kleinberg J. &Tardos E., "Algorithm Design", Pearson Education, New Delhi, 2006.
3. Cormen T.H., Leiserson Charles E.,Rivest Ronald, Stein Clifford "Introduction to Algorithms" 3rd Edition, PHI, New Delhi, 2005.
4. Dasgupta S., Papadimitriou C.H., Vaziran U.V, " Algorithm" 3rd Edition , TMH, New Delhi, 2007.
5. Sahani S., "Data Structures Algorithms and Applications in C++" 2nd Edition, Universities Press (India) Pvt. Ltd., 2005.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	3	3	3	2	2	1
CO2	3	3	3	2	1	3	1	2
CO3	2	2	3	3	3	3	2	1
CO4	1	3	1	1	3	2	1	1
CO5	3	2	2	2	1	1	1	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: CA504
Course title: AUTOMATA THEORY
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P: 0
Class schedule per week: 04
Class: MCA
Semester / Level: III/5
Branch: MCA

Course Objectives
This course enables the students to:

A.	Define a system and recognize the behavior of a system.
B.	Design finite state machines and the equivalent regular expressions.
C.	Construct pushdown automata and the equivalent context free grammars
D.	Design Turing machines and Post machines
E.	Learn about the issues in finite representations for languages and machines, as well as gain a more formal understanding of algorithms and procedures.

Course Outcomes
After the completion of this course, students will be able to:

1.	Relate formal languages and mathematical models of computation
2.	Attain knowledge about different types of languages and the corresponding machines
3.	Learn about the pushdown machine and its role in compiler construction
4.	Understand the capability of real computers and learn examples of unsolvable problems.
5.	Analyse classes of P, NP, NP-C and NP-Hard problems

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SYLLABUS

MODULE: I

Basic Mathematical Objects and Mathematical Induction: Sets, logic, Functions, Relations, Alphabets, Strings, Languages, Principle of mathematical induction, Recursive definition. **(8L)**

MODULE: II

Regular Expressions and Finite Automata: Regular languages and Regular Expressions, Memory required to recognize a language, Finite Automata, capability & limitations of FSM, Deterministic Finite Automata , Non-Deterministic Finite Automata, NFA with e-moves, regular sets & regular expressions, Equivalence of DFA and NDFA, NFA from regular expressions, regular expressions from DFA, Moore versus Mealy m/c, two way finite automata equivalence with one way , Kleen's Theorem, applications of finite automata. **(8L)**

MODULE: III

Regular and Non-regular languages: Criterion for Regularity, Minimal Finite Automata, Pumping Lemma for Regular Languages, Decision problems, Regular Languages and Computers.

Context Free Grammars: Introduction, definition, Regular Grammar, Derivation trees, Ambiguity, Simplified forms and Normal Forms, Applications.**(8L)**

MODULE: IV

Pushdown Automata: Definition, Moves, Instantaneous Descriptions, Language recognised by PDA, Deterministic PDA, Acceptance by final state & empty stack, Equivalence of PDA , Pumping lemma for CFL, Interaction and Complements of CFL,Decision algorithms.

Turing Machines: Definition and examples, Computing Partial Functions with Turing Machine(TM), Combining TMs, Variations of TMs, Multi-tape TMs, Non-deterministic TM, Universal TM, Church Thesis. **(8L)**

MODULE: V

Recursively Enumerable Languages: Recursively Enumerable and Recursive, Enumerating Language, Context Sensitive and Chomosky Hierarchy.

Unsolvable Problems and Computable Functions: Nonrecursive Language and unsolvable Problems, Halting Problem, Rice Theorem, Post Correspondence Problem.

Computational Complexity: Discussion on P, NP, NPC and NP-Hard Problems. **(8L)**

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Text Books:

1. Martin John "Introduction to Languages and the Theory of Computation", 3rd Edition, TMH.

Reference Books:

1. Mishra K.L.P &Chandrasekharan N., "Theory of Computer Science", PHI.
2. Hopcroft John E. And Ullman Jeffrey D., "Introduction to Automata Theory, Languages & Computation", 3rd Edition, Narosa, 2008.
3. Lewis H. R. and Papadimitrou C. H, "Elements of the theory of Computation", PHI.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	2	1	1	2
CO2	3	3	3	2	1	2	2	2
CO3	3	3	3	1	1	2	1	1
CO4	3	2	1	3	3	1	2	1
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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA505
Course title: SOFTWARE ENGINEERING
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P: 0
Class schedule per week: 04
Class: MCA
Semester / Level: III/5
Branch: MCA

Course Objectives

This course enables the students to:

1.	Students are effective team members, aware of cultural diversity, who conduct themselves ethically and professionally
2.	Students use effective communication skills and technical skills to assure production of quality software, on time and within budget.
3.	Students build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks.
4.	Able to increase level of self-reliance, technical expertise, and leadership.

Course Outcomes

After the completion of this course, students will be:

1.	Explain the software engineering principles and techniques
2.	Apply Software Project Management Practices
3.	Apply the knowledge gained for their project work as well as to develop software following software engineering standards
4.	Analyze various methods of software testing strategies
5.	Develop self-reliance, technical expertise, and leadership.

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SYLLABUS

MODULE: I

Introduction to Software Engineering: Evolving Role of Software, Changing Nature of Software, Legacy Software, Process Frame work, Process Patterns, Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Unified Process Model, Agile Process Model. **(8L)**

MODULE: II

Requirement Engineering: A bridge to design and construction, Requirement Engineering Task, Initiating the Requirement Engineering Process, Eliciting Requirements, Developing Use case, Building the Analysis Model, Negotiating Requirements, Validating Requirements.**(8L)**

MODULE: III

Design Engineering: Design Process and Design Quality, Design Concepts, Design Models, Pattern Based Software Design. **(8L)**

MODULE: IV

Testing Strategies and Testing Tactics: Strategic Approach to software Testing, Test Strategies for conventional and Object Oriented Software, Validation Testing System Testing, White Box Testing, Basic Path Testing Control Structure Testing, Black Box Testing, Object Oriented Testing Methods.

(8L)

MODULE: V

Metric for process and Estimation Techniques: Process metrics, Software Measurement, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Estimation for Object Oriented Projects Specialized Estimation Techniques.

Software Quality and Configuration Management: Quality Concepts, Software Quality Assurance, Software Reliability, Software Configuration Management, SCM Repository, SCM Process. **(8L)**

Text Book:

1. Pressman Roger S., "Software Engineering – A Practitioner's Approach", 6th Edition., Tata McGraw Hill.

Reference Books:

1. Vliet Haus Van, "Software Engineering – Principles and Practice", Wiley John and Sons, 2nd Edition.
2. Sommerville Ian, "Software Engineering", 7th Edition., Pearson Education.

Head of Department

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	2	1	1	1
CO2	2	1	3	3	2	2	2	1
CO3	2	3	1	1	2	2	3	2
CO4	3	2	1	3	3	1	2	1
CO5	2	2	3	1	3	3	1	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO5	CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: MT121
Course title: Corporate Social Responsibility
Pre-requisite(s):NIL
Co- requisite(s): NIL
Credits: 2 L:2 T:0 P:0
Class schedule per week: 2
Semester / Level: III/1
Name of Teacher:

Course Objectives

A.	Introduce the concept of Corporate Social Responsibility and Sustainability in business context
B.	Understand the challenges faced by the organization while implementing CSR
C.	Understand who are all of the stakeholders, and how they are affected by the actions of corporations.
D.	Explain the drivers of CSR .

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain the core concepts of CSR and sustainability.
2.	Analyze the complex issues confronting organizational leaders as they develop their CSR program
3.	To formulate strategies to satisfy stakeholders.
4.	Faced with a management problem, suggesting solutions that are ethical and socially responsible and that respect the principles of good governance.

Head of Department

Syllabus

Module I

Introduction to CSR:Meaning& Definition of CSR, History& evolution of CSR. Corporate Citizenship,. Concept of sustainability & Stakeholder, Management.CSR through triple bottom line and Sustainable Business; environmental aspect of CSR; ; theories of CSR , Carroll's model. **(8L)**

Module II

SUSTAINABLE DEVELOPMENT Sustainable development goals, United Nations (UN) Global Compact 2011.UN guiding principles on business and human rights.

(8L)

Module III

CSR-Legislation In India & the world. Section 135 of Companies Act 2013.**(8L)**

Module IV

The Drivers of CSR in India, Relation between CSR and Corporate governance; Identifying key stakeholders of CSR & their roles. (Stakeholders: Organization, Government, Society and Regulatory Environments) **(8L)**

UNIT V

Review current trends and opportunities in CSR.CSR as a Strategic Business tool for Sustainable development. Review of successful corporate initiatives & challenges of CSR.**(8L)**

Reference Books:

1. Corporate Social Responsibility : Kotler and Lee
2. Theory and practices of CSR : **Idowu**, Samuel O., **Louche**, Celine
3. CSR in India : Sanjay Aggarwal

Gaps in the syllabus (to meet Industry/Profession requirements) :
POs met through Gaps in the Syllabus -
Topics beyond syllabus/Advanced topics/Design :
POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

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Course Outcome (CO) Attainment Assessment tools & Evaluation procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
End Sem Examination Marks	50
Mid Sem Examination Marks	25
Quiz (s)	20
Independent Teaching Assessment	5

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	2	1	2	2	1	2
CO2	3	1	2	1	1	2	1	1
CO3	3	3	1	2	1	1	1	1
CO4	2	2	1	2	1	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1, CD5,CD8
CD2	Tutorials/Assignments		CO2	CD1,CD2,CD4,CD5
CD3	Seminars		CO3	CD1 ,CD2,CD4,CD5
CD4	Mini projects/Projects		CO4	CD1, CD4,CD8
CD5	Laboratory experiments/teaching aids/Case Studies			CD1,CD4,CD5,CD8,CD2
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

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COURSE INFORMATION SHEET

Course code: CA530
Course title: DISTRIBUTED DATABASES
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: III/5
Branch: MCA

Course Objectives
This course enables the students:

A.	To understand the structure of databases distributed over the network.
B.	To learn Query processing and decomposition.
C.	To understand how to create a distributed database using fragmentation.
D.	To learn transaction processing in a distributed environment.
E.	To understand how concurrency control is performed in a distributed environment.

Course Outcomes
After the completion of this course, students will be able to:

1.	Explain detailed architecture of distributed database.
2.	Design a distributed database for any environment using horizontal and vertical fragmentation.
3.	Describe transaction execution, rules and protocols used in concurrent access in a distributed environment.
4.	Perform Query Processing and its decomposition a distributed database.
5.	Design a reliable database.

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SYLLABUS

Module I

Introduction: Distributed Data Processing, What is a Distributed Database System? Promises of DDBSs, Problem Areas. **(8L)**

Module II

Distributed DBMS Architecture: DBMS Standardization, Architectural Models for Distributed DBMSs, Distributed DBMS Architecture.

Distributed Database Design: Alternative Design Strategies, Distribution Design Issues, Fragmentation, Allocation. **(8L)**

Module III

Overview of Query Processing: Query Processing Problem, Objectives of Query Processing, Complexity of Relational Algebra Operations, Layers of Query Processing.

Query Decomposition and Optimization: Query Decomposition, Query Optimization, Centralized Query Optimization, Distributed Query Optimization Algorithms.**(8L)**

Module IV

Transaction Management and Concurrency Control: Definition of a Transaction, properties of Transactions, Serializability Theory, Taxonomy of Concurrency Control Mechanisms, Locking-based Concurrency Control Algorithms, Timestamp-based Concurrency Control Algorithms, Deadlock Management. **(8L)**

Module V

Distributed DBMS Reliability: Reliability Concepts and Measures, Failures and Fault Tolerance in Distributed Systems, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols. **(8L)**

Text Books:

1. M. Tamer Ozsu, Patrick Valduriez, "Distributed Database Systems", 2nd Edition, Pearson, 2011.

Reference Books:

1. ElmasriNavathe, "Fundamental of Database Systems", 5th Edition, Pearson Education, 2008.
2. Thomas Connolly, Carolyn Begg, "Database Systems – A Practical Approach to Design, implementation and Management", 4th Edition, Pearson Education, 2008.
3. Silberschatz, Korth, Sudarshan, "Database System Concepts", 4th Edition, McGraw Hill, 2002.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	2	1	2	1	1	1
CO2	1	3	3	3	2	3	2	1
CO3	2	3	1	1	2	2	3	1
CO4	3	1	3	2	3	1	2	1
CO5	3	1	3	3	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA531
Course title: DECISION SUPPORT SYSTEMS
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level:III/5
Branch: MCA

Course Objectives
This course enables the students:

A.	To understand the basic components of DSS
B.	To learn different phases and models for Decision making
C.	To understand how to create a distributed database using fragmentation.
D.	To learn transaction processing in a distributed environment.
E.	To understand how concurrency control is performed in a distributed environment.

Course Outcomes
After the completion of this course, students will be able to:

1.	Discuss the basic components of DSS
2.	Classify the different phases and models for Decision making
3.	Design a DSS according to the requirements.
4.	Model and develop different levels in DSS using Software engineering principles
5.	Analyse the system with pros and cons.

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SYLLABUS

MODULE – I

Decision Making Process: An Over view, Introduction, Managerial decision making and Information System, Need for computerized decision support and the supporting technologies, Framework of DSS, Group Support System, Executive information system, Knowledge management Systems. **(8L)**

MODULE – II

Decision Making, System, Models: Decision Making – Introduction and Definition, System, Models, previews of modeling process, Decision making – The intelligence phase, the design phase and the choice phase.
Evaluation – Multiple Goals, sensitivity analysis, What – if and goal seeking.
Decision Making - The implementation phase, Alternative decision making models.
(8L)

MODULE – III

DSS – Configurations, Definitions, Characteristics & Capabilities, Components, The Data management Subsystem, Model Management Subsystem, Knowledge – based management, Subsystem, User interface Subsystem, DSS Classification, DSS H/W, Difference between Management Science and MIS.

Modeling & Analysis - Modeling for MSS, Static & Dynamic Models, Treating Certainty, Uncertainty and Risk, Interface diags, MSS modeling in spreadsheets, Decision analysis (Decision tables and Decision trees), Optimization via mathematied programming, Meusistic Programming, Multidimensional Modeling – OLAP.
(8L)

MODULE – IV

DSS Development – Introduction, The Traditional System Development life cycle, Alternate Development Methodologies, Prototyping, DSS Technology Levels and Tools, DSS Development Platforms, DSS Development Tool Selection, Team Developed DSS, End – User Developed DSS, DSS System Integration.
(8L)

MODULE – V

Collaboration Communication, Enterprise DSS Group Decision Making – Communication & Collaboration, Communication Support, Collaboration Support – Computer Supported Co-operative work, Group Support System, GSS Technologies. **(8L)**

Head of Department

Text Book:

1. Turloan E. & Aronson E. "Decision Support System & Intelligent System", 6th Edition, Pearson Education.

Reference Book:

1. Marakas G.M. "Decision Support Systems", 2nd Edition, Pearson /Prentice Hall of India.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	3	2	3	3	1	2
CO2	3	2	2	2	2	2	2	1
CO3	1	3	3	3	2	2	3	2
CO4	3	2	1	1	3	1	2	1
CO5	3	3	3	2	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA532
Course title: Data Mining and Warehousing
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: III/5

Head of Department

Branch: MCA

Course Objectives

This course enables the students:

A.	Examine the types of the data to be mined and apply pre-processing methods on raw data.
B.	To introduce the basic concepts of Data Warehouse and Data Mining techniques
C.	Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data
D.	Prepare students for research in the area of data mining and related applications and Enhance students communication and problem solving skills
E.	Provide the students with practice on applying data mining solutions using common data mining software tool /programming languages.

Course Outcomes

After the completion of this course, students will be able to:

1.	Describe the fundamentals of data mining systems as well as issues related to access and retrieval of data at scale.
2.	Explain the various data mining functionalities and data warehousing techniques.
3.	Apply the various data mining techniques to solve classification, clustering and association rule mining problems.
4.	Analyze and choose among different approaches of a data mining task.
5.	Design and evaluate data mining models to be used in solving real life problems, keeping in view social impacts of data mining.

SYLLABUS

MODULE – I

Data Mining: Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction.**(8L)**

MODULE – II

Data Warehouse: Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization**(8L)**

MODULE – III

Mining Association Rules in Large Databases: Association Rule Mining, Single – Dimensional Boolean Association Rules, Multilevel Association Rules from Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis.

(8L)

Head of Department

MODULE – IV

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule Analysis, Other Classification Methods, Prediction, Classification Accuracy. **(8L)**

MODULE – V

Cluster Analysis: Introduction, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Method - k- Medoids Algorithm, CLARANS, Hierarchical Methods - BIRCH, ROCK Density-Based Methods - DBSCAN, Outlier Analysis. **(8L)**

Text books:

1. Jiawei Han & Micheline Kamber "Data Mining Concepts & Techniques", Publisher Harcourt India. Private Limited, 2nd Edition.

Reference books:

1. Gupta G.K. "Introduction to Data Mining with case Studies", PHI, New Delhi, 2006.
2. Berson A. & Smith S.J. "Data Warehousing Data Mining", COLAP, TMH, New Delhi, 2004.
3. Dunham H.M. & Sridhar S. "Data Mining", Pearson Education, New Delhi, 2006.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	2	3	2	1
CO2	2	3	3	3	2	2	2	1
CO3	3	3	1	1	2	2	3	2
CO4	3	2	2	3	3	1	2	1
CO4	3	3	2	3	3	2	2	1
CO5	3	2	2	1	2	2	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA533
Course title: MULTIMEDIA DATABASES
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: III/5
Branch: MCA

Course Objectives
This course enables the students to:

A.	Understand issues related to use of digital media
B.	Know techniques Multimedia database Searching for real-time requirements
C.	Know Multimedia Browsing, Video Browsing
D.	Obtain an understanding for Spatial and Temporal Relations of Semantic Objects
E.	Understand Object Composition Petri Net Model, Interval Based Conceptual Models.

Course Outcomes
After the completion of this course, students will be able to:

1.	Identify multiple issues related to digital media, including audio, image, and video content
2.	Analyses techniques for streaming media
3.	Elaborate Multimedia database Searching techniques
4.	Assess the applications, parameters, and requirements of multimedia databases
5.	Summarize Characteristics of Video Data Modeling , Motion Detection and Tracking Approaches.

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SYLLABUS

MODULE -I

Introduction, Multimedia Information Applications, Issues and Challenges, Semantic Models for Multimedia Information Systems, Multimedia Semantic Models.
(8L)

MODULE -II

Multimedia database Searching, Image Segmentation,Video Parsing and Segmentation Approaches ,Iconic-Based Grouping and Browsing Approaches , Knowledge-Based Event Modeling Approaches , Characteristics of Video Data Modeling , Motion Detection and Tracking Approaches ,Object Recognition Approaches ,Content-Based Retrieval.**(8L)**

MODULE -III

Multimedia Browsing, Video Browsing, Key Frame Selections. **(8L)**

MODULE -IV

Augmented Transition Network Model (ATN), Spatial and Temporal Relations of Semantic Objects, Multimedia Presentations, Multimedia Database Searching, Multimedia Browsing, User Interactions and Loops. **(8L)**

MODULE -V

Object Composition Petri Net Model, Interval Based Conceptual Models.**(8L)**

Text Book:

1. Chen S. C., Kashyap R. L., Ghafoor A. “Semantic Models for Multimedia Database Searching and Browsing”, Kluwer Academic Publishers.

Reference Book:

1. Muneesawang P. “Guan L-Multimedia Database Retrieval A Human-Centered Approach”, Springer Publication, 2006.

Head of Department

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	2	1	1	1
CO2	3	1	3	3	1	2	2	1
CO3	3	3	1	1	2	2	3	2
CO4	3	2	1	3	3	1	2	1
CO5	3	3	2	3	2	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA502
Course title: JAVA PROGRAMMING LAB
Pre-requisite(s):
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level: III/5
Branch: MCA

Course Objectives:
This course enables the students to:

A.	Realize the advanced features in JAVA.
B.	Establish the relationship between the core and advanced JAVA frameworks.
C.	Understand problems where Advanced JAVA is required.
D.	Evaluate the advantages and short comings of advanced JAVA
E.	Understand how frameworks and APIs are designed.

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Course Outcomes:
After the completion of this course, students will be:

1.	Learn the architecture of advanced swing components and design GUIs using them.
2.	Learn to interface with external data sources with Java.
3.	Leverage Java to create and deploy network programs.
4.	Use Java to design enterprise level Web sites.
5.	Understand Java's component based programming model.

1. WAJP to show the characteristic of a number. {E.g. 24 it has two coefficients 2 in tens position and 4 in units position. It is composed of 2 and 3. It is a positive number. Also show whether it is odd or even.
2. WAJP to take input through command line argument and do the following:
    a) Check whether the number is prime.
    b) Generate the reverse a number.
3. Write a menu driven program using switch in Java to perform following:
    a) For input of 1, check whether the number is prime
    b) For input of 3, find the factors of the number
    c) For input of 5, check the number is odd or even.
4. Write a program in Java to generate hexadecimal equivalent of a number without using array.
5. WAJP to take two number inputs through command line argument and do the following:
    a) Check whether two numbers are prime to each other or not.
    b) Find LCM of two numbers.
6. WAJP to create a class and exhibit the role of static functions (other than main) by declaring, defining and calling them.
7. WAJP to compute and display the count of occurrence of 4 in a number. E.g. 4564 will compute 2.
8. WAJP to take an angle value in degrees and then compute the equivalent radians and then prove $\sin^2\theta+\cos^2\theta=1$. Note $180^o=\pi^c$.
9. WAJP to sort a list of numbers in ascending order.
10. WAJP to generate Pascal's Triangle using a square matrix.
11. Write a program in Java to take input of two 3×3 matrices through command line argument and then:
    a) Add them up and display the result
    b) Subtract them and display the result
    c) Multiply them and display product
12. WAJP to count the number of words, characters in a sentence.
13. Write a program in Java to take input of a sentence through command line argument and then count the number of words and vowels.

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14. WAJP to handle the Exception using try and multiple catch block; the exceptions that you will handle are, number format error, array bound error and divide by zero.
15. WAJP to create a class called **Room** with two data member length and width and then implement constructor overloading in it.
16. Write a program in Java to explain the role of the following:
    a) Non-parameterized constructor
    b) Parameterized constructor
    c) Copy constructor

Take input and display the output.

17. WAJP to create a class called **Fraction** with data member numerator and denominator; take input (through command line argument) of two fractions and then add, subtract, multiply and divide, finally display the result in reduced term.
18. Write a program in Java to create a class for **Employee** having 2 data member code and name. Then create 3 classes **Officer**, **AdminStaff** and **MStaff**. The **Officer** class has data members designation and pay-scale; the **AdminStaff** has data members grade and pay-band; the **MStaff**has data member department and two sub-classes **Regular** and **Casual**. The **Regular** staff has data members level and consolidated-pay and **Casual** has data member daily-wage. Take all inputs through constructors and write appropriate methods for displaying one data for each type of class.
19. WAJP to design a class called **Account** using the inheritance and static that show all function of bank (withdrawal, deposit) and generate account number dynamically.
20. WAJP to design an application *Password.java* that produces and prints a random password depending upon name of an individual. If the input is Abdul Kalam then the password would be *33421LAM*. Note: take the first name A=1, B=2, D=4, U=21 where 2+1=3, and L=12, where 1+2=3; so the number comes to be *12433*, so u can find out.
21. WAJP to draw a format like

```
    *
   ***
  *****
 *******
  *****
   ***
    *
```

22. WAJP to take a string count all vowels and then delete the same from the string.
23. Write a **Patient** class which inherits from the **Person** class. Patient can again be of two types, indoor and outdoor. The Patient class requires the following:
    a) a variable to store the patient ID for the patient
    b) a variable to store the department of hospital
    c) a variable to store the ward of hospital

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d) a variable to store the patient 's date of joining the hospital
e) a variable to store the patient 's address
f) a variable to store the medical fees that the patient pays
g) constructor methods, which initialize the variables
h) a method to calculate the medical fees (for both indoor and outdoor patient)

24. WAJP to take a string as password and check whether it contains at least two numbers, 3 alphabets and no space in it. If any contrary throw message.
25. Write a program in Java to create a class called Rational having two data members for numerator and denominator. Take two inputs of rational numbers and perform multiplication and division. Display the result in reduced form.

26. Write a program in Java to print a format like,

```
* * * * * * *
  * * * * *
    * * *
      *
```

27. Write a class called **Shape** which contains a user-defined interface for **Computation**, which contains methods for calculation of area, perimeter and volume. Write four classes for **circle, rectangle, sphere** and **rectangular parallelepiped**, and all these classes inherit from Shape. Now take input for the following:
    a) radius of circle and compute its area and perimeter
    b) Length and breadth of rectangle and compute its area and perimeter
    c) Length, breadth and height for **rectangular parallelepiped** and compute its area and volume
    d) Radius of sphere and compute its area and volume

** Area of circle= πr^2, perimeter of circle= $2\pi r$, area of sphere= $4\pi r^2$, volume of sphere= $\frac{4}{3}\pi r^3$, volume of rectangular parallelepiped = $l \times b \times h$ area of rectangular parallelepiped= $2(l \times b + b \times h + h \times l)$

28. Write a class called Employee, which requires the following:
    a) a variable to store the employee ID
        a. employee ID should be of format EMP**M**1234, EMP**S**1234, EMP**A**1234, EMP**C**1234, where M=manager, S=supervisor, A=analyst, C=clerk; number can be any no. but first three characters should be EMP
    b) a variable to store the employee name
    c) a variable to store department
    d) a variable to store city
    e) a variable to store basic salary
    f) a method to calculate the salary of employee
        a. if the city is metro then the HRA would be 30% else 20%
        b. if the employee ID contain M then DA would be 120%, if S then DA would be 110%, if A then DA would be 100%, and if C then DA would be 90%
    g) constructor methods, which initialize the variables

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29. WAJP to create 4 threads and show exhibit their execution after the call of the "start ( )" method.
30. Write a program in Java to create 3 threads and exhibit their behaviour by changing their priorities in the "main" thread. Display the possible output.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	2	1	1	2
CO2	1	2	3	3	3	2	1	1
CO3	1	3	2	1	2	1	1	2
CO4	3	2	2	3	3	1	2	1
CO5	3	2	3	2	3	1	3	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA506
Course title: SOFTWARE ENGINEERING LAB
Pre-requisite(s):
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level: III/5
Branch: MCA

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Course Objectives

This course enables the students:

A.	To understand the concept of UML
B.	To gain knowledge of various diagrams.
C.	Learn about software requirement specification.
D.	To gain knowledge about software design specification.
E.	To learn about the relationships among different UML diagrams.

Course Outcomes

After the completion of this course, students will be able to:

CO1.	Identify the software requirement capturing process.
CO2.	Elaborate knowledge about dynamic view of system.
CO3.	Analyzeabout static view of software system.
CO4.	Analysis the relationship among static and dynamic view of system.
CO5.	Identify the process of deployment of software system.

SYLLABUS

List of Programs as Assignments:

49. Lab Assignment No: 1

Objective: To Understand and Implement Identification of Requirements from Problem Statements

Q1. To consider the problem statement for a project to be developed and list out the ambiguities, inconsistencies and incompleteness of the problem statement.

Q2. To identify different functionaries to be obtained from a system and characteristics that a system should have, but not possessed by the system itself

50. Lab Assignment No: 2

Objective: To Understand and Implement Estimation ofProject Metrics

Q1. To estimate the minimum size of the team one would require to develop a project through application of intermediate COCOMO.

Q2. To use Halstead's metrics to estimate the effort required to recreate a program in JAVA from C.

51. Lab Assignment No: 3

Objective: To Understand and Implement Modeling UML Use Case Diagrams and Capturing Use Case Scenarios

Q1. To draw a use case diagram for the given case study.

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Q2. To identify the primary and secondary actors for the system and generalization of use cases and «include» stereotypes to prevent redundancy in the coding phase.

52. Lab Assignment No: 4

Objective: To Understand and Implement E-R Modeling from the Problem Statements

Q1. To identify the possible entity sets, their attributes, and relationships for the given case study.

Q2. To draw an ER diagram for the given case study.

53. Lab Assignment No: 5

Objective: To Understand and Implement Identification of Domain Classes from the Problem Statements

Q1. To identify potential classes and their attributes for the given case study.

Q2. To utilize expert knowledge on the subject matter to identify other relevant classes.

54. Lab Assignment No: 6

Objective: To Understand and Implement Identification of Components from the Problem Statements

Q1. To identify potential components for the given case study.

Q2. To draw component diagram for the given case study

55. Lab Assignment No: 7

Objective: To Understand and Implement State Chart and Activity Modeling

Q1. To draw a statechart diagram to graphically represent the given case study.

Q2. To draw an activity diagram to graphically represent the workflow of the given case study.

56. Lab Assignment No: 8

Objective: To Understand and Implement Modeling UML Class Diagrams and Sequence diagrams

Q1. To draw class diagram for the given case study.

Q2. To draw sequence diagram for the given case study.

57. Lab Assignment No: 9

Objective: To Understand and Implement Modeling Data Flow Diagrams

Q1. To draw data flow diagram (Level 0, 1 and 2) for the given case study.

58. Lab Assignment No: 10

Objective: To Understand and Implement Estimation of Test Coverage Metrics and Structural Complexity

Q1. To identify the basic blocks for a given program

Q2. To draw a CFG using the basic blocks

Q3. To determine McCabe's complexity from a CFG.

59. Lab Assignment No: 11

Objective: To Understand and Implement Designing Test Suites

Q1. To design a test suite for the given case study.

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Q2. To verify implementation of functional requirements by writing test cases.

Q3. To analyze results of testing to ascertain the current state of the project.

60. Lab Assignment No: 12

Objective: To Understand and Implement Forward and Reverse Engineering

Q1. To obtain programs from UML diagrams.

Q2. To obtain UML diagrams from programs.

Books recommended:

TEXT BOOKS

9. Software Engineering, Ian Sommerville, Pearson, 10th Edition, 2016.**(T1)**
10. Software Engineering: A Practioner's Approach, Roger S. Pressman, McGraw Hills, 7th Edition, 2009.**(T2)**

REFERENCE BOOKS

5. Fundamentals of Software Engineering, Rajib Mall, Prentice-Hall of India, 3rd Edition, 2009.**(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus: PO2, 5 & 6

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	1	3	1
CO2	3	2	1	1	1	1
CO3	3	3	2	1	3	1
CO4	2	3	2	2	3	2
CO5	2	1	1	3	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3,CD6
CO5	CD1,CD2, CD3, CD6, CD7

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

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Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Head of Department

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A Deemed University u/s 3 of UGC Act, 1956
MESRA, RANCHI – 835 215 (INDIA)

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COURSE INFORMATION SHEET

Course code: CA557
Course title: FRONT END DESIGN
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P: 0
Class schedule per week: 04
Class: MCA
Semester / Level: IV/5
Branch: MCA

Course Objectives

This course enables the students

1.	To impart the basic concepts of User Interface Design.
2.	To develop understanding about human computer interaction methods that utilize more general, widespread and easier-to-learn capabilities.
3.	The cognitive and perceptual constraints that affect interface design
4.	Techniques for evaluating the usability of an interface
5	How to communicate the results of a design process, both in oral and written form

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify the key terms related to user interfaces and user interface design and implementation
2.	Identify and describe various types of computer users and computer use contexts
3.	Identify and describe various types of user interfaces
4.	Explain the user interface design process
5	Identify and describe common abstract user interface components, such as radio buttons and group boxes

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SYLLABUS

Module I

Introduction: Importance of user interface – definition, importance of good design, brief history – Graphical User Interface – Web User Interface – Theories, Principles and Guidelines of User interface design **(8L)**

Module II

Design Process: Obstacles in development path deigning for people-Understanding Human Interaction with computers, Importance of Human Characteristics, Human consideration, Human Interaction speeds – Understanding Business function**(8L)**

Module II

Screen Designing: Design goals - screen meaning and purpose, organizing screen elements ordering of screen data and content – screen navigation and flow – visually pleasing composition – amount of information – focus and emphasis – presenting information simply and meaningfully – information retrieval on web – Statistical graphics – Technological considerations in Interface Design.
(8L)

Module IV

Menus and navigation schemes: structures of menus-functions of menus- contents of menus - formatting of menus – phrasing the menu- selecting menu choices-navigating menus-kinds of graphical menus- Selection of windows-Window characteristics-components of windows-window presentation styles-types of windows-window management-organising window functions-window operations-Selection of device based and screen based controls - text and messages – icons and images – Multimedia – colours- uses, problems, choosing colours. **(8L)**

Module V

Distributed and Collaborative Interaction: Device consistency-distribution of the user interface-event distribution-graphical package layer-programmable API-Model semantics distribution-data layer distribution-asynchronous Collaboration-Software tools-specification methods- interface building tools –evaluation and critiquing tools-Interaction devices keyboard and function keys - pointing devices- speech recognition, digitization and generation – image and video displays – printers.

(8L)

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Text books:

1. Galitz Wilbert O. "The Essential Guide to User Interface Design" 3rdEdition., Wiley Dreamtech, Delhi, 2007.
2. Shneiderman Ben "Designing the User Interface", 5thEdition., Pearson Education Asia, Delhi, 2014.

Reference books:

1. Dan R. Olsen, Human Computer Interaction, Cengage, New Delhi, 2009.
2. John M. Carroll, Human Computer Interaction, Pearson Education Asia, Delhi, 2002.
3. Alan Cooper, The Essentials of User Interface Design, Wiley Dreamtech, Delhi, 2002.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	2	2	1	1
CO2	3	2	3	2	3	2	2	2
CO3	2	3	1	1	1	2	3	2
CO4	3	2	1	3	3	1	2	1
CO5	3	3	3	2	3	2	3	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA559
Course title: DATA COMMUNICATION AND COMPUTER NETWORK
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: MCA
Semester / Level: IV/5
Branch: MCA

Head of Department

Course Objectives

This course enables the students:

A.	To build an understanding of the fundamental concepts of the data communication model and communications architecture.
B.	To study characteristics of communication mediums and the characteristics of signals propagated through different transmission media, including concepts of transmission impairments.
C.	To understand the basic principles of signal encoding techniques, error-detection, and error-correction techniques.
D.	To understand techniques for flow control and multiplexing for maximum utilization of bandwidths in the data communications process.
E.	To understand the various switching techniques and routing techniques for efficient transmission.

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand and be able to explain the principles of a layered protocol architecture; be able to identify and describe the system functions in the correct protocol layer and further describe how the layers interact.
2.	Understand, explain and calculate digital transmission over different types of communication media.
3.	Understand, explain and solve mathematical problems for data-link and network protocols.
4.	Describe the principles of access control to shared media and perform performance calculations.
5.	Understand and explain the principles and protocols for route calculations and be able to perform such calculations.

SYLLABUS

MODULE - I

Data Communications and Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for a Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture**(8L)**

MODULE - II

Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity.

Guided and Wireless Transmission: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission.**(8L)**

MODULE - III

Signal Encoding Techniques: Digital Data Digital Signals, Digital Data Analog Signals, Analog Data Digital Signals, Analog Data Analog Signals.

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Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations, Interfacing.**(8L)**

MODULE – IV

Data Link Control: Flow Control, Error Control, High-Level Data Link Control (HDLC).
Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.

Circuit Switching and Packet Switching: Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Control Signaling, Softswitch Architecture, Packet-Switching Principles, X.25, Frame Relay.**(8L)**

MODULE -V

Asynchronous Transfer Model: Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer.
Routing in Switched Networks: Routing in Circuit-Switching Networks, Routing in Packet-Switching Networks, Least-Cost Algorithms**(8L)**

Text Book:

1. Stallings W. "Data and Computer Communications", 7th Edition., Pearson Education./ PHI, New Delhi, 2006.

Reference Books:

1. Forouzan B. A., "Data Communications and Networking", 4th Edition. TMH, New Delhi, 2006.
2. Gupta P.C. "Data Communications and Computer Networks", PHI, New Delhi 2006.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Head of Department

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
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CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	2	1	1	2	1
CO2	3	3	3	3	2	2	2	1
CO3	2	3	1	1	2	3	3	2
CO4	3	2	1	3	3	1	3	1
CO5	3	3	3	2	3	2	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA561
Course title: SOFTWARE PROJECT MANAGEMENT
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: IV/5
Branch: MCA

Course Objectives:
This course enables the students to:

1.	Illustrate the concepts of Project Management for developing software projects.
2.	Demonstrate the software project evaluation issues
3.	Classify the software projects for development using suitable process models
4.	Predict the software cost and risk for the software projects
5.	Design a framework for managing various aspects of software projects like resource allocation, monitoring and control, contract and quality management etc.

Course Outcomes
After the completion of this course, students will be able to:

1.	Apply the concepts of Project Management for developing software projects.
2.	Solve the software project evaluation issues.
3.	Categorize the software projects for development using suitable process models
4.	Estimate the software cost and risk for the software projects.
5.	Create a framework for managing various aspects of software projects like resource allocation, monitoring and control, contract and quality management etc.

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SYLLABUS

MODULE – I

Managing Software Project: Process & Project Management, Project Management and the CMM, Project Management at Infosys, Introduction to CMMI, PCMM.
The Project Planning Infrastructure: The process data base, The process capability Baseline, Process Assets and the Body of Knowledge System. **(8L)**

Module – II
Planning: The Infosys Development Process, Requirement Change Management
Effort Estimation & Scheduling: Estimation and Scheduling Concepts, Effort – Estimation, Scheduling. **(8L)**

Module – III

Quality Planning: Quality Concepts, Quantitative quality Management Planning, Defect Prevention Planning.
Risk Management: Concepts of Risks and Risk Management, Risk Assessment, Risk Control, Examples. **(8L)**

Module – IV
Measurement and Tracking Planning: Concepts in measurement, Measurements, Project tracking.
Project Management Plan: Team Management, Customer Communication and Issue Resolution, Structure of the Project Management Plan.**(8L)**

Module – V
Configuration Plan: Concepts in Configuration Management, Configuration Management Process.
Reviews: The Reviews, Review process Data Collection, Monitoring & Control, Introduction of Reviews & the NAH Syndrome.

Project Monitoring & Control: Project tracing, Milestone Analysis, Activity Level Analysis using SPC, Defect Analysis & Prevention Process Monitoring & audit.**(8L)**

Text Book:

1. Jalote Pankaj "Software Project Management in Practice", Pearson Education, New Delhi, 2002.

Reference Books:

1. Huges B. and Cotterell M. "Software Project Management", 3rd Edition, Tata Mcgraw Hill, New Delhi, 2004.
2. Jalote Pankaj "CMM in Practice, Pearson Education", New Delhi, 2002.
3. Grey W. Humph "Managing the Software Process", Addition – Wesley, 1989.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	3	1	2	2
CO2	3	3	3	1	1	2	2	1
CO3	1	1	2	2	2	2	3	2
CO4	3	2	2	3	3	1	2	1
CO5	3	3	3	3	3	2	3	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA580
Course title: ADVANCED JAVA PROGRAMMING
Pre-requisite(s): Java Programming
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: IV/5
Branch: MCA

Course Objectives
This course enables the students:

A.	Help students realise the advanced features in JAVA.
B.	Establish the relationship between the core and advanced JAVA frameworks.
C.	Understand problems where Advanced JAVA is required.
D.	Evaluate the advantages and short comings of advanced JAVA
E.	Understand how frameworks and APIs are designed.

Course Outcomes
After the completion of this course, students will be:

1.	Learn the architecture of advanced swing components and design GUIs using them.
2.	Learn to interface with external data sources with Java.
3.	Leverage Java to create and deploy network programs.
4.	Use Java to design enterprise level Web sites.
5.	Understand Java's component based programming model.

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SYLLABUS

MODULE -I

Components and Facilities or Rich Graphical User Interfaces: Programming with the JFC, Swing API Components, Jcomponent Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, and Check Boxes, Menus, Toolbars, and Actions, Sliders, Spinners, Progress Bars, and Scrollbars, Lists and Combo Boxes, Text-Entry Components, Color and File Choosers, Tables and Trees, Printing with the 2D API, Java Print Service API.**(8L)**

MODULE -II

Using Relational Database: Introduction, Best Practices for Programming for Databases, JDBC Drivers for RDBM Systems, SQL to Java Type Mappings, Understanding the Database used in this chapter, Using the **java.sql** API, Coding Transactions, Using the **javax.sql** API, Connection Pooling. **(8L)**

MODULE -III

XML: Introduction, XML Structure, XML Example Document with SAX, Parsing an XML Document with DOM, Generating an XML Document with DOM, Validating XML Documents using DTD and XML Schema, Transforming XML using XSLT.**Network Programming:** Introduction, Working with URLs, Working with Sockets, Remote Method Invocation.**(8L)**

MODULE -IV

Building Web Applications: Introduction, The Technology of the Web, J2EE Web Application Packaging, Servlets, The Servlet API, The User Experience, Building a Web App with Continuity, Java Server Pages, JSP Tags and API, How the Server Processes JSPs, Java Coding in JSPs, Frameworks for Building Web Applications, Building Robust WebApps.**(8L)**

MODULE -V

Enterprise JavaBeans: Introduction, Enterprise Programming, What are EJBs? Session EJBs, EJB Clients, Entity EJBs, Message-Driven Beans, EJB Transactional Characteristics, EJB Security, Best Practices for Designing EJB-Based Applications.**(8L)**

Text Book:

1. Wigglesworth & McMillan "JavaTM Programming Advanced Topics", 3rd Edition, India Edition, Thomson Education, New Delhi, 2007.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	1	2	1	1	2
CO2	3	3	2	3	3	2	2	1
CO3	2	3	1	1	2	3	1	2
CO4	3	2	1	3	3	1	2	1
CO5	3	1	3	2	3	2	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA581
Course title: SYSTEMS PROGRAMMING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: MCA
Semester / Level: IV/5
Branch: MCA

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Course Objectives

This course enables the students:

A.	Describe the utility of different system programs & system tools.
B.	Familiarize with the trade-offs between run-time and compile-time processing (Linking & Loading techniques).
C.	To learn the concepts and techniques behind the designing of various system softwares.
D.	To organize the functionalities & components of system software & tools into different layers for efficient code generation.
E	Understand the designing of text editors, debuggers etc.

Course Outcomes

After the completion of this course, students will be able to:

1.	Elaborate the evolution of various system software.
2.	Define various data structures that helps in the proper functioning of the system programs.
3.	Analyse basic design of various system software.
4.	Apply functionalities & components of system software & tools into different layers for efficient code generation.
5.	Development and designing of text editors, debuggers etc.

SYLLABUS

MODULE -I

Introduction: System Softwares& its Components, Evolution of System Softwares- Operating System, Loaders, Interpreters, Compilers, Linkers, Assemblers.**Assemblers:** Elements of Assembly Language Programming, Assembly Process, Single Pass Assembler, Design of a 2-Pass assembler for In 8088.**(8L)**

MODULE -II

Macros & Macro processors: Macros, Different forms of Macros, Macros using AIF, AGO, REPT. Etc, Design of a Macro Processor, Macro Assembler.**(8L)**

MODULE -III

Loaders: Basic Loader Functions, Absolute Loader, Compile & go Loader, Relocating Loader, Direct Linking Loader.**(8L)**

Head of Department

MODULE -IV

Linkage Editors: Linking and Relocation, Program Relocability, Linkage Editor and its Application in IBP-PC, Linking for Program Overlays.**(8L)**

MODULE -V

Software Tools: Spectrum of Software Tools, Text Editors, Interpreter and Program Generators, Debug Monitors, Programming Environments.**(8L)**

Text Book:

1. Dhamdhere D.M. "System Programming and Operating Systems", 2nd Edition, TMH, New Delhi.

Reference Book:

1. Donovon J.J. "System Programming", TMH, New Delhi.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	2	1	1	2	1	1	2
CO2	3	1	3	3	2	2	2	1
CO3	2	3	1	1	2	2	3	2
CO4	3	2	1	3	3	1	2	2
CO5	3	2	3	2	3	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA582
Course title: COMPILER DESIGN
Pre-requisite(s): Automata theory
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level:IV/5
Branch: MCA

Course Objectives
This course enables the students to:

A.	Understand the need of compiler
B.	Provide a thorough understanding of design, working, and implementation of programming languages
C.	Trace the major concept areas of language translation and compiler design
D.	Create an awareness of the function and complexity of modern compilers.
E.	Develop knowledge for developing tool for natural language processing

Course Outcomes
After the completion of this course, students will be able to

1.	Understand the need of compiler for *interfaci*ng between users and machine
2.	Perceive the role of several phases of compilation process
3.	Trace the major concept areas of language translation and compiler design
4.	Develop a comprehensive Compiler for a given language
5.	Apply knowledge for developing tool for natural language processing

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SYLLABUS

MODULE -I

Introduction to Compiling: Translators, Interpreters, Compiler, other language processors, Phases of a compiler, Passes of compiler, Back-end and Front-end of compiler, Basic idea on Symbol Table, Issues in Compiler construction, Concept on *l*-value and r-value, Programming Language basics, Compiler construction tools.

Lexical and Syntax Analysis: *Lexical analysis*: Role of a Lexical analyser, Input buffering, Specification and recognition of tokens, State-machine driven lexical analysers and their implementations, Lexical analyser generator tool: LEX/FLEX. **(8L)**

MODULE -II

Syntax analysis: Need and Role of Parser, Importance of Context Free Grammars in designing Parser, Parse trees, derivations and sentential forms, Ambiguity.
Top down parsing: Backtracking, Recursive descent and Predictive parsers (LL), Error-detection in LL parser
Bottom-up parsing: Simple Shift-Reduce parsing, LR Parsers: SLR, CLR and LALR parsers, Error detection in S-R parsing, Handling ambiguous grammar, Parser generator tool: YACC/BISON **(8L)**

MODULE -III

Syntax Directed Translation: Syntax directed definitions, Construction of syntax tree, Attribute grammars, Inherited and synthesized attributes, Dependency graphs, Evaluation orders of attributes, S-Attributed definitions, L-attributed definitions.

Intermediate code generation: Variants of Syntax Trees, Three-address codes of different constructs, Translation of expressions, Type checking: Rules for type checking, Type conversion;

(8L)

MODULE -IV

Machine independent code optimization: Sources of optimization, DAG, Peephole optimization and Basic Blocks, Loops in Flow Graphs, Data flow analysis and equations **(8L)**

MODULE -V

Runtime Environment and Code Generation:
Runtime environment: Storage organization: Static and Dynamic, Stack allocation and Heap allocation of memory;
Code generation: Issues in designing of a code generator, Register allocation and Assignment, Target machine (assembly code for 80- series) **(8L)**

Text Book:

1. Aho A.V., Sheth R. I. and Ullman J.D. "Compilers Principles Techniques and Tools", Pearson Education.

Head of Department

Reference Books:

1. Levine John R., Mason Tony, Brown Doug "Lex &Yacc", O'reilly.
2. Appel Andrew N., "Modern Compiler Implementation in C", Cambridge University Press.
3. Cooper & Linda "Engineering a Compiler", Elsevier theory.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	2	1	1	1
CO2	2	1	3	3	2	2	2	1
CO3	2	3	1	1	2	2	3	2
CO4	3	2	1	3	3	1	2	1
CO5	2	3	3	2	3	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA583
Course title: PROGRAMMING LANGUAGE DESIGN AND CONCEPTS
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: IV/5
Branch: MCA

Course Objectives
This course enables the students to:

A.	Understand the need of Programming Language Design
B.	Provide a thorough understanding of design, working, and implementation of programming languages
C.	Understand how to develop programming language effectively
D.	Learn the design principles of design principle of programming languages with it's merits and demerits.
E.	Able to Design a programming Language considering the underlying components and concepts

Course Outcomes
After the completion of this course, students will be able to:

1.	Understand the concept of Programming Language Design
2.	Differentiate the types of Programming languages using design strategy
3.	Design a programming Language considering the underlying components and concepts
4.	Develop a programming language effectively
5.	Analyse the design principle with its merits and demerits.

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SYLLABUS

MODULE -I
Introduction:
The Role of Programming Languages: Toward Higher-Level Languages, Programming Paradigms, Languages Implementation: Bridging the Gap.

Language Description: Syntactic Structure: Expression Notations, Abstract Syntax Trees, Lexical Syntax, Context- Free Grammars, Grammars for Expressions.**(8L)**

MODULE -II

Imperative Programming:
Statements: Structured Programming: The Need for Structured Programming, Syntax-Directed Control Flow, Design Considerations: Syntax, Handling Special Cases in Loops, Programming with Invariants, Proof Rules for Partial Correctness, Control Flow in C.**(8L)**
MODULE -III

Types: Data Representation: The Role of Types, Basic Types, Arrays: Sequences of Elements, Records: Named Fields, Unions and Variant Records, Sets, Pointers: Efficiency and Dynamic Allocation, Two String Tables, Types and Error Checking.
Procedure Activations: Introduction to Procedures, Parameter- Passing Methods, Scope Rules for Names, Nested Scopes in the Source Text, Activation Records, Lexical Scope: Procedures as in C.

(8L)

MODULE -IV

Object-Oriented Programming:
Grouping of Data and Operations: Constructs for Program Structuring, Information Hiding, Program Design with Modules, Modules and Defined Types, Class Declarations in C++, Dynamic Allocation in C++, Templates: Parameterized Types, Implementation of Objects in C++.
Object-Oriented Programming: What is an Object?, Object-Oriented Thinking, Inheritance, Object-Oriented Programming in C++, Derived Classes and Information Hiding, Objects in Smalltalk, Smalltalk Objects have a Self. **(8L)**

Head of Department

MODULE -V

Functional Programming:
Elements of Functional Programming: A Little Language of Expressions, Types: Values and Operations, Approaches to Expression Evaluation, Lexical Scope, Type Checking.
Functional Programming in a Typed Language: Exploring a List, Function Declaration by Cases, Functions as First-Class Values, ML: Implicit Types, Data Types, Exception handling in ML.
Functional Programming with Lists: Scheme, Dialect of Lisp, The Structure of Lists, List Manipulation, A Motivating Example: Differentiation, Simplification of Expressions.**(8L)**

Text Book:

1. Sethi R. & Viswanathan K.V. "Programming Languages Concepts & Constructs", 2nd Edition, Pearson Education, 2007.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	2	1	3	1
CO2	2	3	3	3	2	2	2	2
CO3	2	3	1	2	2	2	3	2
CO4	3	2	1	3	3	1	2	1
CO4	3	1	3	3	3	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA584
Course title: WEB PROGRAMMING
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: MCA
Semester / Level: IV/5
Branch: MCA

Head of Department

Course Objectives

This course enables the students:

A.	To appreciate problems of traditional web designing techniques.
B.	To understand the basics of the MVC architecture
C.	To understand ASP.NET's implementation of the MVC model
D.	To understand how to leverage the model for medium to large projects
E.	To optimize the performance and rendering of web sites for different types of clients.

Course Outcomes

After the completion of this course, students will:

1.	Be able to design models, controllers and views in ASP.NET
2.	Be able to establish secure and optimized database connections from the web sites
3.	Be able to perform secure and optimized user management and role handling
4.	Optimize the design aspects of the web sites in a responsive fashion.
5.	Understand techniques to handle scalability of web sites i.e. using caches

SYLLABUS

MODULE -I

MVC, Asp.NET MVC, ORMs, Entity Framework, Models, Database Contexts, Adding Controllers, Views, Filtering, Searching related entitites.**(8L)**

MODULE -II

ViewBag, View Model, Complex Filtering, Data Validation, Annotations, Sorting, Paging, Routing Configurations, Many to many relationships with the Entity Framework, Partial Views.

(8L)

MODULE -III

Authentication, Authorization, ASP.NET Identity, Role Management, User management, Password management. **(8L)**

MODULE -IV

CSS Fundamentals, Selectors, Inheritance, Cascading, Box Model, Advanced CSS, Animations. **(8L)**

MODULE -V

Designing Responsive web sites, Media Queries, Developing for mobiles and Tablets.**(8L)**

Text books:

1. Naylor L., "ASP.NET MVC with Entity Framework and CSS", 1st Edition, Apress, 2017.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Head of Department

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	2	1	1	2
CO2	3	1	3	1	2	2	2	2
CO3	2	3	2	1	2	2	3	2
CO4	3	2	1	3	3	1	2	1
CO5	3	1	3	3	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA558
Course title: FRONT END DESIGN LAB
Pre-requisite(s):
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level: IV/5
Branch: MCA

Course Objectives

This course enables the students

1.	To impart the basic concepts of User Interface Design.
2.	To develop understanding about human computer interaction methods that utilize more general, widespread and easier-to-learn capabilities.
3.	The cognitive and perceptual constraints that affect interface design
4.	Techniques for evaluating the usability of an interface
5	How to communicate the results of a design process, both in oral and written form

Course Outcomes

After the completion of this course, students will be able to:

1.	Identify the key terms related to user interfaces and user interface design and implementation
2.	Identify and describe various types of computer users and computer use contexts
3.	Identify and describe various types of user interfaces
4.	Explain the user interface design process
5	Identify and describe common abstract user interface components, such as radio buttons and group boxes

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SYLLABUS

List of Programs as Assignments:

84. Lab Assignment No: 1

Objective: To Understand and Implement HTML

Q1. To create a simple html file to demonstrate the use of different tags.

Q2. To create an html file to link to different html page which contains images, tables, and also link within a page.

Q3. To create an html page with different types of frames such as floating frame, navigation frame & mixed frame.

Q4. To create a registration form as mentioned below.

Create an html page named as "registration.html"

a) set background colors

b) use table for alignment

c) provide font colors & size

85. Lab Assignment No: 2

Objective: To Understand and Implement CSS

Q1. To create an html file by applying the different styles using inline, external & internal style sheets.

1. Create a external style sheet named as "external_css.css" and provide some styles for h2, hr, p & a tags.

2. Create an html file named as "Style_sheet.html"

a) Include the external style sheet with necessary tag.

b) Include the internal style sheet for body tags & also use class name, so that the style can be applied for all tags.

c) Include a tags with inline style sheet.

86. Lab Assignment No: 3

Objective: To Understand and Implement JavaScript

Q1. To write a Javascript program to define a user defined function for sorting the values in an array.

Q2. Create an html page named as "exception.html" and do the following.

1. within the script tag write code to handle exception

a) define a method RunTest() to get any string values(str) from the user and cll the method Areletters(str).

b) In Areletters(str) method check whether str contain only alphabets (a-z, AZ), if not throw exception.

c) Define a exception method Input Exception(str) to handle the exception thrown bythe above method.

Head of Department

2. Within the body tag define a script tag to call Runtest() method defined.

Q3. To display the calendar using javascript code by getting the year from the user.

Q4. To create a html page to display a new image & text when the mouse comes over the existing content in the page.

87. **Lab Assignment No: 4**

Objective: To Understand and Implement ASP

Q1. To create an ASP file to find the no of hits on the page and to have rotating banner content.

Q2. To create a table of content using ASP program & navigate within the pages.

Q3. Create an ASP file named as request.asp

a) Create a simple form to get the first name & last name and a button submit. When the button is clicked the values in the text box are printed by response object by Request.QueryString

b) Create a hyperlink with some values defined in the tag & display the same using request & response object.

Q4.To display all the content in the database using ASP program.

Lab Assignment No: 5

Objective: To Understand and Implement Java Servlets

Q1. To create a simple servlet program to display the date (using Tomcat server).

Q2. To create a servlet program to retrieve the values entered in the html file (Using NetBeans IDE).

Q3. To display the cookie values that are entered in the html page using servlet program. (usingNetBean IDE).

Lab Assignment No: 6

Objective: To Understand and Implement XML

Q1. To create a simple catalog using XML file

Q2. To create external style sheet and using the style sheet in xml file.

Lab Assignment No: 7

Objective: To Understand and Implement PHP

Q1. To create a php program to demonstrate the different file handling methods.

Q2. To create a php program to demonstrate the different predefined function in array, Math, Data & Regular Expression.

Books recommended:

TEXT BOOKS

5. Web Technologies: A Computer Science Perspective , Jeffrey C Jackson , Pearson Education , India.
6. Stephen Wynkoop, Running a perfect website, QUE, 1999

Head of Department

REFERENCE BOOKS

4. Eric Ladd, Jim O' Donnel, Using HTML 4, XML and Java, Prentice Hall of India-QUE, 1999
5. Chris Bates, Web Programming - Building Intranet applications, Wiley Publications, 2004
6. Deitel, Deitel& Nieto, Internet and World Wide Web - How to Program, Pearson Education Asia, 2000

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	2	2	2	1
CO2	3	1	2	3	2	2	2	1
CO3	2	3	1	1	3	2	3	2
CO4	3	2	1	3	3	1	2	1
CO5	3	2	3	2	3	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA560
Course title: DCCN LAB
Pre-requisite(s):
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level: IV/5
Branch: MCA

Head of Department

Course Objectives

This course enables the students to:

1.	To familiarize the student in introducing and exploring various Network topologies and networking protocols
2.	To understand the use of client/server architecture in application
3.	To enable the student on how to approach for networking problems using networking simulation tools.
4.	To Design reliable servers using both TCP and UDP sockets
5.	Familiar with network tools and network programming.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Express programming & simulation for networking problems.
CO2	Get a thorough understanding of various aspects of networking devices
CO3	Design and implement simulation of a simple LAN and a WAN that meet a specific set of criteria
CO4	Identify the elements of a communication network
CO5	Simulate various OSI layer protocols using C/C++/ Java

Head of Department

SYLLABUS

List of Programs as Assignments:

1. **Lab Assignment No: 1**

   Q1. To familiarize with the Lab Network Topology, Locating different interfaces, routers and switches. Studying different pools of IP addresses.

   Q2. Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.

   Q3. To learn and observe the usage of different networking commands e.g.PING, TRACEROUTE. Learning remote login using telnet session. Measuringtypical average delays between different locations of the network.

2. **Lab Assignment No: 2**

   Q1. What is the IP of the machine you are using? Compare it with the IP of your neighbors. Are the IPs of your neighbors same? Why or Why not?

   Q2. Ping" is a tool used to determine if a server is responding and to estimate the round trip time of a message sent to that server. Use the ping command for the following URLs and record the success or failure statistics along with the average round trip time.
   a) google.com
   b) facebook.com
   c) bitmesra.ac.in

   Q3. Trace the route that is taken when you try to access:
   a) google.com
   b) facebook.com
   c) bitmesra.ac.in

   Q4. Network Commands on Linux / Unix

3. **Lab Assignment No: 3**

   Q1. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC 32.

   Q2. Implementation of Sub-netting and Super-netting.

   Q3. To study different types of transmission media, various topologies, and configure modem of computer HUB and Switches.

Head of Department

4. **Lab Assignment No: 4**

Q1. Write a C/C++ program to determine if the IP address is in Class A, B, C, D, or E.

Q2. Write a C/C++ program to determine if the IP address is in Class A, B, or C.

Q3. Write a C/C++ program to translate dotted decimal IP address into 32 bit address.

Q4. To implement a routing protocol and check its connectivity in a variable length subnet masked network

Q5. Write a C/C++ program to perform bit stuffing and de-stuffing.

5. **Lab Assignment No: 5**

Q1. Implement Dijkstra‘s algorithm to compute the Shortest path through a graph.

Q2. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

Q3. Take an example subnet of hosts. Obtain broadcast tree for it.

6. **Lab Assignment No: 6**

Q1. Build implementations of the Internet protocols
Q2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
Q3. Write a code simulating ARP /RARP protocols.

7. **Lab Assignment No: 7**

Q1. Create a socket for HTTP for web page upload and download
Q2. Write a code simulating PING and TRACEROUTE commands.

8. **Lab Assignment No: 8**

Q1. Study and implement model for Socket Programming and Client – Server model.
Q2. Experiments with NS2(or any other simulator) to study behavior (especially performance of) link layer protocols such as Ethernet and 802.11 wireless LAN..

9. **Lab Assignment No: 9**

Q1. Experimental study of application protocols such as HTTP, FTP,SMTP, using network packet sniffers and analyzers such as **Wireshark**. Small exercises in socket programming in C/C++/Java..

10. **Lab Assignment No: 10**

Q1. Take a 64 bit playing text and encrypt the same using DES algorithm.

Q2. Write a program to break the above DES coding

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Q3. Using RSA algorithm encrypts a text data and Decrypt the samebjective: To Understand and Implement Data Interpolation

11. Lab Assignment No: 11

Q1. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer
Q2. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
Q3. Echo client and echo server b. Chat c. File Transfer

Books recommended:

TEXT BOOKS

4. William Stallings, Data and Computer Communication, Prentice Hall of India.
5. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill.
6. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.

REFERENCE BOOKS

3. W. Richard Stevens, TCP/IP Illustrated, Volume 1, Addison-Wesley
4. Douglas Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

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Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	2	1
CO2	3	3	2	1	1	2
CO3	2	3	2	1	1	1
CO4	3	2	2	1	1	1
CO5	3	2	1	1	3	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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COURSE INFORMATION SHEET

Course code: MT116
Course title: Quantitative Methods for Business Decisions
Pre-requisite(s): NIL
Co- requisite(s): NIL
Credits: 3 L:3 T:0 P:0
Class schedule per week: 3
Semester / Level:V/1
Branch:MCA
Name of Teacher:

Course Objectives

This course enables the students:

A.	To provide a basic understanding of the value and use of quantitative methods in administrative and operational problem solving and decision-making.
B.	To develop an understanding of a variety of statistical and quantitative techniques applicable to a wide range of business situations.
C.	To recognize particular techniques and their applications so as to be able to apply these techniques in problem solving for management decision making.
D.	To be able to read and interpret statistical information and be able recognize when meaningful statistics are (and are not) being used.
E.	To be able to performance statistical analysis.

Course Outcomes

After the completion of this course, students will be:

1.	Explain the application of quantitative methods in administrative and operational problem solving and decision-making.
2.	Explain the application of statistical and quantitative techniques applicable to a wide range of business situations.
3.	Apply select quantitative techniques in problem solving for management decision making.
4.	Interpret statistical findings and recognize when meaningful statistics are (and are not) being used.
5.	Recommend decisions based on statistical analysis.

Head of Department

SYLLABUS

Module-I–

Statistics: Meaning and Applications of Statistics in business decision making and research. Collection, Tabulation andpresentation of data.Measures of central tendency: Mean, Median and Mode. Measures of dispersion: Range, Mean Deviation, Standard Deviation. Relative measure of Dispersion **(8L)**

Module-II

Correlation: Karl Pearson's coefficient of correlation, Rank, Probable error and coefficient of determination.Regression Analysis: Regression Lines, Equations and Coefficients.Analysis of Time Series and Business Forecasting: Components, Moving Averages, Exponential smoothing and Least Squares Method. **(8L)**

Module-III

Probability Theory: Concepts, Conditional Distribution, Bayes' Theorem and application. Random Variable. Distribution Theory: Discrete and Continuous: Binomial and Poisson Distribution and Normal Distribution. Application of Distribution theory to Engineering and Management Science problems
(8L)

Module -IV

Sampling Theory and Distribution. EstimationTheory: Unbiasedness and Minimum Variance Unbiased Estimator. **(8L)**

Module- V

Testing of Hypotheses: Null and Alternative Hypothesis, Type-I and II error. p test, t test, Chi Square test, F Test and their applications. ANOVA - One way test. **(8L)**

Text Books:

1. Levin Richard I. & Rubin, David S, Statistics for Management, Prentice Hall Of India, New Delhi.

3. Gupta S.P Gupta M P, Business Statistics, Sultan Chand.

3. Terry, Sineich, Business Statistics by Examples, Collier McMillan Publisher.

Gaps in the syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design
POs met through Topics beyond syllabus/Advanced topics/Design

Head of Department

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
End Sem Examination Marks	50
Mid Sem Examination Marks	25
Quiz (s)	20
Independent Teaching Assessment	5

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	2	1
CO2	3	3	2	1	1	2
CO3	2	3	2	2	2	1
CO4	3	2	2	1	1	1
CO5	3	2	1	1	3	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD4
CD3	Seminars	CO3	CD1
CD4	Mini projects/Projects	CO4	CD1, CD2, CD5, CD8
CD5	Laboratory experiments/teaching aids	CO5	CD1, CD2, CD3, CD4, CD6, CD8
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

COURSE INFORMATION SHEET

Course code: CA601
Course title: COMPUTER GRAPHICS
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: V/6
Branch: MCA

Head of Department

Course Objectives

This course enables the students:

A.	To perform visual computations for geometrical drawings.
B.	To understand different hardware used for graphical requirement
C.	To perform visual computations for geometrical drawings.
D.	To display 3D objects in a 2D display devices using projection techniques.
E.	To create realistic images using color and shading techniques.

Course Outcomes

After the completion of this course, students will be:

1.	Able to understand the concept of image formation as realized by human visual system.
2.	Able to Illustrate the digitization process of images and related algorithms for drawing basic geometric figures in the 2D display devices.
3.	Able to describe architecture of basic Input/ Output devices and their underlying working principles along with various primitives for drawing shapes.
4.	Able to apply fundamental mathematics in producing spatial 3D-image of an object in an inherently 2D display device.
5.	Able to produce realism in the target object/ objects in a scene.

SYLLABUS

MODULE -I

Introduction: Image Processing as Picture Analysis, The Advantages of Interactive Graphics, Representative Uses of Computer Graphics, Classification of Applications, Development of Hardware and Software for Computer Graphics, Conceptual Framework for Interactive Graphics.

Basic Raster Graphics Algorithms for Drawing 2D Primitives: Overview, Scan Converting Lines, Scan Converting Circles, Scan Converting Ellipses, Filling Rectangles, Filling Polygons, Filling Ellipse Arcs, Pattern Filling, Thick Primitives, Line Style and Pen Style, Clipping in a Raster World, Clipping Lines, Clipping Circles and Ellipses, Clipping Polygons, Generating Characters, SRGP_copyPixel, Antialising.**(8L)**

Module- II

Graphics Hardware: Hardcopy Technologies, Display Technologies, Raster-Scan Display Systems, The Video Controller, Random-Scan Display Processor, Input Devices for Operator Interaction, Image Scanners.

Geometrical Transformations: 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Composition of 2D Transformations, The Window-to-View port Transformation, Efficiency, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Transformations as a Change in Coordinate System.

(8L)

Head of Department

Module- III

Viewing in 3D: Projections, Specifying an Arbitrary 3D View, Examples of 3D Viewing, The Mathematics of Planar geometric Projections, Implementing Planar Geometric Projections, Coordinate Systems. **(8L)**

Module -IV

Input Devices, Interaction Techniques, and Interaction Tasks: Interaction Hardware, Basic Interaction Tasks, Composite Interaction Tasks.

Representation Curves and Surfaces : Polygon Meshes, Parametric Cubic Curves, Parametric Bicubic Surfaces, Quadric Surfaces.

Achromatic and Colored Light: Achromatic Light, Chromatic Color, Color Models for Raster Graphics, Reproducing Color, Using Color in Computer Graphics. **(8L)**

Module-V

The Quest for Visual Realism: Why Realism?, Fundamental Difficulties, Rendering Techniques for Line Drawings, Rendering Techniques for Shaded Images, Improved Object Models, Dynamics, Stereosis, Improved Displays, Interacting with Our Other Senses, Aliasing and Antialiasing.

Visible-Surface Determination: Functions of Two Variables, Techniques for Efficient Visible-Surface Algorithms, Algorithms for Visible-Line Determination, The z-Buffer Algorithms, List-Priority Algorithms, Area-Subdivision Algorithms, Algorithms for Octress, Algorithms for Curved Surfaces, Visible-Surface Ray Tracing.

Illumination and Shading: Illumination Models, Shading Models for Polygons, Surface Detail, Shadows, Transparency, Inter object Reflections, Physically Based Illumination Models, Extended Light Sources, Spectral Sampling.

(8L)

Text Book:

1. Foley, Dam Van, Feiner, Hughes "Computer Graphics Principles & Practice", 11th Edition., Pearson Education, New Delhi, 2004.

Reference Book:

1. Hearn D. & Baker M.P. "Computer Graphics", PHI, New Delhi, 2006.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Head of Department

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
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CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	2	1	1	1
CO2	3	1	3	3	2	2	2	1
CO3	3	2	1	3	2	2	2	2
CO4	3	2	1	3	3	1	2	1
CO5	3	2	3	2	3	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA603
Course title: SYSTEM SIMULATION AND MODELLING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: V/6
Branch: MCA
Name of Teacher:

Course Objectives
This course enables the students:

A.	To Characterize engineering systems in terms of their essential elements, purpose, parameters, constraints, performance requirements, sub-systems, interconnections and environmental context.
B.	To understand Engineering problem modelling and solving through the relationship between theoretical and mathematical
C.	To provide Mathematical modelling real world situations related to engineering systems development,
D.	To able Generate random numbers and random variates using different techniques.
E.	To provide the knowledge of queuing theory to solve real life problem

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Course Outcomes

After the completion of this course, students will be able to:

1.	Define basic concepts in modeling and simulation (M&S).
2.	Classify various simulation models and give practical examples for each category.
3.	Understand the behavior of a dynamic system and create an analogous model for a dynamic system.
4.	Generate and test random number variates and apply them to develop simulation models.
5.	Develop a real life model using queuing system.

SYLLABUS

Module –I

The concepts of a system, System Environment, Stochastic Activities, continuous and discrete systems, System Modeling, Types of models.

System Studies: Subsystem, A Corporate Model, Environment segment, Production Segment, Management Segment, full Corporate Model, Types of System study, System Analysis, System Design, System Postulation. **(8L)**

Module –II

The technique of simulation, the Monte Carlo method, comparison of simulation and analytical methods, experimental nature of simulation, types of system simulation, numerical computation technique for continuous & discrete models, distributed lag models, cobweb models.

Continuous system models, differential equations, analog computers & methods, hybrid computers, CSSLs, CSMP-III, Feedback Systems, Simulation of an Autopilot.**(8L)**

Module –III

Exponential Growth & decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamics diagrams, Simple system dynamics diagrams, multi–segment models, representation of time delays.**(8L)**

Module –IV

Evaluation of continuous probability functions, continuous uniformly distributed random numbers, a uniform random number numbers, generating discrete distributions, non-uniform continuously distributed random numbers, the rejection method.

Random numbers Generators: Techniques for generating random numbers. Test for random numbers.

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Random vitiate Generation: Inverse transform technique, exponential distribution, uniform distribution.**(8L)**

Module –V

Queuing disciplines, measures of queues. Discrete events, representation of time, generation of arrival patterns, simulation of a telephone system, delayed calls, Simulation programming tasks, measuring utilization and occupancy.
(8L)

Text books:

1. Gordon Geoffrey, "System Simulation", 2nd Edition, Pearson Education, 2007.
2. Banks J., Carson J. S., Nelson B.L., Nicol D.M. Nicol, "Discrete-Event System Simulation", 4th Edition, Pearson Education, 2007.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	2	1	1	1
CO2	3	1	3	3	3	2	2	3
CO3	2	2	1	1	2	3	3	2
CO4	3	3	1	3	3	1	2	1
CO5	3	1	3	3	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA605
Course title:OPTIMIZATION TECHNIQUES
Pre-requisite(s):
Co- requisite(s):
Credits:3 L:3 T:0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level:V/6
Branch: MCA
Course Objectives
This course enables the students to:

A.	Construct the operational models for the real-world applications using Linear Programming
B.	Illustrate the techniques to solve the Network Optimization models
C.	Explain the computational feasibility of the solutions using the Deterministic and Probabilistic Dynamic Programming
D.	Model problems using Non-Linear Programming and evaluate the suitability of the available techniques for the problem at hand
E.	Produce the meta-heuristic algorithms for real world optimization

Course Outcomes
After the completion of this course, students will be able to:

1.	Prepare the operational models for the real-world applications using Linear Programming
2.	Apply the techniques to solve the Network Optimization models
3.	Analyse the computational feasibility of the solutions using the Deterministic and Probabilistic Dynamic Programming
4.	Model problems using Non-Linear Programming and evaluate the suitability of the available techniques for the problem at hand
5	Apply the meta-heuristic algorithms for real world optimization

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SYLLABUS

MODULE I

Operation Research – An overview, Organ and Development of OR, Nature and Features of OR, Modeling in OR, General Solution Methods for OR models, Scientific method in OR, Methodology of OR, Application, Opportunities and Shortcomings of OR.**(8L)**

MODULE II

Linear Programming Problem: Introduction, Mathematical Formulation of the Problem, Graphical Solution Method, Some Exceptional Cases, General LPP, Canonical and Standard forms of LPP, Simplex Method: Introduction, Fundamental properties of solutions, the Computational Procedure, Use of Artificial variables, Solution to simulation Linear Equations, Investing a Matrix using Simplex Method. **(8L)**

MODULE III

Duality in LPP: Introduction, General Primal – Dual pair, Formulating a Dual Problem, Primal Dual pair in Matrix form, Halting theorems, Dual simplex method, Post optical Analysis, Introduction: Variation in cost vector, Requirement Vector, Coefficient Matrix, Structural Variation. **(8L)**

MODULE IV

Integer Programming and Advance LPP techniques: Introduction, Gomory's Method, Court ruction of Gomorra's constraints, Fractional Cut Method: All Integer & Mixed Integer, Revised Simplex Method, Bounded Variable, Parametric LPP, KarmakarAlgorith.**(8L)**

MODULE V

Dynamic Programming & Introduction: Characteristic of Dynamic Programming, Dynamic Programming Algorithm, Solution of LPP by Dynamic Programming.
NLPP: Introduction, Formulality**(8L)**

Text Book:

1. Hiller S. & Lieberman G.J. "Operations Research", 9th Edition, TMH, New Delhi, 2012.

Reference Books:

1. Taha H.A. "Operations Research", 9th Edition, Pearson Education, New Delhi, 2013.
2. Pai Pradeep Prabhakar "Operations Research", 1st Edition, Oxford University Press 2012.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	2	1	2	1
CO2	3	2	3	3	2	2	2	1
CO3	2	3	1	2	2	1	3	1
CO4	3	2	1	3	3	1	1	1
CO5	3	3	2	3	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

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COURSE INFORMATION SHEET

Course code: CA635
Course title: NATURAL LANGUAGE PROCESSING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: V/6
Branch: MCA

Course Objectives

This course enables the students:

A.	To understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
B.	To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks.
C.	To familiarize various NLP software libraries and data sets publicly available.
D.	To develop systems for various NLP problems with moderate complexity.
E.	To learn various strategies for NLP system evaluation and error analysis.

Course Outcomes

After the completion of this course, students will be able to:

1.	Describe the typical NLP problems, their importance & difficulty; and concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
2.	Demonstrate understanding of the relationship between NLP and statistics & machine learning.
3.	Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.
4.	Develop systems for various NLP problems with moderate complexity.
5.	Evaluate a NLP system, identify shortcomings and suggest solutions for these shortcomings.

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SYLLABUS

MODULE-I

Introduction to NLP

NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English. **(8L)**

MODULE-II

Language Modelling: N-gram and Neural Language Models

Language Modelling with N-gram, Simple N-gram models, Smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development.**(8L)**

MODULE-III

Parts-of-speech Tagging

Parts-of-speech Tagging: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, POS Tagging using Maximum Entropy Model.**(8L)**

MODULE-IV

Parsing

Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs. **(8L)**

MODULE-V

Semantics

Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet.**(8L)**

Text books:

1. Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.

Reference books:

1. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing".

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS &EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
✓ Continuous Internal Assessment	✓	✓	✓	✓	✓
✓ Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	3	2	3	1
CO2	3	1	3	3	2	2	2	1
CO3	2	2	1	1	2	2	3	1
CO4	3	2	1	3	3	1	2	1
CO5	2	3	2	3	3	2	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO5	CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: CA636
Course title: ARTIFICIAL INTELLIGENCE
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: V/6
Branch: MCA

Course Objectives

This course enables the students:

A.	An ability to apply knowledge of mathematics, science and engineering to both software and hardware design problems.
B.	An ability to design and conduct experiments and to analyze and interpret data related to software and hardware design solutions.
C.	An ability to design a system, component or process to meet desired needs within realistic constraints.
D.	An ability to function on multidisciplinary teams using current computer engineering tools and technologies.
E.	An ability to identify, formulate and solve engineering problems based on a fundamental understanding of concepts of computer engineering topics.

Head of Department

Course Outcomes

After the completion of this course, students will be able to:

1.	Recall the principles and approaches of artificial intelligence and understand different aspects of Intelligent agent.
2.	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
3.	Understanding the various concepts of knowledge representations and demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.
4.	To develop a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, Robotics etc.
5.	Write various types of LISP and PROLOG programs and explore more sophisticated LISP and PROLOG code.

SYLLABUS

MODULE-I

Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem.

Intelligent Agents: Agents & Environment, Nature Of Environment, Structure Of Agents, Goal Based Agents, Utility Based Agents, Learning Agents.

Problem Solving: Problems, Problem Space & Search: Defining The Problem As State Space Search, Production System, Problem Characteristics, Issues In The Design Of Search Programs.

(8L)

MODULE-II

Search Techniques: Solving Problems By Searching, Problem Solving Agents, Searching For Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies.

Heuristic Search Strategies: Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search For Constraint Satisfaction Problems.

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Adversarial Search: Games, Optimal Decisions & Strategies in Games, The Mini Max Search Procedure, Alpha-Beta Pruning, Additional Refinements, Iterative Deepening.**(8L)**

MODULE-III

Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, and Natural Deduction. **Representing Knowledge Using Rules:** Procedural Verses Declarative Knowledge, Logic Programming, Forward Verses Backward Reasoning, Matching, Control Knowledge**(8L)**

MODULE-IV

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster-Shafer Theory.

Planning: Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning.

Learning: Forms Of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning.
(8L)

MODULE-V

Natural Language Processing: Brief introduction to Syntactic Processing, Semantic Analysis, Discourse & Pragmatic Processing.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, planning uncertain movements, robotic software architecture, application domains.**(8L)**

Text books:

1. Russel S. and Norvig P. "Artificial Intelligence a Modern Approach", 3rd Edition, Pearson Education.
2. Rich E. & Knight K. "Artificial Intelligence", 2nd Edition, TMH, New Delhi.

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ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	2	2	1	1
CO2	3	1	3	2	1	2	2	1
CO3	2	2	3	1	1	2	3	2
CO4	2	2	1	3	3	1	1	1
CO5	3	2	3	2	2	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO4	CD2, CD6, CD7

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COURSE INFORMATION SHEET

Course code: CA637
Course title: IMAGE PROCESSING
Pre-requisite(s): Discrete Mathematics,
Co- requisite(s): Data Structures
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: V/6
Branch: MCA

Course Objective:
This course enables the students:

A.	Understand the fundamentals of digital image processing.
B.	Develop a Broad knowledge of Spatial and Frequency image transforms used for enhancing an image.
C.	Learn Image restoration techniques and noise models used for restoring an image.
D.	Understand Lossless and lossy image compression techniques.
E.	Know Morphological processing algorithms for various operations on an image.

Course Outcomes
After the completion of this course, students will be able to:

1.	Understand the concept of image formation, digitization and the role human visual system plays in perception of image data.
2.	Acquire an appreciation for spatial and frequency based techniques for enhancing the appearance of an image duly applying them in different applications.
3.	Discern the difference between noise models, gain an insight into assessing the degradation function and realize different spatial and frequency based filtering techniques for reduction and removal of noise.
4.	Synthesize a solution to image compression using the concept of information theory and lossless and lossy compression techniques.
5.	Design and create practical solutions using morphological operators for common image processing problems and assess the results.

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SYLLABUS

MODULE -I

What Is Digital Image Processing, Fundamental Steps in Digital Image Processing , Components of an Image Processing System, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. **(8L)**

MODULE -II

Enhancements in Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Enhancements in Frequency Domain**: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphism Filtering **(8L)**

MODULE -III

Image Restoration: A Model of the Image Degradation/Restoration Process, Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformations. **(8L)**

MODULE -IV

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression.**(8L)**

MODULE -V

Morphological Image Processing and Segmentation: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation. Some Basic Morphological Algorithms, Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. **(8L)**

Text books:

1. Rafael. C. & Woods Richard E. "Digital Image Processing", 3rd Edition, Pearson Education, New Delhi, 2009.

Reference books:

1. Pratt W.K. "Digital Image Processing", 4th Edition, John Wiley & sons Inc., 2006.
2. Sonka M., Hlavac Vaclav, Boyle Roger "Image Processing, Analysis and Machine Vision", 2nd Edition, Thomson Learning, India Edition, 2007.
3. Jayaraman "Digital Image Processing", Tata McGraw. Hill Education, 2011.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	2	1	2	2
CO2	1	3	1	3	2	2	1	1
CO3	2	3	1	1	2	2	2	2
CO4	3	2	3	3	3	1	2	1
CO5	3	1	3	3	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA638
Course title: SOFT COMPUTING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: V/6
Branch: MCA

Course Objective:
This course enables the students:

A.	To know the basic functions of different AI branches.
B.	To understand the functionalities of neural networks .
C.	To know the application of fuzzy logic.
D.	To understand the basic functionalities of optimizations through soft computing.
E.	To find the basic functions of soft computing.

Course Outcomes
After the completion of this course, students will be able to:

1.	Solve numerical on Fuzzy sets and Fuzzy Reasoning.
2.	Develop Fuzzy Inference System (FIS).
3.	Solve problems on Genetic Algorithms
4.	Explain concepts of neural networks
5.	Develop neural networks models for various applications.

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SYLLABUS

MODULE – I

Introduction to Artificial Intelligence System, Neural Network, Fuzzy Logic & Genetic Algorithm. Fuzzy Set Theory: Fuzzy Versus Crisp, Crisp Set, Fuzzy Set, Crip Relation, Fuzzy Relations. **(8L)**

MODULE – II

Fuzzy System: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System, Defuzzification Methods, and Applications.**(8L)**

MODULE – III

Genetic Algorithms, Basic Concepts, Creation Of Offspring, Working Principle, Encoding, Fitness Function, Reproduction.
Genetic Modeling, Inheritance Operations, Cross Over, Inversion And Deletion, Mutation Operator, Bit Wise Operators, Generation Cycle, Convergence Of Genetic Algorithm, Application, Multi-Level Optimization, Real Life Problems, Difference And Similarities Between GA And Other Traditional Methods, Advanced In GA.**(8L)**

MODULE – IV

Fundamentals Of Neural Networks, Basic Concepts Of Neural Network, Human Brain, Model Of An Artificial Neuron, Neural Network Architectures, Characteristic Of Neural Networks, Learning Method, Taxonomy Of Neural Network Architectures, History Of Neural Network Research, Early Neural Network Architectures, Some Application Domains.**(8L)**

MODULE – V

Back Propagation Network Architecture Of Back Propagation Network, Back Propagation Learning, Illustration, Applications, Effect Of Tuning Parameters Of The Back Propagation Neural Network, Selection Of Various Parameters In BPN, Variations Of Standard Back Propagation Algorithm.
Associative Memory And Adaptive Resonance Theory, Autocorrelations, Hetrocorrelators , Multiple Training Encoding Strategy, Exponential BAM, Associative Memory For Real Coded Pattern Pairs, Applications, Introduction To Adaptive Resonance Theory, ARTI, Character Recognition Using ARI1**(8L)**

Text Book:

1. Rajasekharan S. &Vijayalakshmi G. A. "Neural Network Fuzzy Logic and GenticAlgorithm Synthesis and Applications", Prentice Hall of India PLT, Pai, 2004.

Reference Book:

1. Jang JyhShing R, Sun C. T., Mizutani E. "Neuro Fuzzy and Soft Computing –A Computational Approach to Learning and Machine Intelligence", Prentice Hall of India, 1997.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	1	1	1	1	1	1
CO2	3	2	3	3	3	2	2	3
CO3	3	1	2	1	2	2	3	2
CO4	3	2	1	3	3	1	2	1
CO4	3	2	3	2	3	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA639
Course title: CLOUD COMPUTING
Pre-requisite(s):
Co-requisite(s):
Credits:3 L:3 T:0 P:0
Class schedule per week: 03
Class: MCA
Semester / Level:V/6
Branch: MCA

Course Objectives
This course enables the students to:

1.	Understand about security requirements in cloud.
2.	Learn about infrastructure security at different levels
3.	Know about management standards of cloud security
4.	Develop and Apply trust-based security model to different layers

Course Outcomes
After the completion of this course, students will be able to:

1.	Identify security aspects of each cloud model
2.	Implement a public cloud instance using a public cloud service provider
3.	Apply trust-based security model to different layer
4.	Develop a risk-management strategy for moving to the Cloud
5.	Identify various research domain of cloud computing

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SYLLABUS

Module I

Introduction: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

(8L)

Module II

Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

(8L)

Module III

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

(8L)

Module IV

Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS, Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.

(8L)

Module V

Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud, Recent developments in hybrid cloud and cloud security**(8L)**

Text Books:

1. Rhoton John, "Cloud Computing Explained: Implementation Handbook for Enterprises", 2009.
2. Tim Mather, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)", ISBN-10: 0596802765, O'Reilly Media, 2009.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
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CD5	Industrial visits/in-plant training
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CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	1	1	1	1
CO2	3	2	1	3	3	2	1	1
CO3	1	1	1	2	1	2	3	1
CO4	3	2	1	3	3	2	2	1
CO5	3	3	2	2	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA640
Course title: MACHINE LEARNING
Pre-requisite(s): Design of Algorithms, Mathematics 2, Artificial Intelligence
Co- requisite(s): None
Credits:3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level:V/6
Branch: MCA

Course Objectives
This course enables the students:

1.	To formulate machine learning problems corresponding to different applications.
2.	To understand various supervised, semi-supervised and unsupervised machine learning algorithms.
3.	To familiarize various machine learning software libraries and data sets publicly available.
4.	To develop machine learning based system for various real-world problems.
5.	To assess how the choice of a machine learning algorithm impacts the accuracy of a system.

Course Outcomes
After the completion of this course, students will be able to:

1.	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity
2.	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses
3.	Implement machine learning solutions to classification, regression, and clustering problems
4.	Design and implement various machine learning algorithms in a range of real-world applications
5.	Evaluate and analyse the performance of a machine learning algorithm or a system based on machine learning algorithm.

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SYLLABUS

Module I
Introduction to Machine Learning
Machine Learning – what and why? Basics of Linear Algebra and Statistics,
Overview of target function representations; Linear Regression.

(8L)

Module II
Supervised Learning
Basics of Feature Selection and Evaluation, Decision Tree, Overfitting and Pruning, Logistic regression, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts.

(8L)

Module III
Neural Networks
Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

(8L)

Module IV
Unsupervised and Semi Supervised Learning
Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-meanspartitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabled data.

(8L)

Module V
Ensemble
Committees of multiple hypotheses, bagging, boosting, active learning with ensembles.

(8L)

Text Books:

1. Mitchell Tom, “Machine Learning”, Latest Edition, Mc-Graw Hill.

Reference Books:

1. Shwartz Shai Shalev, and David Shai Ben, “Understanding Machine Learning”, Cambridge University Press, 2017.
2. Bishop Christopher “Pattern Recognition and Machine Learning”, Springer, 2006

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	3	1	1	2
CO2	3	2	3	3	2	2	2	1
CO3	2	3	1	1	1	1	1	2
CO4	3	2	1	3	3	1	2	1
CO5	3	3	3	2	2	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA641
Course title: IN-MEMORY COMPUTING
Pre-requisite(s):
Co-requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: MCA
Semester / Level: V/6
Branch: MCA

Course Objectives
This course enables the students:

A.	To appreciate the problems of computing with big data
B.	To understand the basic architecture of Apache Spark
C.	To Understand the structured APIs and data structures in Spark
D.	To understand how to handle data streams in Spark
E.	To apply Spark for basic machine learning problems.

Course Outcomes
After the completion of this course, students will be:

1.	Able to map problems to in memory computing architectures.
2.	Able to apply Spark for solving simple problems using the basic data structures
3.	Able to perform joins, sorts, shuffles and other related operations
4.	Able to work with streaming data in Spark and analyse the results
5.	Able to perform simple classification and clustering algorithms using Spark.

Head of Department

SYLLABUS

MODULE -I
An introduction to Apache Spark, Basic Architecture, Spark APIs, Spark Session, Dataframes, Transformations, Actions, Datasets, Structured Streaming**(8L)**

MODULE -II
Structured APIs, Overview, Basic Structured Operations, Different types of Data, Aggregations, Joins, Data Sources, SparkSQL, Datasets
(8L)

MODULE -III
Low Level API, Resilient Distributed Datasets, Advanced Resilient Distributed Datasets, Distributed shared variables. **(8L)**

MODULE -IV
Streaming, Fundamentals, Structured Streaming basics, Event time and stateful processing

(8L)
MODULE -V
Machine Learning, Preprocessing and feature engineering, Classification, Unsupervised learning

(8L)
Text books:

1. Chambers B., Zaharaia M., "Spark The Definitive Guide – Big Data Processing made Simple", 1st Edition, O'Reilly Media, 2018.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	2	1	2	1
CO2	3	2	3	3	2	2	1	1
CO3	3	3	1	1	2	1	1	1
CO4	2	2	1	3	3	1	2	1
CO5	3	1	3	3	3	1	2	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD5

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COURSE INFORMATION SHEET

Course code: CA630
Course title: NETWORK SECURITY AND CRYPTOGRAPHY
Pre-requisite(s):
Co- requisite(s):
Credits:4 L:3 T:1 P:0
Class schedule per week: 04
Class: MCA
Semester / Level:V/6
Branch: MCA

Course Objectives
This course enables the students:

1.	To understand the foundations of cryptographic attacks.
2.	To gain knowledge of encrypting data, and to choose between different algorithms.
3.	Prepare students for research in the area of cryptography and enhance students communication and problem solving skills
4.	To differentiate between the encryption techniques and know their suitability to an application.
5.	To effectively apply their knowledge to the construction of secure cryptosystems.

Course Outcomes
After the completion of this course, students will be able to:

1.	Understand the various types of cryptographic attacks and the mathematics behind cryptography.
2.	Describe the various types of ciphers and hash functions.
3.	Apply the different cryptographic techniques to solve real life problems.
4.	Evaluate different techniques as to their suitability to various applications.
5.	Develop a cryptosystem keeping in view social issues and societal impacts.

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SYLLABUS

Module I
Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols - Advanced Protocols - Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography.
(8L)

Module II
Key Length - Key Management – Public Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information. **(8L)**

Module III
Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation - Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab – RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening. **(8L)**

Module IV
Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design - N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes **(8L)**

Module V
RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes - Ongchnorr-Shamir -Cellular Automata - Feige-Fiat-Shamir -Guillou-Quisquater - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol - IBM Secret-Key Management Protocol - MITRENET - Kerberos - IBM Common Cryptographic Architecture. **(8L)**

Text Books:
1. Schneier Bruce, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", 2nd Edition, John Wiley & Sons, Inc, 1996.
2. Mao Wenbo, "Modern Cryptography Theory and Practice", Pearson Education, 2004.
3. KahateAtul, "Cryptography and Network Security", Tata McGrew Hill, 2003.

Reference Book:
1. Stallings William, "Cryptography & Network Security Principles and Practice", Pearson Education.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
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CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
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CO2	3	1	1	3	3	2	1	1
CO3	3	3	1	1	2	1	1	1
CO4	1	2	1	3	3	1	2	2
CO5	2	2	2	3	3	2	3	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD5

COURSE INFORMATION SHEET

Course code: CA631
Course title:INTERNET OF THINGS(IoT)
Pre-requisite(s):
Co-requisite(s):
Credits:4 L:3 T:1 P:0
Class schedule per week: 04
Class: MCA
Semester / Level:V/6
Branch: MCA

Course Objectives
This course enables the students to:

1.	Understand the basic concept and the IoT Paradigm
2.	Know the state of art architecture for IoT applications
3.	Learn the available protocols used for IoT
4.	Design basic IoT Applications.
5.	Evaluate optimal IoT applications.

Course Outcomes
After the completion of this course, students will be able to:

1.	Identify the IoT Components and its capabilities
2.	Explain the architectural view of IoT under real world constraints
3.	Analyse the different Network and link layer protocols
4.	Evaluate and choose among the transport layer protocols
5.	Design an IoT application

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SYLLABUS

Module I
IoT - An Architectural Overview
Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management. **(8L)**

Module II
IoT Architecture - State of the Art
Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View **(8L)**

Module III
IoT Data Link Layer & Network Layer Protocols
PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART,BluetoothLow Energy, Zigbee Smart Energy
Network Layer-IPv4, IPv6, 6LoWPAN **(8L)**

Module IV
Transport & Session Layer Protocols
Transport Layer (TCP, MPTCP, UDP,) Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT. **(8L)**

Module V
Layer Protocols & Security
Service Layer -oneM2M, ETSI M2M
Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer protocols. **(8L)**

Text Books:

1. Holler Jan, TsiatsisVlasios, Mulligan Catherine, Avesand Stefan, Karnouskos Stamatis, Boyle David, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Waher Peter, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM-MUMBAI

Reference Books:

1. Reiter Bernd Scholz, Michahelles Florian, “Architecting the Internet of Things”, Springer, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2.
2. Minoli Daniel, “Building the Internet of Things with IPv6 and MIPv6:”.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	2	1	2	1
CO2	3	2	3	3	2	2	1	1
CO3	3	3	1	1	2	1	1	1
CO4	2	2	1	3	3	1	2	1
CO5	3	3	3	2	2	1	3	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

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MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD5

COURSE INFORMATION SHEET

Course code: CA632
Course title: MOBILE COMPUTING
Pre-requisite(s): Basic Networking Fundamentals
Co-requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: MCA
Semester / Level: V/6
Branch: MCA
Name of Teacher:

Course Objectives
This course enables the students:

A.	Understand basic mobile network concepts and its architectures.
B.	Know Protocols like mobile telephony and introduce to the concepts of bluetooths etc.
C.	Comprehend the GSM architectures and its features that support mobile communications.
D.	Understand the network management and Middleware services used in Ip and Mobile telephony
E.	Get accustomed to the concepts like GPRS, 3G, 4G networks

Course Outcomes
After the completion of this course, students will be:

1.	Identify the role of cellular networks in Mobile and Pervasive Computing
2.	Analyse about the basic architecture for a pervasive computing environment
3.	Assess the principles for routing and allocating the resources on the 3G-4G wireless network
4.	Evaluate mobile computing applications based on the paradigm of context aware computing
5.	To design and develop applications in mobile and pervasive computing environment

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SYLLABUS

Module –I

Introduction: Mobility of bits and bytes, wireless the beginning, mobile computing, dialogue control, Networks, middleware and gateways, application and services, developing mobile computing applications, security in mobile computing, standard bodies. Mobile Computing Architecture: architecture for mobile computing, three tier architecture,

(8L)

Module –II

Mobile Computing through Telephony: evolution of telephony, multiple access procedures, mobile computing through telephone. Emerging Technologies: introduction, Bluetooth, radio frequency identification, wireless broadband, mobile IP, IPV6,.**(8L)**

Module –III

Global System for Mobile Communications GSM: introduction, GSM architecture , call routing in GSM, PLMN interface, GSM address and identifiers, network aspect in GSM, GSM frequency allocation, authenticity and security. Short Message Service SMS : Mobile computing over SMS, Short message services(SMS) **(8L)**

Module –IV

General Packet Radio Service GPRS:GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, applications for GPRS, limitations for GPRS, billing and charging in GPRS. Wireless Application Protocol WAP: introduction , WAP, MMS, GPRS applications.

CDMA and 3G

Client Programming: introduction, moving beyond the desktop, a peak under the hood: hardware overview, mobile phone, PDA, design constraints in application for handheld devices. **(8L)**

Module –V

Voice Over Internet Protocol and Convergence: VoIP, H 323 framework for VoIP 564, SIP, comparision between H.323 and SIP 570, Real time protocol, convergence technologies, call routing, voice over IP applications, IP multimedia subsystem, Mobile VoIP. **(8L)**

Head of Department

Text Book:

1. Talukedar Ashok, Ahmed Hasan, YavagalRoopa R "Mobile Computing Technology, Applications and Service Creation",Tata McGraw -Hill Education ,2010.

Reference Books:

1. Schiller Jochen H. "Mobile Communications", 2nd Edition, Addison wesley.
2. Kamal Raj "MobileComputing", 2nd Edition, Oxford University Press.
3. Behravanfar Reza "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004.
4. Adelstein Frank, Gupta Sandeep K.S., Richard III Golden G., Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
5. Hansmann Uwe, MerkLothar, Nicklous Martin S., Stober Thomas "Principles of Mobile Computing", 2nd Edition., Springer, 2003.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	2	3	1	1
CO2	2	3	3	2	2	3	1	1
CO3	2	2	1	2	2	2	1	1
CO4	2	2	1	3	3	1	2	1
CO5	3	3	2	2	2	1	3	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD5

COURSE INFORMATION SHEET

Course code: CA634
Course title: Multimedia and Animation
Pre-requisite(s):
Co-requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: MCA
Semester / Level: V/6
Branch: MCA

Head of Department

Course Objectives

This course enables the students:

A.	To understand what constitutes multimedia
B.	Understand the underlying concepts and mathematics of multimedia
C.	Get acquainted with the hardware and software that constitutes multimedia
D.	Know basic algorithms in the field of multimedia and animation
E.	Know file formats and their importance

Course Outcomes

After the completion of this course, students will be able to:

1.	Evaluate the uses of multimedia and different standards in graphics, video, audio, animation, CDROM and other hardware
2.	Apply the principles of multimedia development, including story-board techniques and develop a suitable story-board for a small multimedia project
3.	Implement the multimedia project using appropriate technology
4.	Describe and evaluate a variety of 3D principles and techniques
5.	Design and create concept artwork for a short animated project, including storyboards, turnaround artwork and technical drawings.

SYLLABUS

MODULE -I

Introduction, Multimedia Information Applications, Issues and Challenges, Semantic Models for Multimedia Information Systems, Multimedia Semantic Models
(8L)

MODULE -II

Multimedia database Searching, Image Segmentation, Video Parsing and Segmentation Approaches, Iconic-Based Grouping and Browsing Approaches, Knowledge-Based Event Modeling Approaches, Characteristics of Video Data Modeling, Motion Detection and Tracking Approaches, Object Recognition Approaches, Content-Based Retrieval. **(8L)**

MODULE -III

Multimedia Browsing, Video Browsing, Key Frame Selections **(8L)**

MODULE -IV

Augmented Transition Network Model (ATN), Spatial and Temporal Relations of Semantic Objects, Multimedia Presentations, Multimedia Database Searching, Multimedia Browsing, User Interactions and Loops
(8L)

Head of Department

MODULE -V

Object Composition Petri Net Model, Interval Based Conceptual Models **(8L)**

Text Book:

1. Chen S C, Kashyap R L, Ghafoor A. "Semantic Models for Multimedia Database Searching and Browsing", Kluwer Academic Publishers.

Reference Book:

1. Muneesawang P., Guan L. "Multimedia Database Retrieval a Human-Centered Approach", Springer Publication, 2006.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 % (3 × 10%)
Assignment (s)	10
Seminar before a committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	2	1	2	2
CO2	3	2	2	1	2	2	3	1
CO3	1	3	1	1	2	1	1	1
CO4	2	2	1	3	3	1	2	1
CO5	3	3	3	2	2	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD2,CD3,CD6
CO2	CD1, CD6,CD3
CO3	CD6, CD7, CD3,CD1
CO4	CD1, CD3,CD6,CD7

COURSE INFORMATION SHEET

Course code: CA602
Course title: COMPUTER GRAPHICS LAB
Pre-requisite(s):
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level: V/6
Branch: MCA

Head of Department

Course Objectives

This course enables the students:

1.	To learn computer graphics by practical
2.	To Learn coding for various graphics tools.
3.	To learn the various theory by implementation using programming
4.	To identify the limitations of C Language for graphics related problem.
5.	To know the practical application of computer graphics.

Course Outcomes

After the completion of this course, students will be able:

CO1	To code programs efficiently.
CO2	To translate the graphics algorithm to programs.
CO3	To test and execute the graphical syntax and logical errors.
CO4	To apply programming to solve simple graphical problems using functions.
CO5	To write the C program efficiently for transformation problems.

SYLLABUS

List of Programs as Assignments:

Write programs using ***C language***

1. To get the background color.
2. To set the background color.
3. To plot a point of co-ordinate (100,100).
4. To draw a line using the line function.
5. To draw a line using the line function. Take the end co-ordinates from the user.
6. To draw a triangle using the polygon function.
7. To draw a polygon of ‘n’ edges using polygon function.
8. To draw a polygon of ‘n’ edges taken from the user using the polygon function.
9. To draw a circle using the circle function.

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10. To draw a circle of radius ‘r’ taken from the user using the circle function.
11. To draw a line using DDA algorithm.
12. To draw a line using Bresenham’s line algorithm.
13. To draw a circle using midpoint circle algorithm.
14. To draw a line using Bresenham’s line algo, where end points are taken from the user.
15. To draw a line using DDA algo, where end points are taken from the user.
16. To draw ‘n’ concentric circles taken from user using midpoint algorithm.
17. To create a line and translate it.
18. To create a line and increase its size with a value taken from user.
19. To create an equilateral triangle.
20. To draw a line and rotate it with angle of 45.
21. To create a circle and translate it.
22. To create a circle and translate it with a value taken from user.
23. To create an equilateral triangle and rotate it with angle of 45.
24. To create an equilateral triangle and create reflection.
25. To scale a rectangle.
26. To shear a rectangle. Take the shear factor from the user.
27. To create an equilateral triangle and translate, rotate and scale it.
28. To draw a line with shear and translation.
29. Draw bar chart.
30. Draw pie chart.

Books recommended:

TEXT BOOK

1. Roger T. Stevens, Advanced Graphics Programming in C and C++, BPB Publication
2. Donald Hearn, M. Pauline Baker, Computer Graphics, C Version, Prentice Hall Publication
3. https://www.programmingsimplified.com/c/graphics.

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COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

Course Outcome	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	3	2	1	1
CO2	3	3	2	1	1	3	3	3
CO3	2	3	3	2	1	1	2	3
CO4	1	2	2	1	1	2	2	3
CO5	3	3	2	2	2	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD6
CO2	CD1, CD6
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6
CO5	CD1,CD2

COURSE INFORMATION SHEET

Course code: CA604
Course title: SYSTEM SIMULATION AND MODELLING LAB
Pre-requisite(s):
Co- requisite(s):
Credits:1.5 L: 0 T: 0 P:3
Class schedule per week: 3
Class: MCA
Semester / Level: V/6
Branch: MCA
Name of Teacher:

Head of Department

Course Objectives

This course enables the students to:

1.	Introduction to 3D Studio Max
2.	2D Splines, Shapes & Compound Objects
3.	Simulation & Effects, Lighting & Camera, Texturing with Max
4.	Rendering with V-Ray

Course Outcomes

After the completion of this course, students will be able to:

CO1	Impart the fundamental knowledge on using various analytical tools like ANSYS, FLUENT, etc., for Engineering Simulation.
CO2	Use of these tools for any engineering and real time applications.
CO3	Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment.
CO4	Create 3D object from 2D object
CO5	Develop a real life model using queuing system.

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SYLLABUS

List of Programs as Assignments:

Lab Assignment No: 1

Objective:

Q1. Introduction to 3D Studio Max.

Q2. Exploring the Max Interface.

Lab Assignment No: 2

Objective:

Q1. Understanding 2D Splines & Shape

Q2. Convert 2D to 3D object using extrude, bevel, loft, terrain etc.

Lab Assignment No: 3

Objective:

Q1 Modeling with polygon objects

Q2.Building Simple & Complex Scene

Lab Assignment No: 4

Objective:

Q1. Creating key frames & Auto Key/Set Key

Q2. Animating with simple controllers.

Lab Assignment No: 5

Objective:

Q1. Simulation & Effects.

Q2. Bind to space warp objects.

Lab Assignment No: 6

Objective:

Q1. Configuring & Aiming Cameras

Q2. Using Camera Motion Blur & Depth of Field.

Lab Assignment No: 7

Objective:

Q1. Texturing with Max.

Q2. Create & Apply standard material

Lab Assignment No: 8

Objective:

Q1. Rendering with V-Ray.

Q2. Introduction to Scene

Lab Assignment No: 9

Objective:

Q1. Create & Assign Textures.

Q2. Basic Settings for Texturing.

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Books recommended:

TEXT BOOKS

1. Beginning Blender: Open Source 3D Modeling, Animation, and Game Design By Lance Flavel**(T1)**
2. 3d'sMax5Fundamentals nside3dsmax7 By Ted Boardman **(T2)**

REFERENCE BOOKS

1. 3D Modeling and Animation By Michael G.**(R1)**

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz (es)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Head of Department

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	2	3	3	3	2	1	1
CO2	3	3	2	1	1	3	3	3
CO3	2	3	3	2	1	1	2	3
CO4	1	2	2	1	1	2	2	3
CO5	2	3	3	2	1	1	2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
B. I.T. MESRA, RANCHI

Date: 17-04-2018

Notice

The Departmental Academic Committee meeting will be held on 19th April 2018 at 11:00 AM in the office of undersigned to finalize the Course Structure under CBCS curriculum revision. All the members are requested to make it convenient to attend the same.

(V. Bhattacharjee) 17/4/18
Prof. & Head

Copy to:

1. Dr. G. Sahoo (Member)
2. Dr. S. Dutta (Member)
3. Dr. K. Rajnish (Member)
4. Dr. A. Mustafi (Member)
5. Dr. B.K. Sarkar (Member)
6. Dr. P. Paul (Member)
7. Dr. I. Mukherjee (Member)
8. Dr. S. Pal (Member)
9. Dr. C. Jeganathan (Member) 17/4/18

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
B. I. T. MESRA, RANCHI

Date: 19/04/2018

Minutes of Meeting DAC

A DAC meeting was held on 19th April at the 11 A.M. The committee members went through all the document regarding CBCS Course Structure. The reference documents were presented before the members for their consent.
All the members approved the proposed course structure.

(Dr. G. Sahoo)
Member

(Dr. S. Dutta)
Member

(Dr. K. Rajnish)
Member

(Dr. A. Mustafi)
Member

(Dr. B. K. Sarkar)
Member

(Dr. P. Paul)
Member

(Dr. I. Mukherjee)
Member

(Dr. S. Pal)
Member, ECE

(Dr.C. Jeganathan)
Member, Remote Sensing

19/4/18
(Dr. V. Bhattacharjee)
Chairman

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
B. I.T. MESRA, RANCHI

Date: 18-04-2018

Notice

The Departmental Board of Studies meeting will be held on 24th April 2018 at 10:00 AM in the office of undersigned to finalize the Course Structure under CBCS curriculum revision. All the members are requested to make it convenient to attend the same.

18/4/18
(V. Bhattacharjee)
Prof. & Head

Copy to:

1. Dr. G. Sahoo (Member)
2. Dr. S. Dutta (Member)
3. Dr. K. Rajnish (Member)
4. Dr. A. Mustafi (Member)
5. Dr. B.K. Sarkar (Member)
6. Dr. P. Paul (Member)
7. Dr. I. Mukherjee (Member)
8. Dr. S. Pal (Member)
9. Dr. C. Jeganathan (Member)
10. Dr. P. K. Reddy (IIIT, Hyderabad) (External Member)
11. Dr. Chiranjeev Kumar (IIT-ISM Dhanbad) (External Member)

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Head of Department

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Department of Computer Science & Engineering
B. I. T., Mesra, Ranchi

Date: 24-04-2018

MINUTES OF THE MEETING

A meeting of the Departmental Board of Studies was held on 24.04.2018 at 10:00 A.M in the office of the Head of Department to finalize the Course Structure under CBCS curriculum revision. The Course Structure for the B.Tech (CSE), B.Tech (IT), M.Tech (CSE), M.Tech (IT), M.Tech (IS), M.Tech (S.E), MCA and BCA was presented. The external BOS members went through each programme course structure in detail. Deliberations were made and suggestions as follows were made:

1. PC should shift to Semester IV and PE to start from Semester V.
2. Course on Web programming to be included for B.Tech (CSE).
3. More skill oriented courses as PC for B.Tech (IT).
4. Hierarchical arrangement of courses in order of degree of complexity in specialization areas was decided.
5. HPC was removed as a specialization and Digital Development included for both CSE and IT.
6. Specialization were also organized according to dependency.
7. For PG courses minor changes were suggested and incorporated.

The meeting ended with a vote of thanks by the Chairman to all members ,specially the External members.

On leave
(Dr. G. Sahoo)
Member

(Dr. Sandip Dutta)
Member

(Dr. K. Rajnish)
Member

(Dr. A. Mustafi)
Member

(Dr. B. K. Sarkar)
Member

(Dr. P. Paul)
(Member)

(Dr. I. Mukherjee)
Member

(Dr. S. Pal) 27/04/18
Member (ECE)

(Dr. C. Jeganathan)
Member (RS)

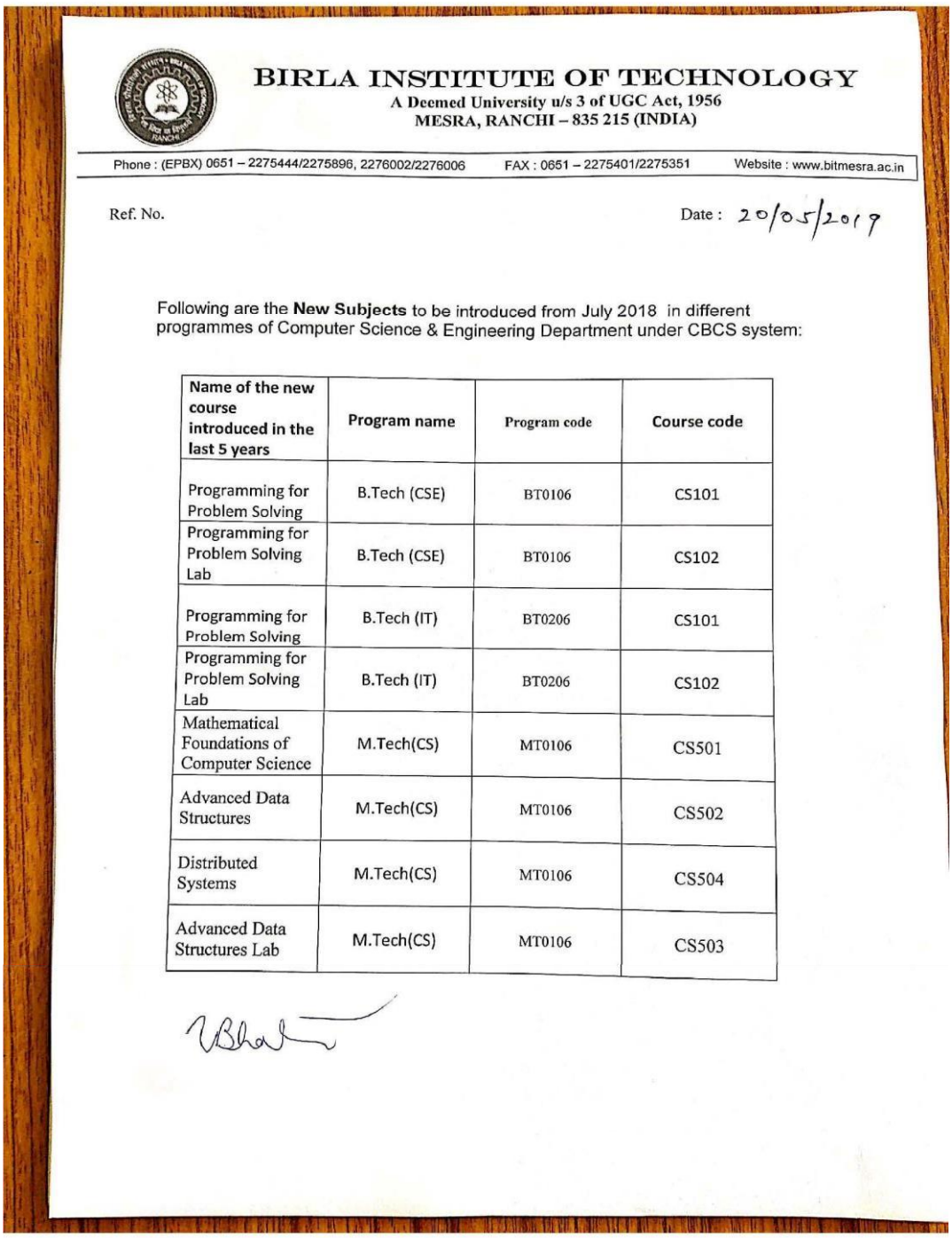
(Dr. P. K. Reddy) 24/04/18
External Member

(Dr. Chiranjeev Kumar) 24/04/18
External Member

(Dr. V.Bhattacharjee) 24/4/18
Chairman

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Head of Department



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Ref. No.

Date : 20/05/2019

Following are the **New Subjects** to be introduced from July 2018 in different programmes of Computer Science & Engineering Department under CBCS system:

Name of the new course introduced in the last 5 years	Program name	Program code	Course code
Programming for Problem Solving	B.Tech (CSE)	BT0106	CS101
Programming for Problem Solving Lab	B.Tech (CSE)	BT0106	CS102
Programming for Problem Solving	B.Tech (IT)	BT0206	CS101
Programming for Problem Solving Lab	B.Tech (IT)	BT0206	CS102
Mathematical Foundations of Computer Science	M.Tech(CS)	MT0106	CS501
Advanced Data Structures	M.Tech(CS)	MT0106	CS502
Distributed Systems	M.Tech(CS)	MT0106	CS504
Advanced Data Structures Lab	M.Tech(CS)	MT0106	CS503

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Advanced Computer Algorithm	M.Tech(CS)	MT0106	CS509
Advanced Database Management System	M.Tech(CS)	MT0106	CS511
Artificial Intelligence	M.Tech(CS)	MT0106	CS512
Advanced Computer Algorithm Lab	M.Tech(CS)	MT0106	CS510
Machine Learning	M.Tech(CS)	MT0106	CS506
Wireless Sensor Networks	M.Tech(CS)	MT0106	IT503
Matlab Programming	M.Tech(CS)	MT0106	IT509
Java Programming	M.Tech(CS)	MT0106	IT510
R Programming	M.Tech(CS)	MT0106	IT511
Advanced Operating System	M.Tech(CS)	MT0106	CS515
Data Mining and Data Analysis	M.Tech(CS)	MT0106	IT516
Data Mining and Data Analysis Lab	M.Tech(CS)	MT0106	IT517
Parallel Computing Lab	M.Tech(CS)	MT0106	CS518

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Advanced Operating System Lab	M.Tech(CS)	MT0106	CS516
Mathematical Foundations of Computer Science	M.Tech(IT)	MT0406	CS501
Advanced Data Structures	M.Tech(IT)	MT0406	CS502
Information Theory and Coding	M.Tech(IT)	MT0406	IT501
Advanced Data Structures Lab	M.Tech(IT)	MT0406	CS503
Advanced Computer Algorithm	M.Tech(IT)	MT0406	CS509
Advanced Web Technology	M.Tech(IT)	MT0406	IT512
Big Data Analytics	M.Tech(IT)	MT0406	IT513
Advanced Computer Algorithm Lab	M.Tech(IT)	MT0406	CS510
Machine Learning	M.Tech(IT)	MT0406	CS506
Wireless Sensor Networks	M.Tech(IT)	MT0406	IT503
Matlab Programming	M.Tech(IT)	MT0406	IT509
Java Programming	M.Tech(IT)	MT0406	IT510

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Data Mining and Data Analysis	M.Tech(IT)	MT0406	IT516
Internet of Things(IoT)	M.Tech(IT)	MT0406	IT518
Data Mining and Data Analysis Lab	M.Tech(IT)	MT0406	IT517
Internet of Things(IoT) Lab	M.Tech(IT)	MT0406	IT519
R Programming	M.Tech(IT)	MT0406	IT511
Mathematical Foundations of Computer Science	M.Tech(IS)	MT0306	CS501
Advanced Data Structures	M.Tech(IS)	MT0306	CS502
Fundamentals of Information Security	M.Tech(IS)	MT0306	IT502
Advanced Data Structures Lab	M.Tech(IS)	MT0306	CS503
Advanced Computer Algorithm	M.Tech(IS)	MT0306	CS509
Cryptography	M.Tech(IS)	MT0306	IT514
Digital Forensics	M.Tech(IS)	MT0306	IT515
Advanced Computer Algorithm Lab	M.Tech(IS)	MT0306	CS510

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Applied Cryptography	M.Tech(IS)	MT0306	IT504
Mobile and Wireless security	M.Tech(IS)	MT0306	IT505
Multimedia Security	M.Tech(IS)	MT0306	IT506
Matlab Programming	M.Tech(IS)	MT0306	IT509
Java Programming	M.Tech(IS)	MT0306	IT510
Network Security	M.Tech(IS)	MT0306	IT520
Data Mining and Data Analysis	M.Tech(IS)	MT0306	IT516
Internet of Things(IoT)	M.Tech(IS)	MT0306	IT518
Data Mining and Data Analysis Lab	M.Tech(IS)	MT0306	IT517
Internet of Things(IoT) Lab	M.Tech(IS)	MT0306	IT519
R Programming	M.Tech(IS)	MT0306	IT511
Internet of Things	M.Tech(IS)	MT0306	IT518
Cyber Security and Digital Forensics	M.Tech(IS)	MT0306	IT522

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