BIRLA INSTITUTE OF TECHNOLOGY- MESRA, RANCHI
NEW COURSE STRUCTURE - To be effective from academic session 2021 - 22
Based on CBCS system & OBE model
Recommended scheme of study
(For Computer Science & Engg.)

Course Level	Semester of Study (Recomended)	Course Code	Course Name	**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	**FS**	MA 103	Mathematics - I	3	1	0	4
		CH101	Chemistry	3	1	0	4
	GE	EC101	Basic of Electronics and Communication Engineering	3	1	0	4
		ME101	Basic of Mechanical Engineering	3	1	0	4
	FS	CE101	Environmental Sciences	2	0	0	2
	LABORATORIES						
	FS	CH102	Chemistry Lab	0	0	3	1.5
	GE	EC102	Electronics and Communication Lab	0	0	3	1.5
		ME102	Engineering Graphics	0	0	4	2
	MC	MC101/102/ 103/104	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
TOTAL (Theory + Labs)							**24**
SECOND	**THEORY**						
	FS	MA107	Mathematics - II	3	1	0	4
		PH113	Physics	3	1	0	4
		BE101	Biological Sciences	2	0	0	2
	GE	CS101	Programming for problem Solving	3	1	0	4
		EE101	Basics of Electrical Engineering	3	1	0	4
	LABORATORIES						
	HSS	MT132	Communication Skills - I	0	0	3	1.5
	FS	PH114	Physics Lab	0	0	3	1.5
	GE	CS102	Programming for problem Solving laboratories	0	0	3	1.5
		PE101	Workshop Practice	0	0	3	1.5
	MC	MC105/106/ 107/108	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
TOTAL (Theory + Labs)							**25**
THIRD	**THEORY**						
	PC		PC including Laboratories				21.5
		MA205	Discrete Mathematics	3	1	0	4
		EC203	Digital System Design	3	0	0	3
		CS231	Data Structures	3	1	0	4
		CS233	Object Oriented Programming and Des	3	0	0	3
		CS235	Computer Organization and Architectu	3	0	0	3
	LABORATORIES						
	PC	EC204	Digital System Design Lab	0	0	3	1.5

		CS232	Data Structures Lab	0	0	3	1.5
		CS234	OOPDP Lab	0	0	3	1.5
	GE	EE102	Electrical Engineering lab	0	0	3	1.5
	MC	MC201/ 202/203/20 4	Choice of: NCC/NSS/PT & Games/ Cr	0	0	2	1
TOTAL (Theory + Labs)							**24**
THEORY							
FOURTH	**FS**	MA203	Numerical Methods	2	0	0	2
	HSS	MT131	UHV2: Understanding Harmony	3	0	0	3
	PC/PE		PC + PE including Laboratories*				14
	PC	CS237	Database Management System	3	1	0	4
		CS239	Operating System	3	1	0	4
		CS241	Design and Analysis of Algorithm	3	0	0	3
	OE		Open Elective-I / MOOC	3	0	0	3
	LABORATORIES						
	PC/PE	CS238	DBMS Lab	0	0	3	1.5
		CS240	Shell and Kernel Programming Lab	0	0	3	1.5
	FS	MA204	Numerical Methods Lab	0	0	2	1
	MC	MC205/ 206/207/20 8	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
TOTAL (Theory + Labs)							**24**
FIFTH	**PC/PE**		PC + PE including Laboratories*				21
	PC	IT333	Data Comm.& Computer Networks	3	0	0	3
		CS331	Formal Language and Automata Theory	3	0	0	3
		IT335	Data Mining Concepts and Techniques	3	0	0	3
	PE		PROGRAM ELECTIVE-I	3	0	0	3
			PROGRAM ELECTIVE-II	3	0	0	3
	OE		Open Elective-II / MOOC	3	0	0	3
	LABORATORIES						
	PC	IT334	DCCN Lab	0	0	3	1.5
		IT202/ CS332	Basic IT Workshop	0	0	3	1.5
		IT336	Data Mining Lab	0	0	3	1.5
			PROGRAM ELECTIVE LAB-II	0	0	3	1.5
TOTAL (Theory + Labs)							**24**
THEORY							
SIXTH	**PC/PE**		PC + PE including Laboratories*				15.5
	PC	CS333	Compiler Design	3	1	0	4
		CS335	Artificial Intelligence and Machine Lea	3	1	0	4
	PE		PROGRAM ELECTIVE-III	3	0	0	3
	OE		Open Elective-III / MOOC	3	0	0	3
	HSS	MT204	Constitution of India	2	0	0	NC
	PROJ	MC300	Summer training				2
	LABORATORIES						

	PC	CS334	Compiler Design Lab	0	0	3	1.5
		CS336	AI & ML Lab	0	0	3	1.5
		CS338	Embeded Systems Lab				1.5
	HSS	MT133	Communication Skills - II	0	0	3	1.5
TOTAL (Theory + Labs)							**22**
THEORY							
SEVENTH	PC/PE		PC + PE including Laboratories*				9.0
	PE		PROGRAM ELECTIVE-IV	3	0	0	3
			PROGRAM ELECTIVE-V	3	0	0	3
	OE		Open Elective-IV / MOOC	3	0	0	3
	PROJ	XX400M	Minor Project				3
LABORATORIES							
	PE		PROGRAM ELECTIVE LAB-IV	0	0	3	1.5
			PROGRAM ELECTIVE LAB-V	0	0	3	1.5
TOTAL (Theory + Labs)							**15**
EIGHTH	PROJ	XX400	Research Project / Industry Internship				**10**
GRAND TOTAL							**168**

***Requirment of Programme Elective Courses (Theory/ Lab) : 18 credit or above**

List of Program Electives (PE)

PE / LEVEL		Code no.	Name of the PE Courses	Prerequis with code	L	T	P	C
3	PE 1	CS341	Optimization Technique	Design anc	3	0	0	3
3		CS343	System Programming	NIL	3	0	0	3
3		IT351	Natural Language Processing		3	0	0	3
3		CS445	Information and Coding Theory	Discrete M	3	0	0	3
3	PE 2	IT447	Information Retrieval		3	0	0	3
		IT448	Information Retrieval Lab		0	0	3	1.5
3		CS347	Soft Computing	Discrete M	3	0	0	3
		CS338	Soft Computing Lab		0	0	3	1.5
3		CS349	Simulation and Modelling	Data Struc	3	0	0	3
		CS350	Simulation and Modelling Lab		0	0	3	1.5
		IT337	Software Engineering		3	0	0	3
3		IT338	Software Engineering & Testing Lab		0	0	3	1.5
4	PE3	IT349	Cryptography & Network Security	Mathemati	3	0	0	3
4		IT354	Wireless Sensor Network	Data comn	3	0	0	3
4		IT353	Block Chain Technology	NIL	3	0	0	3
4		CS351	Nature Inspired Computing	AI & ML	3	0	0	3
4	PE4	CS431	Computer Graphics	Design anc	3	0	0	3
4		CS432	Computer Graphics Lab	Computer	0	0	3	1.5
4		CS433	Knowledgebase Systems	Artificial I	3	0	0	3
4		CS434	Knowledgebase Systems Lab	Artificial Intelligen	0	0	3	1.5

4	PE4	CS435	Frontend Design		3	0	0	3
4		CS436	Frontend Design Lab		0	0	3	1.5
4		CS437	Deep Learning	AI & ML	3	0	0	3
4		CS438	Deep Learning Lab	AI & ML	0	0	3	1.5
		IT445	Internet of Things(IoT)	Data comm	3	0	0	3
		IT446	Internet of Things(IoT) Lab	Internet of	0	0	3	1.5
		IT331	Image Processing		3	0	0	3
	PE5	IT332	Image Processing lab		0	0	3	1.5
		IT347	Cloud Computing	Operating	3	0	0	3
		IT348	Cloud Computing Lab		0	0	3	1.5
		CS439	Parallel Computing		3	0	0	3
		CS440	Parallel Computing Lab		0	0	3	1.5

List of Open Electives (OE)

OPEN ELECTIVES (OE)*

OFFERED FOR LEVEL 1-4

OE / LEVEL		Code no.	Name of the courses	Prerequisites/ Corequisit	L	T	P	C
1	OE I	CS261	Fundamentals of Data Structures	NIL	3	0	0	3
		IT261	Object Oriented Programming concept	NIL	3	0	0	3
2	OE II	IT361	Basics of Intelligent Computing	NIL	3	0	0	3
		CS361	Database Management System Concepts	NIL	3	0	0	3
3	OE III	IT363	Cryptography & Network Security	NIL	3	0	0	3
		CS363	Artificial Intelligence fundamentals	NIL	3	0	0	3
4	OE IV	CS461	Fundamentals of Machine Learning	NIL	3	0	0	3
		IT461	Data mining concepts	NIL	3	0	0	3

	CS MINOR	IT263	Object Oriented Programming and Design pattern	3	1	0	0	4
		CS263	Design and Analysis of Algorithm	3	1	0	0	4
		CS265	Data Base Management System	3	1	0	0	4
		IT365	Data Communication & Computer Networks	3	1	0	0	4
			Mini Project					4

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NEW COURSE STRUCTURE - To be effective from academic session 2021- 22
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Recommended scheme of study
(For Non-Circuit Branches)

Course Level	Semester of Study (Recomended)	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	**FS**	MA103	Mathematics - I	3	1	0	4
		PH113	Physics	3	1	0	4
		BE101	Biological Sciences	2	0	0	2
	GE	EE101	Basic of Electrical Engineering	3	1	0	4
		CS101	Programming for Problem Solving	3	1	0	4
	LABORATORIES						
	HSS	MT132	Communication Skills - I	0	0	3	1.5
	FS	PH114	Physics Lab	0	0	3	1.5
	GE	CS102	Programming for Problem Solving Lab	0	0	3	1.5
		PE101	Workshop Practice	0	0	3	1.5
	MC	MC101/102 /103/104	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
							25
SECOND	**THEORY**						
	FS	MA107	Mathematics - II	3	1	0	4
		CH101	Chemistry	3	1	0	4
		CE101	Environmental Sciences	2	0	0	2
	GE	ME101	Basics of Mechanical Engineering	3	1	0	4
		EC101	Basics of Electronics and Communication Engineering	3	1	0	4
	LABORATORIES						
	FS	CH102	Chemistry Lab	0	0	3	1.5
	GE	EC102	Electronics and Communication Lab	0	0	3	1.5
		ME102	Engineering Graphics	0	0	4	2
	MC	MC105/106 /107/108	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
							24
THIRD	**THEORY**						
	FS	MA207	Numerical Methods	2	0	0	2
	HSS	MT131	UHV2: Understanding Harmony	3	0	0	3
	PC		PC including Laboratories				17
	LABORATORIES						
	FS	MA204	Numerical Methods Laboratories	0	0	2	1
	MC	MC201/202 / 203/204	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1

TOTAL							**24**
FOURTH	**THEORY**						
	PC/PE		PC + PE including Laboratories*				18.5
			Open Elective-I	3	0	0	3
	LABORATORIES						
	GE	EE102	Electrical Engg. Laboratories	0	0	3	1.5
	MC	MC205/206 / 207/208	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
TOTAL							**24**
FIFTH	**THEORY**						
	OE		Open Elective-II	3	0	0	3
	PC/PE		PC + PE including Laboratories*				19.5
	LABORATORIES						
	HSS	MT133	Communication Skills - II	0	0	3	1.5
TOTAL							**24**
SIXTH	**THEORY**						
	PC/PE		PC + PE including Laboratories*				17
	OE		Open Elective-III	3	0	0	3
	PROJ	MC300	Summer Training				2
TOTAL							**22**
SEVENTH	**THEORY**						
	PC/PE		PC + PE including Laboratories*				9
	HSS	MT204	Constitution of India	2	0	0	NC
	OE		Open Elective-IV	3	0	0	3
	PROJ	XX400M	Minor Project				3
TOTAL							**15**
EIGTH	**PROJ**	XX400	**Research Project / Industry Internship**				**10**
							168

***Requirment of Programme Elective courses (Theory/ Lab) : 18 credit or above**

Department of Computer Science & Engineering

Birla Institute of Technology, Mesra, Ranchi - 835215 (India)

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Semester III

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:

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

SYLLABUS

MA205

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:

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.**Seymour Lipschuz and Mark Lipson**,*Discrete Mathematics*, Shaum's outlines, 2003.
2. **Liu, Chung Laung,** *Elements of Discretemathematis*, Mcgraw Hill, 2ndedition, 2001.
3. Bondy and Murty, Grapg Theory with Applications, American Elsevier,1979.
4. 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	

<u>Course outcome (co) attainment assessment tools & evaluation procedure</u>

<u>Direct assessment</u>

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

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

<u>MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD</u>

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,C

	D7

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

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.

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

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**	**CO 2**	**CO 3**	**CO 4**	**CO 5**
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

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: CS231
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

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. (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, 2^{nd} Edition (or latest) , University Press.(T1)

Reference books:

1. TharejaReema, Data Structures Using C, 2^{nd} 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 Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

<u>Indirect Assessment</u>

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

COURSE INFORMATION SHEET

Course Code: CS233
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

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, 10^{th} Edition, Pearson Publications, 2016.(T1)

Reference book:

Wu C. T., Object Oriented Programming in Java, 5^{th} 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

Course Outcome (CO) Attainment Assessment tools &

Evaluation procedure Direct Assessment

Assessment Components	**CO 1**	**CO 2**	**CO 3**	**CO 4**	**CO 5**
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	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: CS235
Course title: Computer Organization and 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.

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:

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

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

(THIRD SEMESTER LABORATORIES)

THIRD SEMESTER LABORATORY

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.

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

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

<u>Course Outcome (CO) Attainment Assessment tools & Evaluation procedure</u>

<u>Direct Assessment</u>

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

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

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

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.

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

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

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: CS232

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:
3/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

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 recursive.
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”, 2^{nd}Edn, Tata McGraw-Hill, 2008.
3. Horowitz E., Sahni S., Susan A., “Fundamentals of Data Structures in C”, 2^{nd} 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

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	√	√	√	√	√

<u>Indirect Assessment</u>

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

<u>MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES</u>

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

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: CS234
Course title: Object Oriented Programming and Design Patterns Lab
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

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, 10^{th} Edition, Pearson Publications, 2016.(T1)

Reference book:

Wu C. T., Object Oriented Programming in Java, 5^{th} 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

Course Outcome (CO) Attainment Assessment tools &

Evaluation procedure Direct Assessment

Assessment Components	CO 1	CO 2	CO 3	CO 4	CO 5
Continuous Internal Assessment	√	√	√	√	
Semester End Examination	√	√	√	√	√

Indirect Assessment

3. Student Feedback on Faculty
4. 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	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

FOURTH SEMESTER (IV)
Theory papers

COURSE INFORMATION SHEET

Course code: MA203
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

Syllabus

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.
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

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

COURSE INFORMATION SHEET

Course code:	MT 131
Course title:	Understanding Harmony
Credits: 1	**(**L: 3, T:0, P:0)
Class schedule per week:	3
Class:	B. Tech
Semester / Level:	4
Branch:	Mechanical Engineering

Syllabus

Module	**Hours**
Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I. 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations. 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.	8
Module 2: Understanding Harmony in the Human Being - Harmony in Myself! 1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. 2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). 4. Understanding the characteristics and activities of 'I' and harmony in 'I'. 5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. 6. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available tome. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.	8
Module 3: Understanding Harmony in the Family and Society- Harmony in Human, Human Relationship 1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 2. Understanding the meaning of Trust; Difference between intention and competence 3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.	8
Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 1. Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. 3. Understanding Existence	8

as Co-existence of mutually interacting units in all- pervasive space. 4. Holistic perception of harmony at all levels of existence. 5. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	
Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics 1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems 6. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations 7. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. to discuss the conduct as an engineer or scientist etc.	8

Text books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

Reference books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.

5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj - PanditSunderlal

9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English) 13. Gandhi - Romain Rolland (English)

COURSE INFORMATION SHEET

Course code: CS237
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.
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 EntitySets, 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)

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	√	√	√	√	√

<u>Indirect Assessment</u>

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)

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: CS239
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:1 P:0
Class schedule per week: 4
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

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

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

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

COURSE INFORMATION SHEET

Course code: CS241
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)

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 Transformand 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)

<u>Gaps in the syllabus (to meet Industry/Profession requirements): N/A</u>

<u>POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-basedassignment</u>

<u>Topics beyond syllabus/Advanced topics/Design: Teaching through paper</u>

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

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

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

LABORATORIES

COURSE INFORMATION SHEET

Course code: CS238
Course title: **Database Management system Lab**
Pre-requisite(s): CS301 Database Management System
Co- requisite(s):
Credits: L:3 T:0 P: 0 Class
schedule per week: 3Class:
B. Tech
Semester / Level: V/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.

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.

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

4. A.Silberschatz et.al - Database System Concepts, 5thEd^{n}, Tata Mc-Graw Hill, New Delhi – 2000.

REFERENCE BOOKS

3. Date C.J. - An Introduction to Database System, Pearson Education, New Delhi, 2005.
4. 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

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
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: CS242
Course title**: Design and Analysis of Algorithm Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 3 Class
schedule per week: 3Class:
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.
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. **<u>Lab Assignment No: 1</u>**
   Programs on Polynomial vs logarithmic running times

   <u>Lab Assignment No: 2</u>

Programs on Divide-and-conquer algorithms

2. **<u>Lab Assignment No: 3</u>**

Programs on Greedy and dynamic-programming algorithms

3. **<u>Lab Assignment No: 4</u>**

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.

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

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:

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

<u>Mapping between Objectives and Outcomes</u>

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		

COURSE INFORMATION SHEET

Course code: CS240
Course title: **Shell and Kernel Programming Lab**
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: V/III
Branch: CSE/IT

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)

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

Assessment 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 (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: 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

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 beread and the integrand is written as a function subprogram. The program is tested for $f(x)=1/(1+x)$.Program to solve an IVP, $dy/dx = f(x), y(x_0)=y_0$ using Euler method. The initial valuethe x_0, y_0 final value x_f and the step size h are to be read. The program is tested for $f(x,y)=-2xy^2$.
14. 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 $f(x,y)=-2xy^2$.

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
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
Progressive Evaluation	(60)
Attendance Marks	12
Lab file Marks	12
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

<u>Mapping between Objectives and Outcomes</u>

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)

<u>MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD</u>

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

FIFTH SEMESTER

THEORY

COURSE INFORMATION SHEET

Course code: IT333
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, 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
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)

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: CS331
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.

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)

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	√	√	√	√	√

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

COURSE INFORMATION SHEET

Course code: IT335
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.

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)

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

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: IT334
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

Syllabus
List of Programs as Assignments:

1. **<u>Lab Assignment No: 1</u>**

   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. **<u>Lab Assignment No: 2</u>**

   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. **<u>Lab Assignment No: 3</u>**

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..

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. <u>Lab Assignment No: 11</u>

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

<u>Gaps in the syllabus (to meet Industry/Profession requirements):</u>

<u>POs met through Gaps in the Syllabus:</u>

<u>Topics beyond syllabus/Advanced topics/Design:</u>

<u>POs met through Topics beyond syllabus/Advanced topics/Design:</u>

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

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: CS332
Course title: **Basic IT Workshop**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 2 Class
schedule per week: 2Class:
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

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.

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:

$$S= 1- x^2/2! + x^4/4! - x^6/6! + x^8/8! \text{ for } x= 1.5$$

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

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:

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

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: IT336
Course title: **Data Mining Lab**
Pre-requisite(s): IT426 Data Mining Concepts and technique
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 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.

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.

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	√	√	√	√	√

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

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

SIXTH SEMESTER

THEORY

COURSE INFORMATION SHEET

Course code: CS333
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: 3Class:
B. Tech
Semester / Level: VI/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

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)

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

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

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: CS335
Course Title: Artificial Intelligence and Machine Learning
Pre-requisite(s): CS241 Design and Analysis of Algorithm
Co- requisite(s): AI and ML Lab.
Credits: L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B.Tech
Semester / Level: 5
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the need of artificial intelligence in solving real world problems.
2	To learn various search techniques.
3.	To understand various knowledge representation techniques.
4.	To understand the basic concept of machine learning.
5.	To learn the concepts of neural networks and clustering techniques.

Course Outcomes
After the completion of this course, students will be able to:

1.	Apply different search techniques for solving real world problems and select the most appropriate solution by comparative evaluation.
2.	Analyze the various concepts of knowledge representations and demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.
3.	Demonstrate the concepts of probabilistic reasoning.
4.	Implement machine learning solutions to classification, regression, and clustering problems
5.	Design and implement various machine learning algorithms in a range of real-world applications

Syllabus

Module I

Introduction to AI. Overview of Artificial Intelligence, Examples of AI systems, AI Technique, Explaining AI through Tic-Tac-Toe Problem.
Search Techniques: Solving Problems by Searching: an overview. Conventional vs Heuristic Search Strategies. Hill Climbing Search, Simulated Annealing Search, Greedy Best-First Search, A* Search. Constraint Satisfaction Problems. Mini-Max Search Procedure, Alpha-Beta Pruning.

Module II
Knowledge & Reasoning: Knowledge Representation & Mapping.
Predicate Logic: FOPL, Clausal Form, Resolution. Forward Verses Backward Reasoning, Matching.

Module III
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.

Module IV
Introduction to Machine learning: Machine Learning – what and why?
Concepts of Noise, bias-variance trade-off, underfitting and overfitting. Linear Regression. Logistic regression. Decision Tree.

Module V
Neural Networks: Introduction, gradient descent training. Multilayer networks and back propagation.
Clustering. Hierarchical Clustering, Partitional clustering, Density-based clustering. Purity Measures.

Text Book:

1. Russel S. and Norvig P., Artificial Intelligence a Modern Approach, 3rd edition, Pearson Education.

Reference Book:

1. Rich E. & Knight K., Artificial Intelligence, 3rd edition, TMH, New Delhi.
2. Mitchell Tom, Machine Learning, Latest 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	
Semester End Examination	

Continuous Internal Assessment	% Distribution
Mid semester examination	
Two quizzes	
Teacher's Assessment	

Assessment 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	
CD2	
CD3	
CD4	
CD5	
CD6	
CD7	

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															
CO2															
CO3															
CO4															
CO5															

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: VI/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.

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

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			

MC300 SUMMER TRAINING

LABORATORIES

COURSE INFORMATION SHEET

Course code: CS334
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:

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:

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. **<u>Lab Assignment No: 1</u>**

Objective: To Understand the concept of tokens.

Q1. C program to count white spaces, numbers, words in a file./

2. **<u>Lab Assignment No: 2</u>**

Objective: To Understand the process of identification of tokens.

Q1. C program to design Finite automata to identify different tokens(identifiers, constants, operators, etc.).

3. **<u>Lab Assignment No: 3</u>**

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. **<u>Lab Assignment No: 4</u>**

Objective: To Understand lex programming tool.

Q1. Lex program to Identify all tokens of C programs.

5. **<u>Lab Assignment No: 5</u>**

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. **<u>Lab Assignment No: 6</u>**

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. **<u>Lab Assignment No: 7</u>**

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. **<u>Lab Assignment No: 8</u>**

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. **<u>Lab Assignment No: 9</u>**

Objective: To Understand and Implement parser coding.

Q1. Build parser using yacc to convert the infix expression to postfix expression.

10. **<u>Lab Assignment No: 10</u>**

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. **<u>Lab Assignment No: 11</u>**

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.

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	√	√	√	√	√

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

COURSE INFORMATION SHEET

Course Code: CS338
Course Title: Embedded Systems Lab
Pre-requisite(s): NIL
Co-requisite(s): NIL
Credits: L: 0 T: 0 P: 1.5
Lab Hours per week: 3
Class: B Tech
Semester / Level: III
Branch: CSE

Course Objectives: This course enables the students:

1.	To overcome the shyness of hardware of a typical undergraduate student of CSE.
2.	To become comfortable with handling various devices and their functionality.
3.	To learn the key aspects of system development process.
4.	To integrate systems using existing skills in design and programming
5.	To design simple embedded systems.

Course Outcomes: After the completion of this course, students will be able to :

1.	Identify embedded system components, their capabilities and functionalities.
2.	Interface digital sensors and other devices, Timers, Counters, speed control, analog sensors and A-to-D conversion.
3.	Use Programming paradigms for embedded systems.
4.	Make realistic use of requirements, design partition, integration, and to develop design strategies to accommodate available resources.
5.	Design and implement embedded system prototype for a simple real life application.

Syllabus: Sample list of experiments are provided below.

1. Familiarization with the hardware and its operating environment - different variants of Arduino boards and their characteristics, driver installation procedure and its Integrated Development Environment (IDE).

2. Experimentation with basic embedded functions, such as for reading and writing digital and analog input and output pins. (a) Program to read a digital input and turn on an LED connected to a digital output. (b) Program to read an analog value from an analogy input pin, convert the value by a simple operation such divide by 2, and outputs a signal.

3. Experimentation with advanced i/o functions. Program to use a 8 bit shift register to light up 8 LEDs one by one.

4. Experimentation with timer and serial communication functions. Program to communicate between a sender board and a receiver board where the sender increments a counter and sends a packet while the receiver checks for information in a loop and on receipt prints the desired output that will be specified.

5. Experimentation with Interrupt functions. Program to blink LED for every given time interval, such as 400 ms. The interrupt pins are to be monitored and different outputs are to be displayed (will be specified) depending on the value of the pin, 0 or 1.

6. Experimentation with light sensitive sensor and temperature sensor modules. (a) Program a photodiode so that when a flashlight is thrown on the photodiode, the LED is turned off and lights up when it is dark. (b) Program a digital temperature sensor and a digital buzzer such that when the temperature sensor is touched by a finger the buzzer alarm starts when the temperature goes above a certain threshold (say 26^oC). (c) Program an analog temperature sensor and a digital buzzer such that the temperature of the environment is displayed and when the temperature goes above a certain threshold (say 26^oC) the buzzer alarm starts and remains on till the temperature drops below the threshold.

7. Experimentation with temperature and humidity sensor. Program a temperature and humidty sensor to extract the temperature and humidity values and display both.

8. Experimentation with an ultrasonic sensor to measure distance of an object. Program an ultrasonic sensor and display the distance measured of a moving object.

9. Experimentation with a digital infrared motion sensor to quantify motion of an object. Program an infrared motion sensor with an LED such that the LED glows when it detects a moving object.

10. Experimentation with a color sensor to detect color of an object. Program a color sensor such that the sensor identifies and displays the color of an object place close to the sensor.

11. Experimentation with an analog sound sensor to detect sound in the environment. Program an analog sound sensor such that it detects and displays the sound in its proximity.

12. Experimentation with a vibration sensor to detect vibrations in its environment. Program a digital vibration sensor such that an LED is lit up when the sensor detects vibrations in its proximity.

13. Experimentation with a flame sensor to detect the presence of a flame in the surroundings. Program a flame sensor such that it sounds a buzzer on detection of a flame and also displays the sensor value.

14. Experimentation with a touch sensor to detect contact. Program a touch sensor such that a digital light illuminates when an object touches the metal surface of the sensor.

15. Mini-project : prototype design of an embedded system for a simple real life application, ideated by a student group in consultation with the instructor, its implementation and demonstration.

Optional Experiments :

1. Electromechanical control : write a program to drive and control a DC motor / stepper motor /servo motor for all the usual operations of a motor.

2. Program infrared tramsmitter and receiver modules to identify which button on the remote has been pressed.

3. Program two bluetooth modules to set up communication between them with one as a master and the other as a slave.

Text Books :

1. "Designing Embedded Systems with Arduino" by Tianhong Pan and Yi Zhu, ebook, Springer, 2018
2. "Embedded Systems Design" A Unified Hardware/ Software Introduction", by Vahid / Givargis, Wiley WSE, 2006.
3. "Embedded Systems: Architecture, Programming and Design", by Raj Kamal, Tata McGraw Hill, 2008
4. " Making of Embedded Systems", by Elecia White, O'Reilly Media Inc, November 2011

Reference Books :

5. Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Second Edition, by E. A. Lee and S. A. Seshia, MIT Press, 2017

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:

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**
Experiment Performance Examination	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 COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3
CO2	CD2, CD3, CD5
CO3	CD1, CD3, CD4, CD6
CO4	CD1, CD3, CD7
CO5	CD2, CD3, CD4

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															
CO2															
CO3															
CO4															
CO5															

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

PROGRAM ELECTIVE 1

COURSE INFORMATION SHEET

Course code: CS341
Course title: **Optimization Technique**
Pre-requisite(s):: CS206Design and Analysis of AlgorithmCo- 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)

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

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	√	√	√	√	√

<u>Indirect Assessment</u>

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

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: CS 343
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 softwares & system tools.
2.	Familiarize with the trade-offs 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 able to:

1.	Understand the evolution of various system software.
2.	Apply various data structures that helps in the proper functioning of the system programs.
3.	Differentiate and analyze the design aspects of different text editors, debuggers etc.
4.	Design various translators and other system software's.
5.	Implement various translators and other system software's.

Syllabus

Module I

Introduction: System Software & its Components, System Software and Machine Architecture, Traditional (CISC) machines, RISC Machines, Inputs and processing steps on language translators 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, Implementation Examples. (8L)

Module III

Loaders: Basic Loader Functions, Absolute Loader, Compile & go Loader, Relocating Loader, Direct Linking Loader. (8L)

Module IV

Macros & Macro processors: Macros, Different forms of Macros, Macros using AIF, AGO, REPT. Etc, Design of a Macro Processor, Macro Assembler. (8L)

Module V

Linkage Editors: Linking and Relocation, Program Reliability, Linkage Editor and its Application in IBM-PC, Linking for Program Overlay, **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

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

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: CS445
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 securedelivery 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

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 ofa 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, ChannelCoding, 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 forPolynomials ,A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, BurstError 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, SomeExamples 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)

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 ProcedureDirect 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	√	√	√	√	√

COURSE INFORMATION SHEET

Course Code: IT353
Course Title: Blockchain Technology
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 3
Class: B.Tech
Semester / Level: PE
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To provide an overview of the different blockchain technologies.
2.	To provide the knowledge on the need of blockchain and its applicability in real world problem.
3.	To provide the knowledge of cryptocurrency design and its security against scam ,fraud, hacking.
4.	To provide the ability to design and implement new ways of using blockchain for applications other than cryptocurrency.
5.	To be able to apply the knowledge gained through the course in actual blockchain development or blockchain contract developer

Course Outcomes
After the completion of this course, students will be able to:

1.	Learn and explain the difference between centralized, decentralized network and blockchain.
2.	Explain fundamental concepts of blockchain using hashes and consensus.
3.	Understand the concept of mining in blockchains.
4.	Understand the working of Bitcoin and its security.
5.	Know about the different platforms for implementing blockchain and its varied application.

Syllabus

Module I
Introduction to Blockchain Technology

Introduction to Blockchain, Trusted Third party for transactions, Difference between centralized, decentralized and distributed peer to peer networks, Types of Blockchain (Permission Blockchain vs. Permissionless Blockchain), History of Bitcoins.

Module II

Fundamental concepts of Blockchain

Concepts of Block, Transactions, Hashes, Consensus. Hashes: Hash cryptography, Encryption vs. hashing, Transactions: Recording transactions, Digital Signature, Verifying and confirming transactions, Blocks and blockchain: Hash pointers, Blocks, Consensus building. Distributed consensus, Byzantine generals problem, Consensus mechanism: POW, POS, POB, POA, etc. Blockchain Architecture, Markle Root Tree.

Module III

Mining and simulating blockchain

Mining and simulating blockchain: Game theory behind competitive mining. Incentives: mining and transaction fees, Energy expended in mining.

Module IV

Bitcoin ad Security

Bitcoin: Bitcoin creation, exchanges. Wallets, security. Protecting blockchain from attackers. Forks – soft and hard, Blockchain security, Key Management in Bitcoin, Case studies.

Module V

Platforms and Applications

Introduction to Blockchain platform: Ethereum, Hyperledger, IOTA, EOS, Multichain, SOLIDITY, Designing a new blockchain, Distributed Application (DAPP).

Applications: E-Governance, Elections, File sharing, Micropayments

Challenges and Research Issues in blockchain

Text Book:

1. Bitcoin and Cryptocurrency technologies: a comprehensive introduction. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Princeton University Press, First edition,2016
2. Blockchain Applications: A Hands-On Approach. Arshdeep Bahga, Vijay Madisetti. VPT Publisher. First edition,2018.
3. Blockchain: Step – by – Step Guide to Understand by Paul Laurence, Createspace Independent Pub.

Reference Book:

1. Introducing Ethereum and Solidity Foundations of Cryptocurrency and Blockchain Programming for Beginners by Chris Dannen, Apress
2. Blockchain: The comprehensive beginner's guide by Frank Walrtin

Web References:

1. https://bitcoin.org/bitcoin.pdf
2. https://blockchain.mit.edu/how-blockchain-works

Gaps in the syllabus (to meet Industry/Profession requirements): NA

POs met through Gaps in the Syllabus: NA

Topics beyond syllabus/Advanced topics/Design: NA

POs met through Topics beyond syllabus/Advanced topics/Design: NA

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/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Mini Project
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

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	2	2	3	1	2	1	2	2	3	2	3	2	1
CO2	3	3	3	2	2	1	1	1	1	2	2	2	3	3	2
CO3	3	3	3	3	2	1	1	1	1	1	1	1	3	3	2
CO4	3	2	2	2	1	1	1	1	2	2	3	2	2	2	1
CO5	3	3	3	3	2	2	1	1	2	2	2	2	3	3	3

Mapping Between Course Outcomes And Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD6
CO2	CD1, CD2, CD6
CO3	CD1, CD2, CD6, CD7
CO4	CD1, CD3, CD6
CO5	CD1, CD2, CD3, CD4, CD5, CD6, CD7

PROGRAM ELECTIVE 2

COURSE INFORMATION SHEET

Course code: IT447
Course title: **Information Retrieval**
Pre-requisite(s): Design of AlgorithmsCo- 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

Syllabus Module I Introduction
Introduction; Search Engine Architecture; An overview of crawling, text transformation, indexcreation, 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; efficientscoring 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: InformationRetrieval 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 ProcedureDirect 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	□	□	□	□	□

<u>Indirect Assessment</u>

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	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)

<u>MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD</u>

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: IT 448
Course title: **Information Retrieval Lab**
Pre-requisite(s): NIL
Co- requisite(s): Information Retrieval
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.	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 be familiar with current R&D scenario in information retrieval.

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
List of Assignments

1. Assignment on making a corpus and preprocessing: (a) search the web using a recent event and collect 50 news articles from various sources – this collection is ‘myCorpus’, (b) perform stop word removal and stemming of the documents.
2. Assignments on term-document matrix: Build term-document matrix using ‘myCorpus’ and top N frequent terms. Now find similarity between the documents using any distance metric.
3. Vary N and choose other distance matrices and perform experiments. Find two documents that have the highest similarity and two documents having the lowest similarity. Manually verify the documents and comment on the value of N and performance of the similarity metrices.
4. Experiments with TfIdf and applications of TfIdf using a given dataset.
5. Experiments with Zips law on Reuters21578 corpus and another Indian language corpus.
6. Assignments on construction of an Inverted Index using a given corpus.
7. Form 3 suitable queries manually and retrieve documents from ‘myCorpus’. Perform experiments on various retrieval models.
8. Implement and evaluate algorithms for index compression.
9. Experiments on studying an available crawler and building own toy crawler for performing specific task.
10. Experiments on Unranked Evaluation Measures: Manually label the set of documents corresponding to each query. Now compare the system-retrieved documents with anually labelled set of documents and compute Precision, Recall, F-measure.
11. Experiments on Ranked Retrieval and Evaluation: Select a task from Forum for Information Retrieval Evaluation(FIRE) resources, use the available dataset(http://fire.irsi.res.in/fire/static/resources) to design a IR system. Then evaluate your system using the given procedure.

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

COURSE INFORMATION SHEET

Course code: CS347
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.

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,MemoryBased,HebbianCompetitive,Boltzma,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, TheHopfield Network. **(8L)**

Text Books:

1. Jang J.S.R., Sun C.T. and Mizutani E., "Neuro-Fuzzy and Soft Computing"PHI/Pearson Education, New Delhi 2004.(T1)
2. Rajasekaran S. & Vijayalakshmi G.A. Pai, PHI, New Delhi 2003.(T2)
3. Ross T. J., "Fuzzy Logic with Engineering Applications." TMH, New York,1997.(T3)
4. HaykinsSimon ,"Neural Networks :A Comprehensive Foundation, Pearson Education,2002.(T4)

Reference Books:

1. Ray K.S. ,"Soft Computing and Its application", Vol 1, Apple AcademicPress, 2015. (R1)
2. Lee K.H. ,"First Course on Fuzzy Theory and App.", Adv in Soft ComputingSpinger, 2005.(R2)
3. Zimmermann H.Z. ,"Fuzzy Set Theory and its App " , 4th Edition, SpingerScience, 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 ProcedureDirect 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

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

<u>MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD</u>

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: CS349
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 discretesystems, System Modeling, Types of models.System Studies: Subsystem, A Corporate Model,Environment segment, Production Segment, Management Segment, full Corporate Model, Typesof 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 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

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

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: CS350
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

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

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

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 Delivery Methods

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

COURSE INFORMATION SHEET

Course code: IT337
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. (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

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

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: IT338
Course title: **Software Engineering & Testing Lab**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T:0 P: 3 Class
schedule per week: 3Class:
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

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.

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.

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

<u>Mapping between Objectives and Outcomes</u>

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)

<u>MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD</u>

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	√	√	√	√	√

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

PROGRAM ELECTIVE 3

COURSE INFORMATION SHEET

Course code: IT349
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

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)

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

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

COURSE INFORMATION SHEET

Course code: IT355
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.	Analyze and evaluate different constraint of wireless sensor network, e.g., coverage, power management, security and data collisions.
5.	Design and development of new sensor network architecture.

Syllabus:

Module I:

Introduction: Wireless channel and communication fundamentals, Features of Wireless sensornetwork, 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, Congestioncontrol and rate control, Collisions, Collision avoidance mechanism. (8L)

Text books:

Karl Holger and Willig Andreas, "Protocols and Architectures for Wireless SensorNetworks".(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

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√		√	√	√

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

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

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: IT351
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.

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)

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

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

COURSE INFORMATION SHEET

Course code: CS351
Course title: **Nature Inspired Computing**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:1 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: IVBranch: CSE/IT

Course Objectives
This course enables the students to:

1	Develop basic knowledge of Nature Inspired Computing Techniques and their working principle.
2	Identify the suitable Nature Inspired Computing Techniques to solve a problem.
3	Generate the possible ways of solution to a certain real world problem using Nature Inspired Computing Techniques
4	Analyze and modify the performance of the Nature Inspired Computing algorithms.

Course Outcomes:

After completion of this course the students will be able to:

1.	Identify the Nature Inspired Computing Techniques and their classifications.
2.	Explain the different Nature Inspired algorithms and other algorithms and their workingprinciples.
3.	Design and modify different Nature Inspired algorithms in terms of Initialization, Processing and Stopping Criteria.
4.	Apply Nature Inspired algorithms to different set of practical problems.
5.	Justify the proper applicability of a Nature Inspired algorithm to a problem.

Syllabus:
Module I:
Introduction to Nature Inspired Computing, Meta-Heuristic and EvolutionaryAlgorithms

Nature inspired Computing Concepts, Concepts of Optimization, Examples of the Formulation of Various Engineering Optimization Problems, Searching the Decision Space for Optimal Solutions, Definition of Terms of Meta-Heuristic and Evolutionary Algorithms, Principles of Meta-Heuristic and Evolutionary Algorithms, Classification of Meta-Heuristic and EvolutionaryAlgorithms.
(8L)

Module II:. Evolutionary Algorithms

Evolutionary Algorithms in Discrete or Continuous Domains, Generating Random Values of theDecision Variables, Dealing with Constraints, Fitness Function, Selection of Solutions in Each Iteration, Generating New Solutions, The Best Solution in Each Algorithmic Iteration, Termination Criteria, General Algorithm, Performance Evaluation of Meta-Heuristic and Evolutionary Algorithms, Search Strategies

Module III: Genetic Algorithm

Introduction, Mapping the Genetic Algorithm (GA) to Natural Evolution, Creating an Initial Population, Selection of Parents to Create a New Generation, Population Diversity and Selective Pressure, Reproduction, Termination Criteria, User-Defined Parameters of the GA, Pseudocode of the GA
(8L)

Module IV: Ant Colony Optimization& Particle Swarm Optimization

Ant Colony Optimization:
ACO Introduction, Mapping Ant Colony Optimization (ACO) to Ants' Foraging Behavior, Creating an Initial Population, Allocating Pheromone to the Decision Space, Generation of NewSolutionsTermination Criteria, User-Defined Parameters of the ACO, Pseudocode of the ACO

Particle Swarm Optimization:
PSO Introduction, Mapping Particle Swarm Optimization (PSO) to the Social Behavior of SomeAnimals, Creating an Initial Population of Particles, The Individual and Global Best Positions Velocities of Particles, Updating the Positions of Particles, Termination Criteria, User-Defined Parameters of the PSO, Pseudocode of the PSO
(8L)

Module V: Other Nature Inspired Algorithms

Honey-Bee Mating Optimization:
Introduction of HBMO, Mapping Honey-Bee Mating Optimization (HBMO) to the Honey-BeeColony Structure, Creating an Initial Population, Pseudocode of the HBMO

Bat Algorithm:
BA Introduction, Mapping the Bat Algorithm (BA) to the Behavior of Microbats, Creating anInitial Population, Pseudocode of the BA

Harmony Search:
Inspiration of the Harmony Search (HS), Initializing the Harmony Memory, Generating New,Harmonies (Solutions), Pseudocode of the HS
(8L)

Textbook:

Meta-heuristic and Evolutionary Algorithms for Engineering Optimization by Omid Bozorg-Haddad, Mohammad Solgi, Hugo A. Loáiciga, Wiley, 2017, ISBN: 9781119386995

Ref Book:

- Nature-Inspired Optimization Algorithms, by Xin-She Yang, Elsevier, 2014, ISBN9780124167438.
- Introduction to Nature-Inspired Optimization,Editor(s): George Lindfield, John Penny,Academic Press, 2017, ISBN 9780128036365.

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 ProcedureDirect 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

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	2	3	2	2	2				1		3	3	1
CO2	2	3	2	3	2	2	1				1	1	2	2	2
CO3	2	3	3	3	3	3	3				1		2	2	3
CO4	3	2	2	3	3	2	2				1		3	3	2
CO5	3	3	3	3	2	2	2	1	3	3	1		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

PROGRAM ELECTIVE 4

COURSE INFORMATION SHEET

Course code: CS431
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:
IIIBranch: 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)

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)

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

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

COURSE INFORMATION SHEET

Course code: CS432
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.

<u>Syllabus</u>

1. Study of basic graphics functions defined in “graphics’”.
2. Write a program to draw a line using Brenham’s Algorithm
3. Write a program to draw a line using DDA Algorithm.
4. Write a program to draw a line using Mid-Point Algorithm.
5. Write a program to draw a Circle using Mid-Point Algorithm.
6. Write a program to draw a Ellipse using Mid-Point Algorithm.
7. Programs using 2-D transformations in C.
8. Implement Polygon filling algorithms [Flood-Fill Algorithm] in C.
9. Program for Cohen Sutherland Line clipping algorithm in C.
10. Write a program to implement reflection of a point, Line.
11. Write a program to rotate a circle around any arbitrary point or around the boundary of another circle.
12. Write a program to implement polygon filling.
13. Programs to study 3-D transformations in C.

Text books:

1. D. Hearn & M.P. Baker - Computer Graphics, 2/e , Pearson Education, New Delhi, 2005.

2. Prabat K Andleigh and KiranThakrar, “Multimedia Systems and Design”, PHI, 2005.

Reference books:

1. W.M. Newman. et. al.- Principle of Interactive Computer Graphics, McGraw Hill Publication, New Delhi, 1995.
2. S. Harrington -Computer Graphics- A Programming Approach, McGraw Hill Publication, New Delhi, 1994.
3. 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**
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

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: CS 433
Course Title: Knowledge – Based Systems
Pre-requisite(s): Fundamental Concept of Data, Information, Knowledge and of Fuzzy Logic, Neural Networks and Genetic Algorithm
Co- requisite(s):
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.	Develop concepts and understand Knowledge –Based Systems
2	Design Knowledge –Based Systems
3.	Utilize tools to develop Knowledge –Based Systems
4.	Learn advance theories of Knowledge –Based Systems
5.	Manage Knowledge using Knowledge Management tool and Techniques

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand Knowledge –Based Systems
2.	Get Knowledge about advance theories of Knowledge –Based Systems
3.	Design Knowledge –Based Systems
4.	Utilize tools to develop Knowledge –Based Systems
5.	Manage Knowledge using Knowledge Management tool and Techniques

Syllabus

Module I

Knowledge – Based System: Definition of KBS, Objectives of KBS, Categories of KBS, Difficulties of KBS
Agent – Based Systems : Agent – Definition , Characteristics and Advantages ; Agent Typologies, Agent Communication languages, Standard Communicative Actions, Multi Agent Systems, Knowledge- Engineering based methodologies **(6L)**

Module II

KBS Architecture : Source of Knowledge, Types of Knowledge, Components of Knowledge, Basic structure of KBS, Knowledge Base, Inference Engine, Self – Learning, Reasoning, Explanation, Applications, Knowledge – Based Shell, Advantages and Limitations of KBS

Development of KBS : Nature of KBS, KBS Development Model, Knowledge Acquisition and Techniques for Knowledge Acquisition, Sharing Knowledge, Updating Knowledge, Knowledge Representation, Factual Knowledge, Representation of Procedural Knowledge, Users of KBS, KBS tools

(8L)

Module III

Soft Computing Systems : Introduction to Soft Computing – its constituents and characteristics. Neuro – Fuzzy Systems, Genetic- Fuzzy Systems, Neuro-Genetic Systems, Genetic- Fuzzy-Neural Networks, Applications of Soft-Computing

(10L)

Module IV

Chaos Theory – Basic Construct and Hybridization

Rough Set Theory – Rough Sets, Rough Logic, Rough Models, Rough Set Based Systems

Quantum Machine Learning Theory

(8L)

Module V

Knowledge management : Introduction of KM , Perspective of KM, Drivers of KM, Evolution of KM within organization, Elements and Process of KM, KM tools and techniques, KM Models

(8L)

Text Book:

1. Knowledge – Based Systems : Rajendra Arvind Akerkar and Priti Srinivas Sajja ; Jones and Bartlett Publishers, Sudbury , Massachusetts Boston, 2010 , ISBN -13 : 978-0-7637-7647-3 (pbk)
2. Uncertainty Management with Fuzzy and Rough Sets - Recent Advances and Applications Editors Rafael Bello, Rafael Falcon, José Luis Verdegay, Springer - 2019

Reference Book:

1. Artificial Intelligence : A Modern Approach (3rd Edition) : Stuart Russell and Peter Norvig , Pearson 2021
2. Principles of Soft Computing (3rd Edition): S. N. Sivanandam and S.N. Deepa, Wiley – 2019
3. Advances in Quantum Machine Learning : J. C. Adcock et.al. Quantum Engineering Centre for Doctoral Training, University of Bristol, UK, 2010

<u>Gaps in the syllabus (to meet Industry/Profession requirements):</u>

Self-Learning, Expert Lecture, Collaboration with other Departments, Industrial Visits

<u>POs met through Gaps in the Syllabus:</u>

2, 4, 9

<u>Topics beyond syllabus/Advanced topics/Design:</u>

Current Research Papers

POs met through Topics beyond syllabus/Advanced topics/Design:

1, 2, 3, 4, 5, 9, 11

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (10 + 10)
Teacher's Assessment (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	Lectures by use of boards , PPT
CD2	Assignments
CD3	Presentation in Seminars by each students
CD4	Expert Lectures (Interdisciplinary in nature)
CD5	Industrial Visits
CD6	Collaboration with other Departments
CD7	Self-Learning

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	1	1	1	2	3	3	3	1	3	1	3	1	2	3
CO2	3	3	2	3	3	3	3	2	2	3	2	3	2	1	3
CO3	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3
CO4	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3

CO5	2	3	3	2	3	3	2	3	3	3	3	3	3	3	3

Mapping Between Course Outcomes And Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1
CO2	CD1, CD2, CD4
CO3	CD2, CD3 , CD5, CD6, CD7
CO4	CD2, CD5, CD6, CD7
CO5	CD7

COURSE INFORMATION SHEET

Course Code: CS 434
Course Title: Knowledge - Based Systems Lab
Pre-requisite(s): Python
Co- requisite(s):
Credits: L: 0 T: 0 P: 03
Class schedule per week: 03
Class: B.Tech
Semester / Level: IV
Branch: CSE/IT

Course Objectives

This course enables the students to:

1.	Decide Application area for the development of Knowledge –Based Systems
2	Import Data or create to Design Knowledge –Based Systems
3.	Utilize tools to develop Knowledge –Based Systems
4.	Test developed Knowledge –Based Systems
5.	Manage Knowledge –Based Systems

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand tools and techniques to design Knowledge –Based Systems
2.	Design Knowledge –Based Systems in a particular application area
3.	Develop Knowledge –Based Systems
4.	Test the developed Knowledge –Based Systems
5.	Implement and manage developed Knowledge –Based Systems

Syllabus

1. Application area is to be decided (1)
2. Data relevant to the application are to be imported or created (1)
3. Knowledge map is to be created (2)
4. Knowledge representation is to be done (3)
5. Knowledge processing by creating rules are to be done with the help of training data and test data (5-6)
6. Question – Answer KBS system to be developed (2)

Text Book

Python: The Complete Reference (4th Edition) , Martin C. Brown , McGraw Hill Education, 2018
ISBN-13 : 978-9387572942

Gaps in the syllabus (to meet Industry/Profession requirements):

Subject Teacher, Self-learning, Collaboration with other Departments

POs met through Gaps in the Syllabus:

2, 3, 4, 5

Topics beyond syllabus/Advanced topics/Design:

Current Research Paper

POs met through Topics beyond syllabus/Advanced topics/Design:

1, 2, 3 ,4 , 5 , 9, 11, 12

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 and Lab files	30
Quiz(zes)	10
Viva Voce	20

Assessment 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	Lectures by use of boards , PPT
CD2	Assignments
CD3	Laboratory experiments / Teaching aids
CD4	Collaboration with other Departments
CD5	Seminars by each students (May be in groups)
CD6	Simulation
CD7	Self-Learning

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	2	1	2	3	2	2	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	2	2	3	2	3	2
CO3	3	3	3	3	3	3	2	2	3	2	2	3	2	2	2
CO4	3	3	3	3	3	3	2	2	3	2	2	3	3	2	3

CO5	3	3	3	3	3	2	2	2	3	2	2	3	2	3	3

Mapping Between Course Outcomes And Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2
CO2	CD2, CD3, CD4
CO3	CD3, CD4
CO4	CD5, CD6
CO5	CD5, CD6, CD7

COURSE INFORMATION SHEET

Course Code: CS435
Course Title: Front End Design
Pre-requisite(s): NA
Co- requisite(s): NA
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3
Class: B.Tech
Semester / Level: 7
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the need for front end development in websites
2	To learn the syntax of Javascript and integrate scripts into websites
3.	To know about the various classes and objects available in Javascript
4.	Manipulate website components at the client end
5.	To manage Javascript for large projects including debugging and error handling skills

Course Outcomes
After the completion of this course, students will be able to:

1.	Shall be able to decide the kind of problems which require the use of Javascript in the context of web programming
2.	Write programs using all the basic syntax of Javascript e.g. loops, functions, objects etc.
3.	Program against the document object model and the browser object model.
4.	Program the standard built in objects of Javascript
5.	Perform basic error handling, input validation and cookie manipulation

Syllabus

Module I
Introduction to Web Development, Client-Side and Server-Side JavaScript, Origin, History and Evolution of JavaScript, Features of JavaScript, Advantages and Limitations, Structure of Browsers, Lexical Structure, Literals, Identifiers, Keywords, Variables, Variable Declaration and Scope, Data type, Operators, Control flow statements

Module II
Objects, Properties of Objects, Property Configuration Descriptors, Creating Objects, Objects as Record and Dictionary, Operations on Objects, Accessors and Mutators, Useful Operations and Loops, Object Methods, Built-In Object Methods, Prototypal Inheritance, Prototype Chaining, Classes, Constructor, Properties and Methods, Extending Classes, Getters and Setters in Classes, Static Members, Garbage Collection, Functions – Scope and Declaration, Parameter passing, recursion, closure

Module III
Properties of Array, Declaring an Array, Array Literal, Using the New Keyword and Array Constructor, Accessing an Array, Built-In Methods inside Array, Accessor Methods, Mutator Methods, Iterator Methods, Using Fundamental Loops, Predefined Iterator Methods, Nesting and Multidimensional Arrays, Sorting, Browser Object Model, Window Object, Properties of Window Object, Methods of Window Object, History Object, Properties of History Object, Methods of History Object, Navigator Object, Properties and Methods of Navigator Object, Location Object, Properties of Location Object, Methods of Location Object, Screen Object, Properties of Screen Object, Document Object

Module IV
Document Object Model (DOM), Relationship between BOM, DOM and JavaScript, Understanding DOM Tree and Nodes, Properties of Node Object, Method of Node Object, Document Object, Properties of Document Object, Methods for Document Object, Elements in DOM, Properties of Element Object, Methods for Element Object, Accessing Elements in the DOM, Event Handling Using DOM

Module V
Built-In Objects, Fundamental Objects, Object Prototype, Function Object, Boolean Object, Symbol Object, Error Objects, Number and Dates, Number Object, Date Object, Math Object, Text or String Processing, String Object, RegExp Object, Keyed Collections, Map Object, Set Object, Indexed Collections, Array Object, Structured Data, Value Properties, Function Properties, Validation, Error Handling, Cookies, Strict mode

Text Book:

1. Dangi S., Tomar R., "JAVASCRIPT Syntax and Practices", 1st Edition, CRC Press, 2022

a. Reference Book:

2. Scott A. D., MacDonald M., Powers s., "JAVASCRIPT Cookbook", 3rd Edition, O'Reilly Press, 2021

Gaps in the syllabus (to meet Industry/Profession requirements): Learning about full stack development

POs met through Gaps in the Syllabus: NA

Topics beyond syllabus/Advanced topics/Design: NA

POs met through Topics beyond syllabus/Advanced topics/Design: NA

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
CD2	Quizzes
CD3	Assignments/Seminars
CD4	Mini Projects/Projects
CD5	Laboratory Experiments/Teaching Aids
CD6	Self- learning such as use of NPTEL Materials
CD7	Internets

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, CD2
CO2	CD1, CD2, CD4, CD5
CO3	CD1, CD2, CD5, CD7
CO4	CD1, CD2, CD6, CD7
CO5	CD1, CD2, CD3

COURSE INFORMATION SHEET

Course Code: CS 436
Course Title: Front End Design Lab
Pre-requisite(s): NA
Co- requisite(s): NA
Credits: L: 0 T: 0 P:3
Class schedule per week: 3
Class: B.Tech
Semester / Level:
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	To understand the need for front end development in websites
2	To learn the syntax of Javascript and integrate scripts into websites
3.	To know about the various classes and objects available in Javascript
4.	Manipulate website components at the client end
5.	To manage Javascript for large projects including debugging and error handling skills

Course Outcomes
After the completion of this course, students will be able to:

1.	Shall be able to decide the kind of problems which require the use of Javascript in the context of web programming
2.	Write programs using all the basic syntax of Javascript e.g. loops, functions, objects etc.
3.	Program against the document object model and the browser object model.
4.	Master the usage of a modern Javascript based stack like Angular, React or Vue
5.	Perform data persistence operation using the chosen stack.

Syllabus

Module I
Write basic Javascript programs to explore the normal programming constructs, functions, closures etc.

Module II
Write programs to explore the object-oriented properties of Javascript.
Write programs to manipulate the BOM.
Write programs to Manipulate the DOM.

Module III
Write programs to perform UI refresh using any of the modern stacks like Vue, Angular, React etc.

Module IV
Write programs for data persistence using Javascript using the chosen stack.

Module V
Learn advanced Javascript programming techniques using the chosen Stack.

Text Book:

2. Dangi S., Tomar R., "JAVASCRIPT Syntax and Practices", 1st Edition, CRC Press, 2022

Reference Book:

3. Scott A. D., MacDonald M., Powers s., "JAVASCRIPT Cookbook", 3rd Edition, O'Reilly Press, 2021

Gaps in the syllabus (to meet Industry/Profession requirements): Learning about full stack development

POs met through Gaps in the Syllabus: NA

Topics beyond syllabus/Advanced topics/Design: NA

POs met through Topics beyond syllabus/Advanced topics/Design: NA

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 and Lab files	30
Quiz(zes)	10
Viva Voce	20

Assessment 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
CD2	Quizzes
CD3	Assignments/Seminars
CD4	Mini Projects/Projects
CD5	Laboratory Experiments/Teaching Aids
CD6	Self- learning such as use of NPTEL Materials
CD7	Internets

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, CD2
CO2	CD1, CD2, CD4, CD5
CO3	CD1, CD2, CD5, CD7
CO4	CD1, CD2, CD6, CD7
CO5	CD1, CD2, CD3

COURSE INFORMATION SHEET

Course code: CS437
Course title: **Deep Learning**
Pre-requisite(s):
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 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 able to:

1.	Distinguish between machine learning and deep learning
2.	Identify problems suitable for application of deep learning.
3.	Explain the working of FF Neural Networks and their modifications.
4.	Apply Convolutional & Recurrent Neural Networks to solve problems
5.	Discuss the efficiency of deep learning systems.

Syllabus
Module I

Machine Learning Basics: Learning Algorithms, Capacity, Over Fitting and Under fitting, Hyperparameters and Validation sets, Estimators, Bias and variance, Maximum Likelihood Estimation, BayesianStatistics, Supervised and Unsupervised Learning algorithms, SGD, Building a ML algorithm,

(8L)

Module II
History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm Deep feedforward Networks, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Representation Power of Feedforward Neural Networks, Backpropagation.

(8L)

Module III
Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition. Autoencoders and relation to PCA, Regularization in autoencoders, Denoisingautoencoders, Sparseautoencoders, Contractive autoencoders.

(8L)

Module IV
Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset Augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout. Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization. Learning Vectorial Representations Of Words.

(8L)

Module V
Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks,Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs.Encoder Decoder Models, Attention Mechanism, Attention over images,Introduction to GANs.

. (8L)

Text book:

1. Ian Goodfellow and YoshuaBengio and Aaron Courville,Deep Learning (2016) An MIT Press book, http://www.deeplearningbook.org.(T2)
2. Skansi S., Introduction to Deep Learning - From Logical Calculus to Artificial Intelligence, 1st Edition, Springer International Publishing, 2018.(T2)

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				
Assessment 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												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	3	2	3	2	1	2	2	1	2	2	2	3	1	1	1
2	2	3	2	1	1	1	1	1	1	1	1	2	1	2	1
3	3	3	1	3	3	3	2	1	1	1	1	2	2	2	2
4	3	1	2	1	2	2	1	2	1	1	2	1	1	2	1
5	2	2	1	2	3	1	1	1	2	3	1	1	1	2	3

<u>MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD</u>

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: CS438
Course title: **Deep Learning Lab**
Pre-requisite(s):
Co- requisite(s): CS473 Deep Learning
Credits: L:3 T:1 P:0
Class schedule per week: 4
Class: B.Tech
Semester / Level: IV
Branch: B Tech/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 able to:

1.	Develop Neural network models to solve classification problems.
2.	Design decision trees to solve real world problems.
3.	Create Bayesian Networks for classification problems
4.	Design Convolutional & Recurrent Neural Networks to solve problems
5.	Interpret the training and testing results of deep learning systems.

Syllabus

1. Programs showing Implementation and demonstration of the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file.
2. Write a Program 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 ID3algorithm. Use an appropriate data set for building the decision tree and apply thisknowledge to classify a new sample.
4. Write a program to 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 dataset stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Write a program 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 a data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8. Write a program to Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
9. Write a program showing implementation of k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python MLlibrary classes can be
10. Write a program showing implementation of the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set foryour experiment and draw graphs.

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

<u>Gaps in the syllabus (to meet Industry/Profession requirements):</u>
Implementing of real world problems
POs met through Gaps in the Syllabus: PO5&6

<u>Topics beyond syllabus/Advanced topics/Design:</u>

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
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

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 5

COURSE INFORMATION SHEET

Course code: IT445
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.

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)

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

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

COURSE INFORMATION SHEET

Course code: IT446
Course title: **Internet of Things(IoT) Lab**
Pre-requisite(s): IT423 Internet of Things(IoT)
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.	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:

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
   RTCIO 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.

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

Assessment 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

COURSE INFORMATION SHEET

Course code: IT331
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 visualsystem 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.**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

ii.

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

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

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	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)

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: IT332
Course title: **Image Processing Lab**
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 visualsystem 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

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 domain.
9. Program for detecting edges in an image using Roberts cross gradient
10. operator and sobel operator.
11. Program for smooth an image using low pass filter in frequency domain . (Butterworth lpf)
12. Program for smooth an image using high pass filter in frequency domain . (Butterworth hpf)
13. Program for morphological image operations-erosion, dilation, opening & closing.
14. Program for illustrating color image processing.
15. 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:

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:

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	30
Performance	
Quiz	10

<u>Indirect Assessment</u>

1. Student Feedback on Faculty
2. Student Feedback on Course

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
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Seminars
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

<u>MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES</u>

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)

<u>MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD</u>

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:IT 347
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.

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 andConsumer 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

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

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

COURSE INFORMATION SHEET

Course Code: IT 348
Course Title: Cloud Computing Lab
Pre-requisite(s): Java thread programming, Eclipse, Any web framework (Java, .Net, Python, Ruby etc.), Aneka platform and framework, Hadoop Framework.
Co- requisite(s): Network Programming, Operating system, distributed and parallel programming framework.
Credits: L: T: P: 1.5
Class schedule per week: **3**
Class**: B. Tech**
Semester / Level:
Branch: CSE/IT

Course Objectives
This course enables the students:

1.	Understand Cloud Sim setup first and then implement various task scheduling, resource allocation and resource provisioning based on QoS/ SLA algorithms on Cloud Simulator.
2	Understand various web services, web applications and API. Design and develop different web application and cloud-based application using enterprise cloud like Amazon Web Services, Google App. Engine, Microsoft Azure etc.
3.	Understand the difference between conventional thread programming and Aneka thread programming model and analyse them using various programming exercises.
4.	Understand image decomposition, filtering, histogram, convolution, resolution, scalability techniques etc. using Task Programming Model supported in Aneka and MapReduce programming model supported in Aneka and compare their results.
5.	Understand the designing of different workflows according to requirements and apply MapReduce programming model supported in Aneka.

Course Outcomes
After the completion of this course, students will be able to:

1.	Recall the various cloud computing setup like Cloud Sim, Aneka platform and framework, Hadoop framework etc.
2.	Understand the different task scheduling algorithms, resource allocation algorithms and resource provisioning based on QoS/ SLA and apply Cloud Simulator.
3.	Analyze the difference between conventional thread programming model, Aneka thread programming model by using various programming exercises (Like-texts print, mathematical problems etc.)
4.	Evaluate different mathematical problems and image processing techniques (like- image filtering, decomposition, convolution, scalability, resolution etc. techniques) using Task Programming Model supported in Aneka and MapReduce programming model supported in Aneka and compare their results.
5.	Develop and deploy various web applications using AWS, Google App. Engine, Microsoft Azure etc. And create different services (Like-compute, storage, application services etc.) using AWS, Google App. Engine, etc.

Syllabus

Module I: **Cloud Sim (latest version -5.0) Programs**

1. Implement different task scheduling algorithms like FCFS, Round Robin, SJF, Max-min Min-min algorithms etc. using cloud Simulator.
2. Implement different Resource allocation algorithms like GA, BFO, Simulated annealing, Hill Climbing, best first search etc. using cloud Simulator.
3. Implement resource provisioning based on QoS/ SLA on Cloud Simulator.

Module II: **Develop and Deploy Web Application and use API for integrating two applications:**

1. Web services API integration from Client App. to Cloud App.
2. Install Amazon Web Service to develop and deploy the web applications.
3. Install Google App. Engine to launch the web applications.
4. Install Windows Azure 2 to develop and deploy the web applications

Module III: **Aneka cloud program (Aneka Thread Programming, Aneka Task Programming model):**

1. Write a program to print "Hello World" using Aneka Thread Programming model and Conventional Thread and Understand the differences?
2. Write a program to print "Hello World" using Aneka Thread Programming model use Single Thread?
3. Write a program to print "Hello World" based on Thread model and use exactly five threads also print the executor node information along with the Submission Time and Completion Time?
4. Write a program to compute the following mathematical equation using Aneka Threads (Note: Consider each trigonometric function in independent thread)? P= sin(x) + cos(y) + tan(z)
5. Write a program to sum the two numbers using Aneka Task Programming model?
6. Write a program to compute the matrix addition using Aneka Thread Programming Model.
7. Write a program to compute the matrix multiplication using Aneka Thread Programming Model.
8. Write a program to decompose the image into 25 parts(5X5) and apply histogram (dynamic stretch)
9. Write a program for Image Convolution using Task Programming Model.
10. Using a Thread programming model supported in Aneka, develop a program for parallel multiplication of two very large square matrices or order greater than 500. Conduct and report results of scalability experiments by varying the order of matrix from 500 to 1000 in steps of 100 on computing nodes/workers varying from 10 to 50 in step of 10 in an Aneka-based enterprise Cloud.

Module IV: **MapReduce programming model supported in Aneka**

1. Using a MapReduce programming model supported in Aneka, develop a program for image filtering of hundreds of photos you have taken using digital camera. Conduct and report results of scalability experiments by varying the number of computing nodes/workers and images of different resolutions or file size on an Aneka-based enterprise Cloud.
2. Write a program using Map/Reduce to count the words in the given input set.

Module V: **Enterprise Cloud: advance programming**

1. To create and access VM instances and demonstrate various components such as EC2, S3, Simple DB, EBS, etc. technologies using AWS console, API, and web services.
2. To create GFS, Big Tables, Google NO SQL system, Chubby, Google Distributed Lock services using programming support for Google App. Engine.

Text Book:

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.
3. Cloud Computing Principles and Paradigms, Rajkumar Buyya Wiley.
4. Distributed and Cloud Computing, Kai Hwang, Mk Publication
5. Cloud computing Black Book Dreamtech Publication

References Books:

1. Using Google Apps engine O’reilly Publication
2. Programming Amazon EC2, O’reilly Publication
3. Cloud security, Ronald L. Wiley Publication
4. Cloud computing Dr. Kumar Saurabh, wily Publication
5. Virtualization for Dummies, Wiley Publication
6. John W. Rittinghouse, JamesF. Ran some, Cloud Computing: Implementation, management and security, CRC Press, Taylor and Francis Publication

Direct Assessment

(CBCS)

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	**50**
Semester End Examination	**50**

Continuous Internal Assessment	**% Distribution**
Mid semester examination (Day to day performance+ File+ Lab quiz)	**30+10+10=50**
End Examination (Performance and Viva)	**30+20=50**

Assessment 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 INFORMATION SHEET

Course code: CS439
Course title: **Parallel Computing**
Pre-requisite(s): CS203 Computer Organization and Architecture, 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.	Explain the need of concurrent execution of problems
2.	Solve the issues related to concurrency control
3.	Interpret 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

SYLLABUS:
Module I
Introduction: Parallel Processing Environment- Pipelining and Data Parallelism, Flynn's Taxonomy, Speedup, Scaled Speedup, Analyzing 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, Sorting algorithms: Enumeration Sort, ODD-EVEN Transposition sort, BITONIC Merge, Quicksort Based Algorithms.

(8L)

TEXT BOOK:

Quin M. J., "Parallel Computing: Theory and Practice", McGraw Hill, New York, 1994.

REFERENCE BOOKS:

1. Akl Selim G., "The Design and Analysis of Parallel Algorithms", Prentice Hall International.
2. Sasikumar M., Shikhare D. and Prakash P. Ravi, "Introduction to Parallel Processing", PHI, 2006.

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

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: CS440
Course title: **Parallel Computing Lab**
Pre-requisite(s):
Co-requisite(s):CS421 Parallel Computing
Credits: L:0 T:0 P:2 Class
schedule per week: 4
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:

1	Explain about task and data parallel programs.
2	Build common algorithms in a functional style and solve them in parallel.
3	Analyse a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
4	Develop parallel programs using OpenMP, CUDA, MPI programming models.
5	Examine analysis and optimization of parallel program.

SYLLABUS: CS421 Parallel Computing

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 ImplementMPI 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.
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:
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.

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	√	√	√	√	√

<u>Indirect Assessment</u>

1. Student Feedback on Faculty
2. Student Feedback on Course

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 Delivery Methods

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)

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

OPEN ELECTIVES I (OE)*

COURSE INFORMATION SHEET

Course code: CS261
Course title**: Fundamentals of 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

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

Stack and Queue

Singly Linked List: concept, representation and operations, Circular Linked List, Polynomialand 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.

Module V

Searching and Sorting

Sequential Search and Binary Search, Insertion Sort, Heap Sort, Radix Sort,External Sorting:k-way merging approach.

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 Assessmen

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

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

COURSE INFORMATION SHEET

Course code: IT261
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.

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)

Module V

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:

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 UniversityPress, 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

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

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 ELECTIVES II (OE)*

COURSE INFORMATION SHEET

Course Code: IT361
Course Title: Basics of Software Engineering
Pre-requisite(s):
Credits: L: 3 T: 0 P: 0
Class schedule per week: 3

Course Objectives

This course enables the students:

A.	To explore the basic Software Engineering principles and practices
B.	To learn about various software development processes and apply this in real life applications of product development
C.	To explore various testing techniques and toolsto improve the quality of software
D.	Apply maintenance and software configuration management techniques to tackle change in the requirements.

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain process models and their suitable applications for creating and maintaining software in different development environment.
2.	Apply project management tools and techniques for planning and managing software projects.
3.	Choose a suitable requirement engineering process and design approach to apply them for efficient coding of software.
4.	Evaluate and develop the software using various testing methods.
5.	Use techniques and principles of quality management and software change management.

Syllabus

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 , Incremental model and Agile Models

MODULE – II

Project Management: Management activities, Project planning, Project scheduling, Risk Management.SW cost estimation: Estimation techniques, Algorithmic cost modeling, Project duration and staffing

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 case design, White Box testing, Black box testing, Unit testing, Integration Testing, System testing, Reliability.

Text Book:

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

Reference Books:

1. R1: R. S. Pressman: Software Engineering: A Practitioners Approach, 5th Edn., TMA, New Delhi.
2. R2: J. F. Peters & W. Pedrycz– Software Engineering, John Wiley & Sons,Inc. 2000
3. R3: A.Behforooz & F.J. Hudson – Software Engineering Fundamentals, Oxford Univ. Press, New York, 2000.
4. R4: R.Mall: Fundamentals of Software Engineering. Prentice Hall, 3rd Edn, 2004
5. R5: Naresh Chauhan: Software Testing,Oxford Univ.Press,
6. R6: Presentations used in the course

<u>Portion for Mid-semester Examination:</u>

Modules: I, II &III (Spread in 6 questions each of 5 marks).

The Final Examination is comprehensive of the entire course.

Assignment will be given individually or in small group.

<u>Minimum 75% of attendance is must</u>

<u>**Gaps in the syllabus (to meet Industry/Profession requirements):** Use of open source software testing tools</u>

<u>POs met through Gaps in the Syllabus: All POs</u>

<u>**Topics beyond syllabus/Advanced topics/Design:** Use of open source software testing tools</u>

<u>POs met through Topics beyond syllabus/Advanced topics/Design: All POs</u>

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	10 x 2
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 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	CD_1 , CD_2
CD2	Tutorials/Assignments	CO2	CD_1,CD_2
CD3	Seminars	CO3	CD_1, CD_2
CD4	Mini projects/Projects	CO4	CD_1, CD_2, CD_5,CD_8
CD5	Laboratory experiments/teaching aids	CO5	CD_1, CD_2, CD_5
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

Mapping between Course Objectives and Course Outcomes: IT361

Course Outcome	Course Objectives			
	A	B	C	D
1	H	H	M	M
2	H	H	L	L
3	H	H	M	H
4	H	M	H	L
5	H	M	L	H

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes									
	a	b	c	d	e	f	g	h	i	j
1	H	H	H	H	H	H	L	L	L	L
2	H	H	H	H	H	H	L	L	H	L
3	H	H	H	H	H	L	L	L	L	H

4	H	H	H	H	H	H	L	H	L	L	
5	H	H	H	M	H	L	H	H	L	M	

COURSE INFORMATION SHEET

Course code: CS361
Course title: **Operating System Concepts**
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: B.Tech
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

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

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 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	√	√	√	√	√

<u>Indirect Assessment</u>

3. Student Feedback on Faculty
4. 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	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

OPEN ELECTIVES III (OE)*

COURSE INFORMATION SHEET

Course code: IT363
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

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)

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

3. Student Feedback on Faculty
4. 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

COURSE INFORMATION SHEET

Course code: CS363
Course title: **Artificial Intelligence fundamentals**
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.

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)

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

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

OPEN ELECTIVES IV (OE)*

COURSE INFORMATION SHEET

Course code: CS461
Course title: **Fundamentals of Machine Learning**
Pre-requisite(s): CS206 Design and Analysis of Algorithm
Co- requisite(s):NIL
Credits: L: 3 T: 1 P: 0 Class
schedule per week: 3Class:
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.

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:

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

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)

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: IT461
Course title: **Data Mining Concepts**
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.

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)

<u>Gaps in the syllabus (to meet Industry/Profession requirements):</u>N/A

<u>POs met through Gaps in the Syllabus:</u>N/A

<u>Topics beyond syllabus/Advanced topics/Design:</u>N/A

<u>POs met through Topics beyond syllabus/Advanced topics/Design:</u>N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
<u>Direct Assessment</u>

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	√	√	√	√	√

<u>Indirect Assessment</u>
3. Student Feedback on Faculty
4. 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	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

CS MINOR

COURSE INFORMATION SHEET

Course code: IT263
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

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.

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.

Text book:

Deitel P., Deitel H., Java How to Program, 10^{th} Edition, Pearson Publications, 2016.(T1)

Reference book:

Wu C. T., Object Oriented Programming in Java, 5^{th} Edition, McGrawHill Publications, 2010.(R1)

<u>Gaps in the syllabus (to meet Industry/Profession requirements): N/A</u>

<u>POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-basedassignment</u>

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

Direct Assessment

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

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

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: CS263
Course title: **Data Structures and Algorithms**
Pre-requisite(s): Programming for Problem SolvingCo- 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

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.

<u>**SYLLABUS**</u>

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, Polynomialand 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: conceptand terminologies, Concept of BFS, DFS, Spanning Tree, Connected Components.
(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 (orlatest) , University Press.(T1)

Reference books:

2. TharejaReema, Data Structures Using C, 2nd Edition, Oxford University Press.(R1)
3. 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

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Assessment tool	**% contribution during co assessment**
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

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
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

Course code: CS265
Course title: **Database Management System Concept**
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

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 EntitySets, 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)

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

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: IT365
Course title: **Data Communication & Networking (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, 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
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment	√	√	√	√	√
Semester End Examination	√	√	√	√	√

Indirect Assessment

3. Student Feedback on Faculty
4. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
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Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes (POs)**	**Program Specific Outcomes (PSOs)**

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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

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