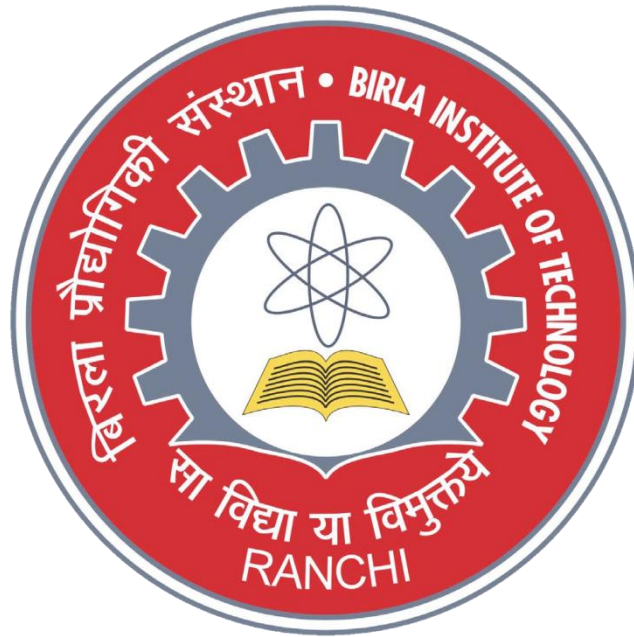


BIRLA INSTITUTE OF TECHNOLOGY



BACHELOR IN COMPUTER APPLICATION

CURRICULUM

BASED ON NATIONAL EDUCATION POLICY 2020

(Effective from Academic Session: 2025-26)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Institute Vision

To become a Globally Recognized Academic Institution in consonance with the social, economic and ecological environment, striving continuously for excellence in education, research, and technological service to the National needs.

Institute Mission

- To educate students at Under Graduate, Post Graduate, Doctoral, and Post-Doctoral levels to perform challenging engineering and managerial jobs in industry.
- To provide excellent research and development facilities to take up Ph.D. programmes and research projects.
- To develop effective teaching learning skills and state of art research potential of the faculty.
- To build national capabilities in technology, education, and research in emerging areas.
- To provide excellent technological services to satisfy the requirements of the industry and overall academic needs of society.

Department Vision

The department strives to be recognized globally for outstanding education and research, leading to excellent professionals and innovators in the field of Computer Science and Engineering, who can positively contribute to the society.

Department Mission

1. To impart quality education and equip the students with strong foundation that could make them capable of handling challenges of the new century.
2. To maintain state-of-the-art research facilities and facilitate interaction with world's leading universities, industries, and research organization for constant improvement in the quality of education and research.

Programme Educational Objectives (PEOs)

- PEO 1:** The program will produce graduates who will be competent professionals in IT industry, academics, government or entrepreneurs.
- PEO2:** Graduates will exhibit professional ethics, critical thinking, problem solving and effective communication skills to work collaboratively in a team-based environment.
- PEO 3:** The graduates will possess leadership qualities and will be capable of attaining higher positions in their professional career.
- PEO4:** Graduates will be able to adapt to the fast-changing world of technology and will become effective professionals to address the technical, social and business challenges.
- PEO 5:** Graduates will recognize the importance of interdisciplinary learning; engage in lifelong learning and professional development.

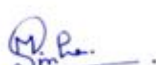
(A) Programme Outcomes (POs)

Graduates will be able to:

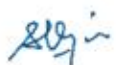
1. **Discipline knowledge:** Demonstrate the comprehensive knowledge of mathematics, computing fundamentals and domain concepts to enhance their professional skills.
2. **Problem analysis:** Apply to identify, formulate and analyze solutions to various computing problems using the fundamental principles of computing.
3. **Design/development of solutions:** Ability to design, develop and implement computer-based solutions to real world problems using appropriate tools and techniques.



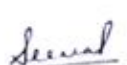
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



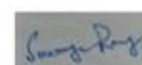
Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



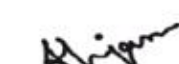
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad

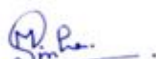


Dr. Amrita Priyam

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
 5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modeling to challenging problems.
 6. **The graduates and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the IT professionals
 7. **Environment and sustainability:** Understand the impact of the professional computer-based solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
 8. **Ethics:** Apply ethical principles to maintain the integrity in a working environment in sustainable societal development through objective, unbiased and truthful actions.
 9. **Individual and teamwork:** Ability to work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
 10. **Communication:** Express thoughts and ideas effectively in understanding computing activities by writing effective reports, making effective presentations, constructing documentation and presenting complex information in a concise manner.
 11. **Project management:** Learn to build a project from pre-implementation to completion within constraints in multidisciplinary environments.
 12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- (B) Programme Specific Outcomes (PSOs)**
1. The ability to analyze, design, code and test application specific or complex problems in Cryptography and Network Security, Design and Analysis of Algorithm, Computer Networks, Cloud Computing, Mobile Computing, Data Mining and Big Data by applying the knowledge of basic sciences, mathematics and fundamentals.
 2. The ability to adapt for rapid changes in tools and technology with an understanding of societal and ecological issues relevant to professional practice through life-long learning.
 3. Excellent adaptability to function in multi-disciplinary work environment, good interpersonal skills as a leader in a team in appreciation of professional ethics and societal responsibilities.



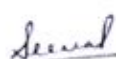
Dr. Archana
Bhatnagar



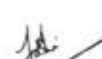
Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



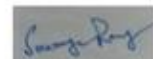
Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

PROGRAMME COURSE STRUCTURE

	BIRLA INSTITUTE OF TECHNOLOGY -MESRA, RANCHI COURSE STRUCTURE FOR BACHELOR OF COMPUTER APPLICATION as per NEP-2020 (w.e.f. Academic Session 2025-26)								
Semester/ Session of Study (Recommended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery and credits L-Lecture; T-Tutorial; P-Practical			Total Credits	
			THEORY		L	T	P	C	
First Monsoon	First	Pre-requisite course *	PR25001	Elementary Mathematics	3	0	0	0	
		DSC- Elective		DSC-Elective I	3	0	0	3	
		DSC-Course	CA25105	Basics of Operating Systems	3	0	0	3	
		DSC-Course	CA25107	Fundamentals of Computer Science	2	0	0	2	
		MDC	MN25106	Principles of Management	3	0	0	3	
		VAC– Elective		VAC Elective		-	-	2	
		VAC– Elective		VAC Elective	-	-	-	2	
		LABORATORIES							
		AECC	HS24131	Communication Skills-I	0	0	3	1.5	
		DSC Lab		DSC Lab –Elective I	0	0	3	1.5	
		SEC-SB Elective		SEC-SB Elective I	-	-	-	3	
		TOTAL				21			

*[will be pass course with no credits]

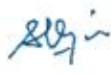
Semester /Session of Study (Recommended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery & credits L-Lecture; T-Tutorial; P-Practical			Total Credits C
					L (Periods/ week)	T (Periods /week)	P (Periods /week)	
Second Spring	First			THEORY				
		DSC-Course	CA25121	Introduction to Data Structures	3	1	0	4
		DSC-Course	CA25123	Basics of Digital Computer and Logic Design	3	1	0	4
		MDC	CA25131	Mathematics for Computing I	3	1	0	4
		VAC-Elective		VAC Elective	2	0	0	2
				LABORATORIES				



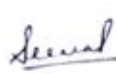
Dr. Archana Bhatnagar



Dr. Madhavi Sinha



Dr. Shripal Vijayvargiya



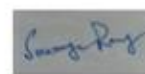
Mrs. Seema Sharma



Mr. Anurag Joshi



Dr. Sounak Paul



Dr. Soumya Ray



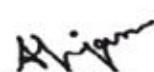
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

		AECC	HS24133	Communication Skills-II	0	0	3	1.5
			CA25122	Data Structure Lab	0	0	3	1.5
		SEC-SB Elective		SEC-SB Elective II	-	-	-	3
		Total						20
		GRAND TOTAL FOR FIRST YEAR						41
VOCATIONAL COURSES FOR EXIT AFTER 1 st Year								
Vocational Course I	MN25120	Event Management			3	0	0	3
Vocational Course II	CA25131	Fundamentals of Multimedia			3	0	0	3

EXIT OPTION WITH CERTIFICATION IN COMPUTER APPLICATIONS

Semester/ Session of Study (Recommended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery and credits L- Lecture; T-Tutorial; P-Practical			Total Credits C
					L (Periods/ week)	T (Periods/ week)	P (Periods /week)	C
Third Monsoon	Second	THEORY						
		DSC- Course	CA25201	Java Programming	3	0	0	3
			CA25203	Database Management System	3	0	0	3
			CA25205	Computer Organization & Architecture	3	0	0	3
		MDC	CA25207	Mathematics for Computing II	3	0	0	3
		AECC	MN25109	Public speaking and creative writing	1	0	2	2
		SEC-SB		SEC-SB Elective III	2	0	2	3
		LABORATORIES						
		DSC Lab	CA25202	Java Lab	0	0	3	1.5
		DSC Lab	CA25204	DBMS Lab	0	0	3	1.5
		TOTAL			20			

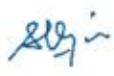
Semester/ Session of Study (Recommend ed)	Course Level	Category of Course	Course Code	Courses	Mode of delivery and credits L-Lecture; T-Tutorial; P-Practical			Total Credits
					L (Periods /week)	T (Periods /week)	P (Periods /week)	
Fourth Spring	Second	THEORY						
		DSC-Course	CA25221	Software Engineering	3	1	0	4
		DSC-Course	CA25223	Python Programming	3	1	0	4
		DSC-Course	CA25225	Computer Networks	3	0	0	3
		DSE-Elective		DSE Elective I	3	0	0	3
		AECC	MN25201	Personality Development	2	0	2	3
		MC	HU24211	Indian Knowledge System				0
		LABORATORIES						



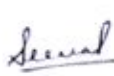
Dr. Archana
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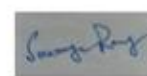
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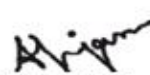
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

		DSC Lab	CA25222	Software Engineering Lab	0	0	3	1.5
		DSC Lab	CA25224	Python Programming Lab	0	0	3	1.5
			Total					20
				GRAND TOTAL FOR SECOND YEAR				40

VOCATIONAL COURSES FOR EXIT AFTER 2 nd Year							
Vocational Course III	MN25214	Basic of Financial Markets and Equity Research	3	0	0	3	
Vocational Course IV	CA25225	Business Intelligence	3	0	0	3	

EXIT OPTION WITH DIPLOMA IN COMPUTER APPLICATIONS



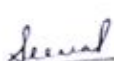
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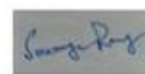
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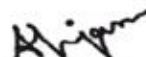
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Dr. Umesh Prasad



Dr. Amrita Priyam

Semester/ Session of Study (Recomm ended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery and credits L-Lecture; T-Tutorial; P- Practical			Total Credits
					L (Periods /week)	T (Periods /week)	P (Periods /week)	
Fifth Monsoon	Third	THEORY						
		DSC-Course	CA25301	Fundamentals of Computer Algorithm	3	1	0	4
		DSE-Elective		DSE-Elective II	3	0	0	3
		DSC-Course	CA25307	Web Programming	3	1	0	4
		DSC-Course	CA25309	Software Testing	3	1	0	4
		LABORATORIES						
		DSE Lab		DSE Lab-Elective II	0	0	3	1.5
		DSC-Course	CA25308	Web Programming Lab	0	0	3	1.5
		Minor Internship/ Project	CA25312	Internship/Project	0	0	0	2
		TOTAL	20					

Semester/ Session of Study (Recommended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery and credits L- Lecture; T-Tutorial; P-Practical			Total Credits
					L (Periods /week)	T (Periods /week)	P (Periods /week)	
Sixth Spring	Third	THEORY						
		DSE Elective		DSE-Elective III	3	1	0	4
		DSC-Course	CA25335	Distributed Computing	3	0	0	3
		DSE-Elective		DSE-Elective IV	3	0	0	3
			CA25341	Optimization Techniques	3	1	0	4
		LABORATORIES						
		DSE Lab-Elective		DSE Lab-Elective III	0	0	3	1.5
		DSE Lab-Elective		DSE Lab-Elective IV	0	0	3	1.5
			CA25344	Minor Project	0	0	0	3
		TOTAL			20			
GRAND TOTAL FOR THIRD YEAR				40				

EXIT OPTION WITH DEGREE (BCA)

Total Credits [I Year + II year + III Year = 41 + 40 + 40 = 121]

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Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

SPECIALIZATION:**Artificial Intelligence and Machine Learning/ DataScience/ High Performance Computing**

Artificial Intelligence and Machine Learning/ DataScience/ High Performance Computing									
Semester/ Session of Study (Recommended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery and credits L- Lecture; T-Tutorial; P-Practical			Total Credits	
					L (Periods /week)	T (Periods /week)	P (Periods /week)		
					THEORY				C
Seventh Monsoon	Fourth	DSE- Elective		DSE-Elective V Annexure A/ Annexure B/ Annexure C	3	1	0	4	
		DSE- Elective		DSE-Elective VI Annexure A/ Annexure B/ Annexure C	3	1	0	4	
		DSE- Course	CA25407	Research Methodology	3	1	0	4	
		DSE- Elective		DSE-Elective VII Annexure A/ Annexure B/ Annexure C	3	1	0	4	
		LABORATORIES							
		DSE Lab- Elective		DSE Lab- Elective V Annexure A/ Annexure B/ Annexure C	0	0	4	2	
		DSE Lab- Elective		DSE Lab-Elective VI Annexure A/ Annexure B/ Annexure C	0	0	4	2	
		TOTAL						20	

Semester/ Session of Study (Recommended)	Course Level	Category of Course	Course Code	Courses	Mode of delivery and credits L- Lecture; T-Tutorial; P-Practical			Total Credits
					L (Periods /week)	T (Periods /week)	P (Periods /week)	
					C			
		THEORY						
Eighth Spring	Fourth	DSE-Elective		DSE-Elective VIII Annexure A/Annexure B/ Annexure C	3	0	0	3
		DSE-Elective		DSE-Elective IX Annexure A /Annexure B/ Annexure C	3	0	0	3
		LABORATORIES						
		DSE Lab-Elective		DSE Lab-Elective VIII Annexure A/ Annexure B/ Annexure C	0	0	4	2
		Research Project/ Dissertation	CA25470	Research project/ Internship with Viva-voce and seminar presentation.	0	0	0	12
	TOTAL							20

AFTER FOURTH YEAR BACHELOR'S DEGREE:BCA HONOURS

Total Credits 161 for 4 years course

Student will select the specialization in one of the followings:

- **Annexure A-Artificial Intelligence and Machine Learning**
- **Annexure B-Data Science**
- **Annexure C-High Performance Computing**

Dr. Archana
BhatnagarDr. Madhavi
SinhaDr. Shripal
VijayvargiyaMrs. Seema
SharmaMr. Anurag
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PaulDr. Soumya
Ray

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Acronyms Expanded

- AECC : Ability Enhancement Compulsory Course
- DSC : Discipline-Specific Core (Course)
- DSE : Discipline-Specific Elective (Course)
- VAC : ValueAddedCourse
- SEC-SB : Skill Enhancement Course-Skill Based
- MDC : Multidisciplinary Course

ELECTIVES

DSC Electives

	Course Code	Course	L	T	P	C
DSC-Elective I						
	CA25101	Programming and Problem-Solving using C	3	0	0	3
	CA25103	Programming and Problem-Solving using C++	3	0	0	3
DSC Lab–Elective I						
	CA25102	C Lab	0	0	3	1.5
	CA25104	C++ Lab	0	0	3	1.5

VAC Electives

	Course Code	Course	L	T	P	C
VAC Elective	MN25102	Human Values and Professional Ethics	2	0	0	2
	CA25109	Environmental Science	2	0	0	2
	MN25103	Yoga	1	0	2	2
	MN25104	Physical Education	1	0	2	2
	MN25111	Digital Empowerment	2	0	0	2
	MN25112	Emotional Intelligence	2	0	0	2

SEC-SB Electives

	Course Code	Course	L	T	P	C
SEC I	CA25110	Office Automation Tools	0	1	4	3
	CA25112	Linux administration	0	1	4	3
SEC II	CA25130	Programming with MATLAB	0	1	4	3
	CA25132	Introduction to Latex	0	1	4	3
SEC III	CA25209	Statistics with R	2	0	2	3
	CA25215	Computer Oriented Numerical Methods	2	0	2	3

DSE Electives

	CourseCode	Course	L	T	P	C
DSE-Elective I	CA25227	Introduction to Data Science	3	0	0	3
	CA25229	Introduction to Artificial Intelligence	3	0	0	3
	CA25231	Enterprise Resource Planning	3	0	0	3
DSE-Elective II	CA25303	Introduction to Machine Learning	3	0	0	3
	CA25305	Computer Graphics	3	0	0	3
DSE Lab-Elective II	CA25304	Machine Learning Lab	0	0	3	1.5
	CA25306	Computer Graphics Lab	0	0	3	1.5
DSE-Elective III	CA25331	Advanced Java Programming	3	1	0	4
	CA25333	Data Analytics	3	1	0	4
DSE Lab-Elective III	CA25332	Advanced Java Programming Lab	0	0	3	1.5
	CA25334	Data Analytics Lab	0	0	3	1.5
DSE-Elective IV	CA25337	Introduction to Data Mining	3	0	0	3
	CA25339	Introduction to IOT	3	0	0	3
DSE Lab-Elective IV	CA25338	Data Mining Lab	0	0	3	1.5
	CA25340	IOT Lab	0	0	3	1.5

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

ANNEXURE A: Artificial Intelligence and Machine Learning
Courses and Labs to be taken from the following table in 7th and 8th semesters

DSE	Course Code	Course	L	T	P	C
DSE-Elective V	CA25401	Deep Learning	3	1	0	4
	CA25411	Data Visualization	3	1	0	4
DSE Lab-Elective V	CA25402	Deep Learning Lab	0	0	4	2
	CA25412	Data Visualization Lab	0	0	4	2
DSE-Elective VI	CA25403	Digital Gaming	3	1	0	4
	CA25415	Advanced Python Programming	3	1	0	4
DSE Lab-Elective VI	CA25404	Digital Gaming Lab	0	0	4	2
	CA25416	Advanced Python Programming Lab	0	0	4	2
DSE-Elective VII	CA25405	Soft Computing	3	1	0	4
	CA25409	Natural Language Processing	3	1	0	4
DSE-Elective VIII	CA25413	Advanced Data Analytics	3	0	0	3
	CA25421	Reinforcement Learning	3	0	0	3
	CA25423	Feature Engineering	3	0	0	3
DSE Lab-Elective VIII	CA25414	Advanced Data Analytics Lab	0	0	4	2
	CA25422	Reinforcement Learning Lab	0	0	4	2
	CA25424	Feature Engineering Lab	0	0	4	2
DSE-Elective IX	CA25417	Computer Vision	3	0	0	3
	CA25419	Image Processing	3	0	0	3

ANNEXURE B: Data Science
Courses and Labs to be taken from following table in 7th and 8th semester

DSE Electives	Course Code	Course	L	T	P	C
DSE-Elective V	CA25425	No SQL Data Base	3	1	0	4
	CA25431	Cloud Computing	3	1	0	4
DSELab- ElectiveV	CA25426	No SQL Lab	0	0	4	2
	CA25432	Cloud Computing Lab	0	0	4	2
DSE-ElectiveVI	CA25415	Advanced Python Programming	3	1	0	4
	CA25433	Data PrProcessing and Reporting	3	1	0	4
DSELab-ElectiveVI	CA25416	Advanced Python Programming Lab	0	0	4	2
	CA25434	Data Preprocessing and reporting Lab	0	0	4	2
DSE-ElectiveVII	CA25405	Soft Computing	3	1	0	4
	CA25427	Data Ethics and Privacy	3	1	0	4
	CA25429	Cryptography &Network Security	3	1	0	4
DSE-ElectiveVIII	CA25413	Advanced Data Analytics	3	0	0	3
	CA25437	Data Security	3	0	0	3
DSE Lab-Elective VIII	CA25414	Advanced Data AnalyticsLab	0	0	4	2
	CA25438	Data security Lab	0	0	4	2
DSE-ElectiveIX	CA25435	Big Data Analytics	3	0	0	3
	CA25419	Image Processing	3	0	0	3

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Dr. Soumya
Ray

(Dr. Sheel Shalini)

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Dr. Umesh Prasad

Dr. Amrita Priyam

ANNEXURE C: High Performance Computing
Courses and Labs to be taken from the following table in the 7th and 8th semester

DSE Electives	Course Code	Course	L	T	P	C
DSE-Elective V	CA25441	Massively Parallel Models of Computation	3	1	0	4
DSE Lab- Elective V	CA25442	Massively Parallel Models of Computation Lab	0	0	4	2
DSE-Elective VI	CA25431	Cloud Computing	3	1	0	4
DSE Lab-Elective VI	CA25432	Cloud Computing Lab	0	0	4	2
DSE-Elective VII	CA25439	Advanced Computer Architecture	3	1	0	4
DSE-Elective VIII	CA25443	High Performance Cluster Computing	3	0	0	3
	CA25445	Grid Computing	3	0	0	3
	CA25447	Introduction to Quantum Computing	3	0	0	3
DSE Lab-ElectiveVIII	CA25444	Cluster Computing Lab	0	0	4	2
	CA25446	Grid Computing Lab	0	0	4	2
	CA25448	Quantum Computing Lab	0	0	4	2
DSE-ElectiveIX	CA25449	Parallel Algorithm and Computation	3	0	0	3
	CA25451	High-Performance Big Data Computing	3	0	0	3



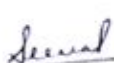
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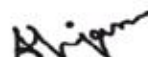
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SYLLABUS



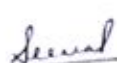
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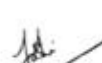
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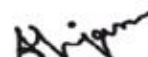
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Dr. P.S. Bishnu



Dr. Umesh Prasad



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SEMESTER I

CourseCode		:PR25001
CourseTitle		:ELEMENTARY MATHEMATICS
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:0	L:3	T:0 P:0

Class schedule per week :03
Class :BCA
Semester/Level :I/1
Branch :Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand cartesian system, appropriate designing of basic curves.
B.	Perform Matrix operations, Linear system and their solutions.
C.	Work with simple Finite series and Elementary statistics.
D.	Find derivatives of different functions, chain rules and basic understanding of maxima and minima.
E.	Solve integral calculus problems ,understand integration rules and definite integrals etc.

CourseOutcomes

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

CO1	Find distance between points, able to draw the basic curves.
CO2	Understand linear system of equations and Gauss elimination method.
CO3	Understand Trigonometry and statistics and able to Solve related Problems.
CO4	Find the solutions through differentiations, concept of extreme points and to obtain the functional value on the point.
CO5	Understand how to integrate different algebraic and trigonometric functions.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 ElementaryGeometry Point, Location of point, line, Slope of line, Two-point equation, Intercept form of line, Cartesian system, Basic curves-Circle and Parabola.	8
Module2 Matrix Matrix Operation – addition, subtraction, product, Idea of determinant, Inverse ofMatrix, Linear system of equations, solution of linear system, rank of matrix.	8
Module3 Series and Statistics Arithmetic Progression, Geometric Progression, Infinite Geometric Progression, Binomial Expansion. Mean, mode, median, deviation, Standard deviation.	8
Module4 Elementary Differential Calculus	8



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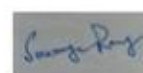
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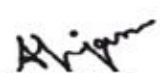
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Basics of Functions, Differentiation of functions, Rules of derivatives, addition and subtraction, product rule, Quotient rule, chain rule. Maxima and Minima.	
Module5 Elementary Integral Calculus Integration, Rules of integration, integration of constant, Integration of Variable. Integration of Square, Integration of Reciprocal, Integration of Exponential function, Integration of Trigonometric Function, Definite integrals.	8

TEXT BOOKS:

1. Thomas George B., "THOMAS' CALCULUS-early Transcendental" Thirteenth edition, Pearson, ISBN 978-0-321-88407-7
2. R.D.Sharma. Mathematics, Part I (Vol. I & II) and Part II (Vol. I & II), Dhanpat Rai Publication.

REFERENCE BOOKS:

1. K.C.Sinha. A Textbook of Mathematics, Rastogi Publications; 13th Edition: 2019-2020.
2. M.N.Mukherjee, P.Mukhopadhyay, S.Sinha Roy and U.Dasgupta. Rudiments of Mathematics, Parul Prakashani Pvt. Ltd.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

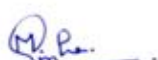
1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Cos and Program Outcomes

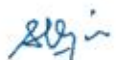
Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	1	1	2	1	1	1	1	2	2	2	1	1	1
CO2	2	2	2	1	2	1	1	1	1	1	2	2	1	1	1
CO3	2	3	3	1	3	1	1	1	1	1	2	3	3	1	1
CO4	2	2	2	3	3	1	1	1	2	1	3	3	3	2	1
CO5	2	2	3	2	3	1	1	1	3	2	3	3	3	2	1



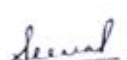
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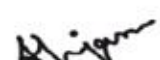
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Dr. Umesh Prasad



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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 Code	CourseDelivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2
CD2	Tutorials/Assignments	CO2	CD1,CD2
CD3	Seminars	CO3	CD1,CD2
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning of NPTEL Materials and Internet		
CD9	Simulation		

CourseCode		: CA25101
CourseTitle		: PROGRAMMING AND PROBLEM- SOLVING USING C
Pre-requisite(s)		:
Co-requisite(s)		: C Lab
Credits:3	L:3	T: 0 P: 0

Class schedule per week

: 03

Class

: BCA

Semester/Level

:I/1

Branch

: Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understand the fundamentals of C programming.
B.	Learn about different problems and the approach to solve them.
C.	Gain proficiency with the fundamental concepts of the C programming language.
D.	Be able to apply these concepts to solve real world problems.
E.	Able to program in C programming for a given application.

Course Outcomes

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

CO1	Choose the loops and decision-making statements to solve the problem.
CO2	Implement different Operations on arrays.
CO3	Use functions to solve the given problem.
CO4	Understand pointers, structures and unions.
CO5	Implement file Operations in C programming for a given application.

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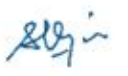
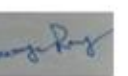
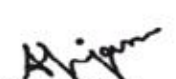
Syllabus

MODULE	(No. of Lecture Hours)
Module1 Problem Solving and Programming Concepts: Problem Solving in Everyday Life, Types of Problem, Problem Solving with Computers, General Problem-Solving Strategies. Overview of C: History of C, Importance of C, Structure of C program, Sample of C programs. Constant, Variable and Data types: C Tokens – keywords, identifier, constant, string, and operators, and symbols, Data types – primary data types, user defined data types, and derived data types, Declaration of variables, assign values to variables. Operators and Expressions: Different types of operators – arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, bitwise operators, conditional operators and special operators, Arithmetic expressions –precedence of arithmetic operators, Type conversions in expressions. Managing input and output operations: Reading a character, Writing a character, Formatted input, and Formatted output.	10
Module2 Decision making and Branching: Decision making with if statement - Simple if statement, The if else statement, Nesting of if else statement, The else if ladder, The switch statement, The ?: Operator, The go-to statement. Decision making and Looping: The while statement, The do statement, The for statement, Nesting of loops, Jumps in loops: break, continue.	8
Module3 Arrays: One - dimensional arrays, Declaration and assign value of one – dimensional arrays, Two dimensional arrays, Declaration and assign value of two– dimensional arrays, Multi – dimensional arrays. Character Arrays and String: Declaring and initializing string variables, Reading string from terminal, Writing string to screen, Putting string together, Comparison of two strings, String handling functions, Other features of strings.	7
Module4 User defined functions: A multi – function program, Definition of function, Function calls, Function declaration, Category of functions, Nesting of functions, Recursion, Passing arrays to functions, Passing strings to functions. Standard Library function: math, date and time.	8
Module5 Structures and Unions: Defining a structure, declaring structure variables, Accessing structure members, Arrays of structures, Arrays within structures, Structures within structures, Structures and functions, Union. Pointers: Understanding pointers, Accessing the address of a variable, Declaring pointer variables, Pointer expressions, Array of pointers, Pointers to function, Pointers and structures. File Management: Defining and opening a file, Closing a file, Input/ Output operations on files, Error handling during I/O operations.	7

TEXT BOOKS:

- Balagurusamy E., “Programming in ANSIC”, 5th Edition, TMH, 2010.
- Sprankle M., “Problem Solving and Programming Concepts”, 7th Edition, Pearson Education, New Delhi, 2006.

REFERENCE BOOKS:

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

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CourseCode		:CA25103
CourseTitle		:PROGRAMMING AND PROBLEM-SOLVING USING C++
Pre-requisite(s)		:
Co-requisite(s)		:C++ Lab
Credits:3	L:3	T: 0 P: 0

Class schedule per week : 03
Class : BCA
Semester/Level :I/1
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the basic concepts of OOP.
B.	The course will exemplify the basic syntax and constructs of C++.
C.	Understand the application OOP principles in various use cases.
D.	Explain basic C++ characteristics and their working.
E.	The course aims to expose students to newer C++ constructs.

Course Outcomes

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

CO1	Identify the difference between procedural and OO programming.
CO2	Construct programs using various OOP principles.
CO3	Design programs using C++.
CO4	Operate on files and strings in real life scenarios.
CO5	Analyze the difference between procedural language and OOP.

SYLLABUS

MODULE	(No. of Lecture Hours)
Module1 Introduction to Object Oriented Programming: Basic concept of OOP, Comparison of Procedural Programming and OOP, Benefits of OOP, C++ compilation, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C and C++. Elements of C++ Language: Tokens and identifiers: Character set and symbols, Keywords, C++ identifiers; Variables and Constants: Integer, character and symbolic constants; Dynamic initialization of variables, Reference variables, Basic data types in C++, Streams in C++.	6
Module2 Operators and Manipulators: Operators, Types of operators in C++, Precedence and associativity of operators, Manipulators. Decision and Control Structures: if statement, if-else statement, switch statement, Loop: while, do-while, for; Jump statements: break, continue.	6

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Module3 Arrays: One - dimensional arrays, Declaration of one – dimensional arrays, Two – dimensional arrays, Declaration of two – dimensional arrays, Multi – dimensional arrays. Functions: Components of function: prototype, function call, definition, parameter; passing arguments; types of function, inline function, function overloading. Introduction to Classes and Objects: Classes in C++, class declaration, declaring objects, Defining Member functions, Inline member function, Array of objects, Objects as function argument, Static data member and member function, Friend function and friend class.	9
Module4 Structures and Unions: Defining a structure, declaring structure variables, Accessing structure members, Arrays of structures, Arrays within structures, Structures within structures, Structures and functions, Union. Pointers: Understanding pointers, Accessing the address of a variable, Declaring pointer variables. Constructors and Destructors: Constructors, Instantiation of objects, Default constructor, Parameterized constructor, Copy constructor and its use, Destructors, Constraints on constructors and destructors, Dynamic initialization of objects.	9
Module5 Inheritance: Derived class and base class: Defining a derived class, Accessing the base class member, Inheritance: multilevel, multiple, hierarchical, hybrid; Virtual base class, Abstract class. Virtual Functions and Polymorphism: Virtual functions, pure virtual functions; Polymorphism, Categorization of polymorphism techniques: Compile time polymorphism, Run time polymorphism. FileHandling: File classes, Opening and Closing a file, File modes, Manipulation of file pointers, Functions for I/O operations.	10

TEXT BOOKS:

1. Balagurusamy E, “Object-Oriented Programming with C++”, 4th Edition, TMH, 2008.

REFERENCE BOOKS:

1. Cohoon J.P. & Davidson J.W., “C++ Program Design: An Introduction to Programming and Object-Oriented Design”, 2nd Edition, TMH Education, New Delhi, 2000.
2. Friedman F.L. & Koffman E.B., “Problem Solving, Abstraction, and Design Using C++”, 4th Edition, Pearson Education, Inc. 2004.

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design: Template, GUI Design

Pos met through Topics beyond syllabus/Advanced topics/Design

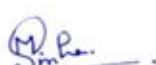
Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

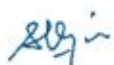
Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50



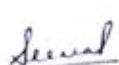
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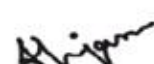
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



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In Direct Assessment

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

Mapping between Cos and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1	2	2	3	2	2	3	2
CO2	3	3	3	1	3	1	1	1	1	3	3	2	2	2	2
CO3	3	3	3	3	3	1	2	2	2	1	1	2	2	3	2
CO4	3	3	3	1	3		1	1	1	1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD7,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD9
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1,CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25105
Course Title		:Basics of Operating Systems
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week

:3

Class

:BCA

Semester/Level

: I/1

Branch

:Bachelor of Computer Applications

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Dr. Umesh Prasad

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Course Objectives

This course enables the students to:

A.	Understand the key concepts and principles of operating systems.
B.	Introduce the concepts of process and thread and their scheduling policies
C.	Handle concurrent processes and deadlocks
D.	Analyze the different techniques for managing memory and virtual Memory
E.	Understand the file organization and I/O and disk scheduling

Course Outcomes

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

CO1	Describe the main components of OS and their working
CO2	Explain the core concepts of process management. Analyze and compare different process scheduling algorithms.
CO3	Describe and solve different deadlock issues and solutions
CO4	Compare the different techniques for managing memory and virtual Memory
CO5	Explain the various file organization methods, I/O structure and Disk scheduling.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Operating system Objective and Functions, Evolution of Operating System, Major Advances in OS Components, Characteristics of Modern Operating Systems, Services	7
Module2 Process Concept, Process States, Process Description, Process Control, Threads, Types of Threads, Type of scheduling, Uniprocessor Scheduling, Multiprocessor Scheduling	7
Module3 Principle of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery. Combined approaches.	7
Module4 Memory Management Requirements, Memory Partitioning, Paging, Segmentation. Virtual Memory, Operating System Policies for Virtual Memory	7
Module5 Overview, File Organization and Access, File Directories, File Sharing, Record Blocking, File Allocation. I/O device, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling	7

TEXT BOOKS:

1. Silberschatz A., Galvin P. B. & Gagne G., "Operating System Concepts", 10th Edition (or later), Wiley India, 2018

REFERENCE BOOKS:

1. D. M. Dhamdhare, "Operating Systems: A Concept Based Approach", Tata McGraw Hill 2nd Edition
2. Tanenbaum, "Operating Systems Design and Implementation", 3rd Edition., Prentice-Hall Inc., 2006

Gaps in the Syllabus (to meet Industry/Professional requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

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Dr. Umesh Prasad

Dr. Amrita Priyam

POs met through Topics beyond syllabus/ Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between Cos and ProgramOutcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	3	3	3	2	1	1	2
CO2	3	1	1	1	1	3	1	1	3	1	1	1	1	3	1
CO3	2	3	3	1	2	1	2	2	2	3	3	1	2	1	2
CO4	1	1	3	3	1	1	1	1	1	1	3	3	1	1	1
CO5	3	3	3	1	2	1	1	2	3	3	3	1	2	1	1

Correlation Levels1, 2or3 as defined below:

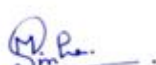
- 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between Cos and Course Delivery(CD) methods

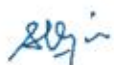
CD Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD2,CD5, CD8, CD9
CD3	Seminars	CO3	CD1,CD2,CD5, CD8, CD9
CD4	Mini Projects/ Projects	CO4	CD1,CD2,CD5, CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD8
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		



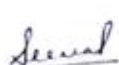
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



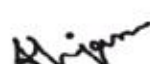
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Dr. P.S. Bishnu



Dr. Umesh Prasad



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CourseCode		: CA25107
CourseTitle		: FUNDAMENTALS OF COMPUTER SCIENCE
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:2	L:2	T:0 P:0

Class schedule per week : 02
Class : BCA
Semester/Level : I/1
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand working of Computer, software and hardware.
B.	Understand basics of operating system and programming languages.
C.	Understand number systems and Boolean algebra.
D.	Understand different computer devices.
E.	Understand the concept of computer memory.

Course Outcomes

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

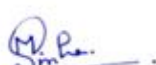
CO1	Learn the basics of computer, its software and hardware.
CO2	Describe the concepts of operating system and programming languages.
CO3	Explain number systems and Boolean algebra.
CO4	Describe various input and output devices.
CO5	Describe different memories.

Syllabus

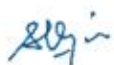
MODULE	(No. of Lecture Hours)
Module1 Introduction to Computers: Definition, Characteristics of Computers, Classification of Computers, Applications of Computers. Computer Software: Software: Definition, Relationship between Software and Hardware, Software Categories, System Software, Application Software.	5
Module2 Operating system: Definition of Operating system, Evolution of operating system, Types of Operating System, Functions of an Operating System, Modern Operating Systems. Computer Program & Languages: Introduction, Developing a program, Algorithm, Flowchart, Pseudo Code (P-Code). Generations of Programming Languages.	6
Module3 Number Systems and Logic Gates: Number Systems, Conversion between Number bases, Arithmetic System. Signed and Unsigned Numbers, Concept of Overflow, Binary Coding, Logic Gates, Boolean Algebra and Combination of Logic Gates.	7



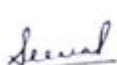
Dr. Archana
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Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



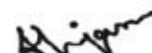
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Module4 Input Devices & Output Devices: Keyboard, Pointing Devices, Digital Camera, Scanners, Optical Scanners, output devices: Printers, Plotters, Monitors, Audio output, Projectors, Terminals.	5
Module5 Computer Architecture: Central Processing Unit (CPU), Memory, Communication between various units of a Computer System, The Instruction Format, Instruction Set, Computer Memory: Primary Memory Hierarchy, Random Access Memory, Types of RAM, Read only memory (ROM), Types of ROM, Classification of Secondary Storage Devices, Magnetic Tape, Magnetic Disk, Optical Disk.	7

TEXT BOOKS:

1. ITL Education Solution Limited, R & D Wing, Introduction to Computer Science, Pearson Education.
2. ManoM., "Computer System Architecture", Prentice Hall of India, New Delhi,

REFERENCE BOOKS:

1. Raja Raman V, Fundamentals of Computers, Second Edition, PHI, New Delhi.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1	1	1	1	2	2	3	2
CO2	3	3	3	1	3	1	1	1	1	1	1	2	2	2	2
CO3	3	3	3	3	3	1	2	2	1	1	1	2	2	3	2
CO4	3	3	3	1	3	1	1	1	1	1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

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Paul

Dr. Soumya
Ray

(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

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 Code	CourseDeliveryMethods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD7,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD9
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits /In-plant Training		
CD8	Self-learning, such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25109
CourseTitle		: ENVIRONMENTAL SCIENCE
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:2	L:2	T: 0 P: 0

Class schedule per week**: 02****Class****: BCA****Semester/Level****: I/1****Branch****: Bachelor of Computer Applications****Course Objectives**

This course enables the students to:

A.	Develop basic knowledge of ecological principles and their applications in environment.
B.	Identify the structure and composition of the spheres of the earth, the only planet sustaining life.
C.	Analyze how the environment is getting contaminated and probable control mechanisms for them.
D.	Generate awareness and become a sensitive citizen towards the changing environment.
E.	Understand and practice various preventive measures of environmental pollution.

Course Outcomes

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

CO1	Explain the structure and function of ecosystems and their importance in the holistic environment.
CO2	Identify the sources, causes, impacts and control of air pollution.
CO3	Distinguish the various types of water pollution happening in the environment and understand about their effects and potential control mechanisms.
CO4	Judge the importance of soil, causes of contamination and need of solid waste management.
CO5	Predict the sources of radiation hazards and pros and cons of noise pollution.

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Dr. Umesh Prasad

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Syllabus

MODULE	(No. of Lecture Hours)
Module1 Ecosystem and Environment: Concepts of Ecology and Environmental Science, ecosystem: structure, function and services, Biogeochemical cycles, energy and nutrient flow, ecosystem management, fate of environmental pollutants, environmental status and reports on climate change.	6
Module2 Air Pollution: Structure and composition of unpolluted atmosphere, classification of air pollution sources, types of air pollutants, effects of air pollution, monitoring of air pollution, control methods and equipment for air pollution control, vehicular emissions and control, indoor air pollution, air pollution episodes and case studies.	6
Module3 Water Pollution: Water Resource; Water Pollution: types and Sources of Pollutants; effects of water pollution; Water quality monitoring, various water quality indices, water and waste water treatment: primary, secondary and tertiary treatment, advanced treatments (nitrate and phosphate removal); Sludge treatment and disposal.	6
Module4 Soil Pollution and Solid Waste Management: Lithosphere – composition, soil properties, soil pollution, ecological & health effects, Municipal solid waste management – classification of solid wastes, MSW characteristics, collection, storage, transport and disposal methods, sanitary landfills, technologies for processing of MSW: incineration, composting, pyrolysis.	6
Module5 Noise pollution & Radioactive pollution: Noise pollution: introduction, sources: Point, line and area sources; outdoor and indoor noise propagation, Effects of noise on health, criteria noise standards and limit values, Noise measurement techniques and analysis, prevention of noise pollution; Radioactive pollution: introduction, sources, classification, health and safety aspects, Hazards associated with nuclear reactors and disposal of spent fuel rods- safe guards from exposure to radiations, international regulation, Management of radioactive wastes.	6

TEXT BOOKS:

1. A. K. De., "Environmental Chemistry", New Age Publications India Ltd., 3rd Edition, 2008.
2. R. Rajagopalan, "Environmental Studies: From Crisis to Future", 3rd Edition, Oxford University Press, 2016.
3. Eugene P. Odum., "Fundamentals of Ecology", 3rd Edition, WB Saunders Company, Philadelphia, 1971.
4. C. N. Sawyer, P. L. McCarty and G. F. Parkin, "Chemistry for Environmental Engineering and Science", John Henry Press, 2002.
5. S. C. Santra, "Environmental Science", New Central Book Agency, 2011.

REFERENCE BOOKS:

1. D.W. Conell, "Basic Concepts of Environmental Chemistry", CRC Press.
2. Peavy, H.S, Rowe, D.R, Tchobanoglous, G., "Environmental Engineering", Mc-Graw-Hill International.
3. G.M. Masters & Wendell Ela, "Introduction to Environmental Engineering and Science", PHI Publishers, 1991.

Gaps in the Syllabus (to meet Industry/Profession requirements)

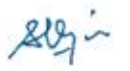
1. Explain the structure and function of ecosystems and their importance in the holistic environment.
2. Identify the sources, causes, impacts and control of air pollution.



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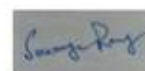
Mrs. Seema
Sharma



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Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



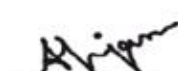
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



Dr. Amrita Priyam

3. Distinguish the various types of water pollution happening in the environment and understand about their effects and potential control mechanisms.

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus /Advanced topics /Design-3, 4,12,13,14

Course Outcome(CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between Cos and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1															
CO2	3	3	3	1	3	1	1	1				2			
CO3	3	3	3	1	3	1	1	1				2			
CO4	3	3	3	3	3	1	2	2		1	1	2			
CO5	3	3	3	3	1		1	1		1	1	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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2
CD2	Tutorials/Assignments	CO2	CD1,CD2
CD3	Seminars	CO3	CD1,CD2
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1,CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		

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CD9	Simulation		
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CourseCode		: CA25110
CourseTitle		: OFFICE AUTOMATION TOOLS
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:0	T:1 P:4

Class schedule per week :T(1) P(4)
Class : BCA
Semester/Level :I/1
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Use file managers, word processors, spreadsheets, and presentation softwares.
B.	Understand the dynamics of an office environment.
C.	Present conclusions effectively, orally and in writing.
D.	Demonstrate the ability to apply application software in an office environment.
E.	To know the practical application of various automation tools.

Course Outcomes

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

CO1	Use file managers, word processors, spreadsheets, and presentation software.
CO2	Describe the features and functions of the categories of application software.
CO3	Understand the dynamics of an office environment.
CO4	To apply different tools for different automation problems.
CO5	Use Google Suite for office data management tasks.

Syllabus

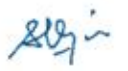
MODULE	(No. of Lecture Hours)
Module1 Basics of Computer: Introduction of Computer, Computer generations, Types of Computer, Characteristics of Computer, Fundamental understanding of Computer Storage Device, Input Device, Output Device, Types of Software, Usage of Computer. Windows Operating System: Introduction to Windows, Starting Windows, Desktop, TaskBar, StartUp Menu, Working with programs and icons-Adding, removing, starting, and quitting programs and icons. Working with files and folders-creating, deleting, opening, finding, copying, moving, and renaming files and folders. Control Panel, setting, My Computer, Recycle bin, My documents, drives. Windows notepad, Accessories, and windows Explorer.	8



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Vijayvargiya



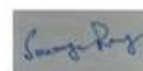
Mrs. Seema
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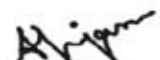
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



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Module2 Introduction to OpenOffice/MS Office/LibreOffice Word Processing: Features, Creating, Saving and Opening Documents in Word, Interface, Toolbars, Ruler, Menus, Keyboard, Shortcut, Editing, Previewing, Printing & Formatting a Document, Advanced Features of MS Word, Find & Replace, Using Thesaurus, Using Auto-Multiple Functions, Mail Merge, Handling Graphics, Tables & Charts, Converting a word document into various formats like-Text, Rich Text format, Word perfect, HTML, PDF etc.	8
Module 3 Spreadsheets Worksheet basics, creating worksheet, entering into worksheet, heading information, data, text, dates, alphanumeric values, saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and Menus, Keyboard shortcuts, Working with single and multiple workbook, working with formulae & cell referencing, Auto sum, Copying formulae, Absolute & relative addressing, Worksheet with ranges, formatting of worksheet, Previewing & Printing worksheet, Graphs and charts, Database, Creating and Using macros, Multiple worksheets- concepts, creating and using.	8
Module4 Presentation Tools: Presentation Tools: Adding and formatting text, pictures, graphic objects, including charts, objects, formatting slides, notes, hand-outs, slide shows, using transitions, animations.	8
Module5 Online Office Tool Google Docs Tools: Creating, saving, downloading, sharing files/folders from Google Drive, creating and sharing Google Docs, importing and exporting Docs, creating and sharing Google Sheets, importing and exporting Google Sheets, Google Forms and form responses, creating Google Slides to present your ideas.	8

List of Programs as Assignments:

Implementation of the above modules in the lab experiments.

TEXT BOOKS:

1. Computer Fundamentals by Pradeep K Sinha
2. Peter Norton: Computing Fundamentals. 6th Edition, McGraw-Hill-Osborne, 6 Edition
3. Working in Microsoft Office–Richard Mansfield–Tata McGraw-Hill Education.
4. Microsoft Office 2010 For Dummies By Wallace Wang

REFERENCE BOOKS:

1. <https://gsuite.google.com/learning-center>

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Introduction to online automation software and applications.
2. Multimedia Introduction.

POs met through Gaps in the Syllabus -1,2, 3,4

Topics beyond syllabus/Advanced topics/Design

1. Online automation, online apps

POs met through Topics beyond syllabus/Advanced topics/Design-3, 5, 7, 8

Course Outcome(CO) Attainment Assessment Tools & Evaluation Procedure

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Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between Cos and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	3	3	2	3	2	1	3	2	3	3
CO2	3	3	2	3	2	2	1	1	1	2	3	2	3	2	2
CO3	1	2	3	3	2	3	3	2	3	2	3	2	3	3	3
CO4	2	3	2	3	2	3	3	2	3	2	2	3	2	3	3
CO5	3	2	3	2	3	3	2	3	3	2	3	3	3		3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture using Boards/LCD Projectors	CO1	CD1, CD2
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD3, CD8
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD5
CD5	Laboratory Experiments/Teaching Aids	CO5	CD2, CD4, CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning as the use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25112
Course Title		: LINUX ADMINISTRATION
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:0	T:1 P:4

Class schedule per week

:T(1) P(4)

Class

: BCA

Semester/Level

: I/1

Branch

: Bachelor of Computer Applications

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Ray

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Course Objectives

This course enables the students to:

A.	Explain some of the different distributions of Linux and the reasons for open source.
B.	Familiar with Linux commands to manage files and file systems. In-depth knowledge of the structure of the Linux operating system.
C.	Learning how to write Shell Scripting with the Linux operating system. Gaining knowledge to configure basic Linux network services.
D.	Establish user accounts and permissions.
E.	Understand the basics of various OS related concepts, from a programmer's point of view, like files, directories, kernel, inodes, processes, signals, etc.

Course Outcomes

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

CO1	Know about the Linux Boot Process and System Logging.
CO2	Know about Linux logs and Linux logfiles.
CO3	Know about Disk Management: Creating partitions with fdisk, File Systems.
CO4	Know about LVM-The Logical Volume Manager.
CO5	Know about User Management, ShellScripting, and Networking with the Linux Operating System.

Syllabus

MODULES	(No. of Lecture Hours)
Module1 About Linux Administration, The Linux Boot Process and System Logging, creating Virtual Machine, Installation of Linux Operating System on Virtual Machines, System Login and Linux log files, Viewing and Editing Files, Linux Permissions, File and Directory Permissions.	6
Module2 Creating partitions with fdisk, File Systems, LVM - The Logical Volume Manager. Introduction to the Logical Volume Manager (LVM), LVM: Layers of Abstraction Creating Physical Volumes (PVs), Volume Groups (VGs), and Logical Volumes Extending Volume Groups and Logical Volumes Mirroring Logical Volumes, Removing Logical Volumes, Physical Volumes, and Volume Groups Migrating Data from One Storage Device to Another.	6
Module3 User Management: Managing Users and Groups, Switching Users, Running Commands, Shell Scripting.	6
Module4 Networking: TCP/IP Networking for Linux System Administrators, Networking - DNS and hostnames, DHCP, Dynamic and Static Addressing, TELNET Configuration, FTP, SAMBA Configuration, NFS Configuration, and Network Troubleshooting.	6
Module5 Managing Processes and Jobs, Processes and Job Control, Scheduling Jobs with Cron, Managing Software, Installing Software on RPM-Based Linux Distros, Printer Installing Process (CUP) on Linux OS.	6

List of Programs as Assignments:

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Sinha

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Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

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Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Implementation of the above modules in the lab experiments.

1. Install a Linux distribution of your choice on a virtual machine or a spare computer.
2. Create a new user account and set a password for it.
3. Change the hostname of the Linux system.
4. Update the system using the package manager.
5. Install a new software package using the package manager.
6. Create a directory called "Documents" in your home directory.
7. Use the command line to navigate to a specific directory.
8. Create a text file using a text editor and save it to your home directory.
9. Use the "ls" command to list the contents of a directory.
10. Use the "cp" command to make a copy of a file.
11. Use the "rm" command to delete a file.
12. Use the "chmod" command to change the permissions of a file or directory.
13. Create a compressed archive of a directory using the "tar" command.
14. Configure a static IP address for the network interface.
15. Set up a basic firewall rule to allow or block incoming connections.
16. Create a symbolic link from one file to another

TEXT BOOKS:

1. Linux: The Complete Reference, by Richard Petersen, Sixth Edition, McGraw-Hill.

REFERENCE BOOKS:

1. Linux for Beginners: An Introduction to the Linux Operating System and Command Line. E-book
2. Linux Command Line and Shell Scripting Bible by Richard Blum, Christine Bresnahan, 2021

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 & Evaluation Procedure****Direct Assessment**

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	3	3	2	3	2	1	3	2	3	3

Dr. Archana
BhatnagarDr. Madhavi
SinhaDr. Shripal
VijayvargiyaMrs. Seema
SharmaMr. Anurag
JoshiDr. Sounak
PaulDr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

CO2	3	3	2	3	2	2	1	1	1	2	3	2	3	2	2
CO3	1	2	3	3	2	3	3	2	3	2	3	2	3	3	3
CO4	2	3	2	3	2	3	3	2	3	2	2	3	2	3	3
CO5	3	2	3	2	3	3	2	3	3	2	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 COs and Course Delivery (CD)methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD3, CD8
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/Projects	CO4	CD1,CD2,CD5
CD5	Laboratory Experiments/Teaching Aids	CO5	CD2,CD4,CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25102
CourseTitle		: C LAB
Pre-requisite(s)		:
Co-requisite(s)		: Programming and Problem Solving using C
Credits: 1.5	L:0	T:0 P:3

Class schedule per week

: 3

Class

:BCA

Semester/Level

: II/1

Branch

: Bachelor of Computer Applications

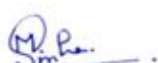
Course Objectives

This course enables the students to:

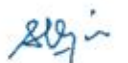
A.	Understand the syntax, semantics, and structure of the C programming language and apply them to solve simple problems.
B.	Implement decision-making and iterative constructs for problem-solving using control structures.
C.	Design and use arrays, strings, and functions to develop modular and reusable code.
D.	Apply pointers and structures to manage and manipulate memory and complex data types effectively.
E.	Utilize file handling techniques to perform data storage and retrieval operations, and build real-world applications using C.



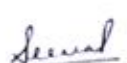
Dr. Archana
Bhatnagar



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Dr. Shripal
Vijayvargiya



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Sharma



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Dr. Sounak
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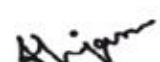
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Course Outcomes

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

CO1	Write, compile, and execute basic C programs using variables, data types, and input/output operations.
CO2	Apply conditional and iterative control structures to solve algorithmic problems.
CO3	Implement programs using arrays, strings, and modularize code using functions and recursion.
CO4	Manipulate data efficiently using pointers and structured data types (structures and unions).
CO5	Develop programs that perform file operations and demonstrate the ability to work on real-life problem statements using C.

SYLLABUS

MODULE	(No. of Lecture hours)
Module 1: Introduction to C Programming Topics: • Basic syntax, keywords, variables, data types • Input/output using scanf and printf • Arithmetic operations and expression evaluation Programs: 1. Input and display student information (name, roll, marks). 2. Write a program to compute simple interest. 3. Write a program to perform all arithmetic operations. 4. Convert temperature from Celsius to Fahrenheit. 5. Swap two numbers using a third variable. 6. Swap two numbers without using a third variable.	4
Module 2: Control Structures and Looping Topics: • Conditional statements (if, if-else, switch) • Loops (for, while, do-while) • Nested control structures Programs: 7. Check whether a number is even or odd. 8. Find the largest of three numbers. 9. Check whether a number is prime. 10. Generate Fibonacci series up to n terms. 11. Find factorial of a number using a loop. 12. Write a menu-driven calculator using switch. 13. Sum of digits of a number using a loop.	4
Module 3: Arrays, Strings, and Functions Topics: • One-D and Two-D arrays • String manipulation using string.h • User-defined functions and recursion Programs: 14. Read and display an array of n integers. 15. Find the largest and smallest element in an array. 16. Matrix addition and subtraction. 17. Check whether a string is a palindrome. 18. Count the number of vowels in a string.	4

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19. Find the length of a string without using strlen().	
20. Find GCD of two numbers using recursion.	
Module 4: Pointers and Structures Topics: • Pointers and pointer arithmetic • Structures, arrays of structures, pointers to structures Programs: 21. Demonstrate pointer arithmetic operations. 22. Swap two numbers using pointers. 23. Access array elements using pointers. 24. Create a structure to store student records (name, roll, marks). 25. Store and display an array of structures (e.g., employees). 26. Pointer to structure: display structure contents using pointer. 27. Dynamic memory allocation.	4
Module 5: File Handling Topics: • File operations: fopen(), fclose(), fread(), fwrite(), fprintf(), fscanf() Programs: 28. Create and write data to a text file. 29. Read and display contents of a file. 30. Count the number of characters, words, and lines in a file	4

TEXT BOOKS:

1. Jerry R Hanly, "ProblemsolvingandProgramdesigninC", Pearson Education, 7th Edition.
2. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill.

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall India Learning Private Limited.
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
3. R. G. Dromey, How to Solve it by Computer, Pearson Education.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

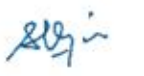
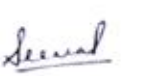
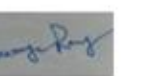
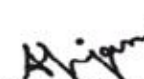
POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

1. Student Feedback on Faculty
2. StudentFeedbackonCourseOutcome

Mapping between COs and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	1	3	2	1	2	1	1	3	1	2	2
CO2	3	2	1	1	2	3	1	3	2	1	1	2	1	3	2
CO3	2	3	3	1	3	1	2	2	1	1	1	1	3	2	3
CO4	1	1	3	3	1	3	1	1	1	1	1	1	1	3	2
CO5	2	3	3	1	3	1	2	2	3	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

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3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/ Assignments	CO2	CD1, CD8, CD9
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD9
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/ In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25104
Course Title		:C++ LAB
Pre-requisite(s)		:
Co-requisite(s)		Programming and problem-solving using C++
Credits: 1.5	L:0	T:0 P:3

Class schedule per week

03

Class

:BCA

Semester/Level

:I/1

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Learn computer language.
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B.	Learn coding for problems.
C.	Learn the problem-solving process through computer.
D.	Know the limitations of system during program execution.
E.	Know the practical application of various programming techniques.

Course Outcomes

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

CO1	Formulate simple algorithms for arithmetic and logical problems.
CO2	Translate the algorithms to programs.
CO3	Test and execute the programs and correct syntax and logical errors.
CO4	Apply programming to solve simple numerical method problems, differentiation of function and simple integration.
CO5	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.

SYLLABUS

List of Programs as Assignments:

- Write a program to read two numbers from the keyboard and display the larger value on the screen.
- Write a program to read two numbers from the keyboard and display the larger value on the screen
- Write a program to read the values a, b and c and display x, where $x = a/b - c$.
- Write a function using reference variables as arguments to swap the values of a pair of integers.
- Write a program to evaluate the following investment equation $V = P(1+r)^n$
- A cricket has the following table of batting figure for a series of test matches: Player's name, Run, Innings, Time not out. "Sachin" "8430", "230", "18"; "Saurav" "4200", "130", "9"; "Rahul", "3350", "105", "11"; Write a program to read the figures, set out in the above forms, to calculate the batting averages and to print out the complete table including the averages.
- An electricity board charges the following rates to domestic users to discourage large consumption of energy: For the first 100 units – 60P per unit For the first 200 units – 80P per unit For the first 300 units – 90P per unit All users are charged a minimum of Rs. 50.00. If the total amount is more than Rs. 300.00 then an additional surcharge of 15% is added. Write a program to read the names of users and number of units consumed and print out the charges with names
- Write a program to read a matrix of size m*n from the keyboard and display the same on the screen using function.
- Write a function power() to raise a number m to power n. The function takes a double value for m and int value for n and returns the result correctly. Use a default value of 2 for n to make the function to calculate the squares when this argument is omitted. Write a main that gets the values of m and n from the user to test the function.
- Create two classes DM and DB which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results may be a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimeters depending on the object on display.
- Write a function to obtain maximum among three numbers.
- Assume that a bank maintains two kinds of accounts for customers, one called as savings and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level a service charge is



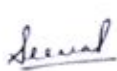
Dr. Archana
Bhatnagar



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Vijayvargiya



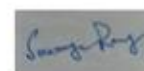
Mrs. Seema
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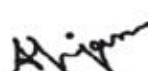
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



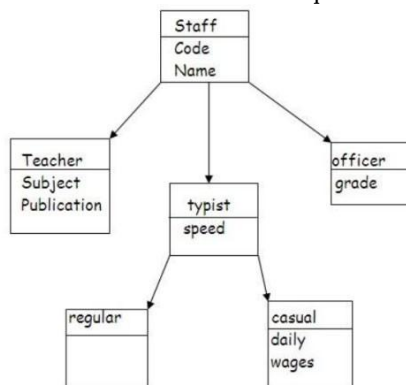
Dr. Umesh Prasad



Dr. Amrita Priyam

imposed. Create a class account that stores customer name, account number and type of account. From this derive the classes cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:(a)Accept the deposit from a customer and update the balance. (b) Display the balance.(c) Compute and deposit interest. (d) Permit withdrawal and update the balance .(e) Check for the minimum balance, impose penalty, necessary and update the balance. Do not use any constructors. Use member functions to initialize class member.

13. An educational institution wishes to maintain a database of its employees. The database is divided into a number of classes whose hierarchical relationships are shown in following figure. The figure also shows the minimum information required for each class. Specify all classes and define functions to create the database and retrieve individual information as and when required.



14. The database created in exercise19 does not include educational information of the staff.It has been decided to add this information to teachers and officers (and not for typists) which will help management in decision making with regard to training, promotions etc. Add another data class called education that holds two pieces of educational information namely highest qualification in general education and highest professional qualification. This class should be inherited by the classes teacher and officer. Modify the program of exercise 19 to incorporate these additions
15. Create a base class called shape.Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the baseshape.Add to the base class, a member function get_data() to initialize baseclass data members and another member function display_area() to compute and display the area of figures. Make display_area() as a virtual function and redefine this function in the derived classes to suit their requirements
16. Write a program to read a list containing item name, item code, and cost interactively and produce a three column output as shown below.
- | | | | |
|----|----------|------|--------|
| a. | Name | Code | Cost |
| b. | TurboC++ | 1001 | 250.95 |
| c. | C primer | 905 | 95.70 |
17. Modify the above program (Q.16) to fill the unused spaces with hyphens.

TEXT BOOKS:

1. Balagurusamy E.,“Object-Oriented Programming with C++”,8th Edition, TMH,2020.

REFERENCE BOOKS:

1. Cohoon J.P.& Davidson J.W.,“C++ Program Design: An Introduction to Programming and Object-Oriented Design”, 3rd Edition, TMH Education, New Delhi, 2002.
2. Friedman F.L. & Koffman E.B., “Problem Solving, Abstraction, and Design Using C++”, 4th Edition, Pearson Education, Inc. 2004.

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

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(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/ Advanced topics/Design

Course Outcome(CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Day to day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

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CO4	3	3	3	1	3	1	1	1	2	1	1	2	3	2	3
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

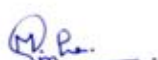
1:Slight(Low) 2:Moderate (Medium) 3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

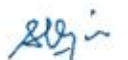
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CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2
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CD9	Simulation		



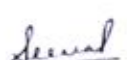
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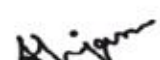
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CourseCode		: CA25131
CourseTitle		: Fundamentals of Multimedia
Pre-requisite(s)		: None
Co-requisite(s)		:None
Credits:3	L:3	T:0 P:3

Classscheduleperweek :3

Class :BCA

Semester/Level : 1

Branch :Bachelor of Computer Applications

Course Outcomes

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

CO1	Define and explain key concepts, types, and applications of multimedia.
CO2	Describe multimedia elements like text, images, audio, video, and animation and their working principles.
CO3	Identify multimedia tools and hardware components used in system design and authoring.
CO4	Explain multimedia file formats and apply compression techniques.
CO5	Analyze multimedia applications in real-life scenarios and suggest basic project solutions.

Syllabus

MODULE	(No. of Lecture Hours)
Module 1: Introduction to Multimedia Definition and types of multimedia, Multimedia vs traditional media, Components of multimedia, Applications: Education, Entertainment, Advertising, Virtual Reality, Web	6
Module2: Multimedia Elements Text: Fonts, Unicode, text compression, Image: Bitmap and vector graphics, color models (RGB, CMYK), Audio: Sampling, MIDI, digital audio, audio file formats, Video: Frame rate, resolution, standards (PAL, NTSC), video file formats, Animation: Types, techniques, and principles of animation	6
Module3: Multimedia Hardware and Software Input and output devices: Scanners, cameras, microphones, speakers, Storage devices: CD/DVD, SSD, Flash, Display devices: Monitors, projectors, Authoring tools: Types (Icon-based, Timeline-based),	7
Module4: Compression and File Formats Need for compression, Lossless vs Lossy compression, Image compression (JPEG, PNG), Audio (MP3, WAV), Video (MPEG, AVI), Codecs and containers, Multimedia file standards and compatibility,	7
Module5: Multimedia Systems and Applications Multimedia communication systems, Multimedia in web design, Multimedia databases and streaming, Case studies: e-learning platforms, gaming, social media, Ethical and legal issues in multimedia.	7

TEXT BOOKS:

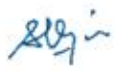
1. 'O' LEVEL Introduction to Multimedia by R.K. Jain [Khanna Publishing House]
2. Introduction to Multimedia (O2.R0) by Satish Jain [BPB Publication]



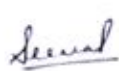
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Dr. Shripal
Vijayvargiya



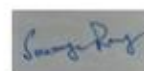
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Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



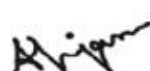
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

REFERENCE BOOKS:

1. Adobe Photoshop Classroom in a Book by Conrad Chavez
2. Adobe Premiere Pro Classroom in a Book by Maxim Jago

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 & Evaluation Procedure****Direct Assessment**

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	1	1	1	1	2	1	2	1	1	3	2	2
CO2	3	2	2	1	1	1	1	2	1	2	1	1	2	3	2
CO3	3	2	2	3	2	1	1	2	1	1	2	2	3	3	2
CO4	3	2	2	3	1	1	1	2	1	1	2	2	2	3	2
CO5	2	3	3	2	2	2	2	3	2	3	2	3	2	2	3

Correlation Levels 1, 2, or 3 as defined below:

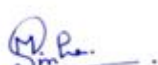
- 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

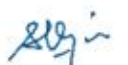
CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2
CD2	Tutorials/Assignments	CO2	CD1, CD2
CD3	Seminars	CO3	CD1, CD2
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CD9	Simulation		



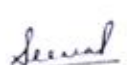
Dr. Archana
Bhatnagar



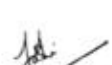
Dr. Madhavi
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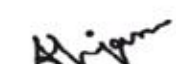
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

SEMESTER II

CourseCode		:CA25121
CourseTitle		:INTRODUCTION TO DATA STRUCTURES
Pre-requisite(s)		:
Co-requisite(s)		:DataStructuresLab
Credits:4	L:3	T:1 P:0

Class schedule per week : 04
Class : BCA
Semester/Level :II/1
Branch : Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Know the details about the data structure.
B.	Applications, advantages and limitations of various data structures.
C.	Real life use of various data structures.
D.	Implementations of various data structures.
E.	Analyze and compare the different algorithms.

CourseOutcomes

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

CO1	Analyze and compare the efficiency of algorithms and understand the properties of various data structures.
CO2	Apply data structures in the modeling of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design.
CO3	Demonstrate the usage of optimal trees.
CO4	Identifying one of many sorting and searching algorithms and implementing the same for real-life applications.
CO5	Develop solutions for real-life problems using graph-based algorithms.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction: Introduction to Algorithmic, Asymptotic notations, Complexity- Time- Space Trade off. Data Structure-Definition and Classification. Arrays: Representation of Arrays in Memory: Accessing of elements of an array, performing operations like Insertion, Deletion, arranging elements, and searching, applications of arrays. Stacks and Queues: Introduction to data structures like Stacks and Queues. Operations onStacksandQueues, Array representation of Stacks, Applications of Stacks: Operations of Queues, Representations of Queues, Applications of Queues.	10

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(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Module2 Linked Lists: Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion Deletion, Searching, Applications of Linked List.	10
Concepts of Circular linked list and doubly linked list and their Applications, Stacks and Queues as linked lists.	
Module3 Trees: Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching, Insertion and Deletion, Applications of Binary search Trees, Complete Binary trees, AVL trees, Threaded Binary trees, m-way search trees, B-Trees.	8
Module4: Searching and Sorting: Definition. Linear Search, Binary search, Interpolation Search, Transpose Sequential Search. Insertion Sort, Selection sort, Quick sort, Merge sort, Heap sort.	6
Module5 Graphs: Terminology and Representations, Adjacency Matrix and Adjacency List Representation, Directed Graphs and Undirected Graphs and their Transversal – DFS & BFS.	6

TEXT BOOKS:

1. Horowitz and Sahni, "Fundamentals of Data Structures", Galgotia Publications.
2. Pai G A V, "Data Structures and Algorithms: Concepts, Techniques and Applications", Tata McGraw-Hill.

REFERENCE BOOKS:

1. Tannenbaum, "Data Structures", PHI.
2. Lipschutz Seymour, "Data Structures", Tata McGraw-Hill.
3. Drozdek Adam, "Data Structures and Algorithms in C++", Thomson Learning.
4. R.L.Kruse, B.P.Leary, C.L.Tondo, "Data Structure and Program Design in C", PHI,
5. Michael T. Goodrich, "Data Structures and Algorithms in C++", Wiley India Edition.
6. Tremblay J. P., Sorenson P. G, "An Introduction to Data Structures with Applications", McGraw-Hill.

Gaps in the Syllabus (to meet industry/professional 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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

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(Dr. Sheel Shalini)

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Dr. Umesh Prasad

Dr. Amrita Priyam

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	2	2	3	3	3	3	1	2	2
CO2	3	3	3	2	2	3	2	1	3	2	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	2	3	3	2	2	3
CO4	2	2	2	3	1	2	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	3	3	3	3	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/ Projects	CO4	CD1,CD5,CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD9
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25123
CourseTitle		:BASICS OF DIGITAL COMPUTER AND LOGIC DESIGN
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:4 L:3	T:1	P:0

Class schedule per week

:04

Class

: BCA

Semester/Level

: II/1

Branch

: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
B.	Identify the number of variables and their simplification, importance and understand different circuits for the implementation of Boolean equations.
C.	Understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
D.	Implement and design simple logical operations using combinational logic circuits and sequential logic circuits.
E.	Implement synchronous statemachines using flip-flops.



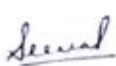
Dr. Archana
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Vijayvargiya



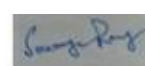
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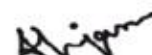
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Course Outcomes

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

CO1	Manipulate numeric information in different forms.
CO2	Manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
CO3	Minimize the circuit diagrams by use of K-Map concepts and Boolean Algebra.
CO4	Design and analyze the outcome of the circuit designed.
CO5	Design and analyze sequential circuits and to use standard sequential functions to build larger more complex circuits.

Syllabus

Module	(No. of Lecture Hours)
Module1 Number System and Boolean Algebra: Digital Systems, Binary Numbers, Number Base Conversion Methods, Complements of Numbers, Signed Binary Numbers, Binary Codes, Binary Coded Decimal Code, Gray Codes, ASCII Character Code, Error Detecting Codes. Boolean Algebra, Axiomatic Definition of Boolean Algebra, Basic theorems and properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates, Properties of XOR Gates, Universal Gates.	10
Module2 Minimization Techniques: Introduction, The minimization with theorems, The Karnaugh Map Method, Three, Four and Five variable K-Maps, Prime and Essential Implications, Product of Sums Simplification, Don't Care Conditions, NAND and NOR Implementation, Multilevel NAND/ NOR realizations.	10
Module3 Combinational Circuits: Design Procedure – Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Binary Adder, Parallel binary subtractor, Binary Multiplier, Multiplexers/ De-Multiplexers, decoder, Encoder, Code Converters, Magnitude Comparator.	10
Module4 Sequential Circuits: Introduction, Basic Architectural Distinctions between Combinational and Sequential circuits, Latches, The S-R-Latch Flip-Flop The D-Latch, Flip-Flops, SR, JK, D, T and Master slave, characteristic Tables and equations, Conversion from one type of Flip-Flop to another, Analysis of clocked sequential circuits, Register and Counters: Registers, Shift Register, Ripple Counter, Synchronous Counters.	10
Module5 Memory Devices: Classification of memories – ROM: ROM organization, PROM, EPROM, EEPROM, RAM: RAM organization, Write operation, Read operation, Static RAM, Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic, Implementation of Combinational Logic circuits using ROM, PLA, PAL.	10

TEXT BOOKS:

1. Digital Design-Morris Mano, PHI, 3rd Edition.

REFERENCE BOOKS:

1. Computer System Architecture-Morris Mano, PHI, 3rd Edition
2. Switching Theory and Logic Design-A. Anand Kumar, PHI, 2nd Edition.
3. Fundamentals of Logic Design-Charles H. Roth, Cengage Learning, 5th, Edition, 2004

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Dr. Amrita Priyam

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1	2	1	2	2	2	3	2
CO2	3	3	3	1	3	1	1	1	1	1	2	2	2	2	2
CO3	3	3	3	3	3	1	2	2	3	1	1	2	2	3	2
CO4	3	3	3	1	3	1	1	1	1	2	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	LecturebyuseofBoards/LCD Projectors	CO1	CD1,CD7,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD9
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CO4CD1,CD2
CD5	Laboratory Experiments/TeachingAids	CO5	CD1,CD2
CD6	Industrial/GuestLectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internets		
CD9	Simulation		

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CourseCode		:CA25131
CourseTitle		:MATHEMATICS FOR COMPUTING I
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:4	L:3	T:1 P: 0

Class schedule per week :04
Class : BCA
Semester/Level : II/1
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Use appropriate set, function, or relation models to analyse practical examples, interpret the associated operations and terminology in context.
B.	Meaning and application of Counting Problems and their uses.
C.	Use Pictorial Representation (Graphs) to model Problems and find solutions.
D.	Understand the Abstract structure of mathematics, which helps students understand Modular Mathematics, algebra, Cryptography, etc.
E.	Solving Problems Using Mathematical Methods.

Course Outcomes

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

CO1	Familiar with different terminologies used in Mathematics and Computing.
CO2	Understand and Formulate the Problem.
CO3	Understand Mathematics and its ways for solving a Problem.
CO4	Analyze to solve the Problem using Mathematical Methods.
CO5	Solve the Problems by applying Methods.

Syllabus

MODULE	(No. of Lecture Hours)
Module 1 Sets and Functions Set, Subset, Set Operations, Properties of Set operations, Functions, properties of Functions, Composite of functions, Inverse of Function. Trigonometric Functions, Exponential and Log function, Greatest Integer and least Integer function.	10
Module2 Relations Relations on a Set, Properties of relations, Closures of Relation, Equivalence Relation, Partial ordered Relation, Hasse Diagram, Effect of Relations of the Set.	10
Module3 Counting and Recurrence relation Basics of Counting, Permutation, Combination, Pigeonhole Principle, Solving Recurrence relation using Backtracking and Characteristic equation roots Method.	10
Module4 GraphTheory	10

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Terminology of Graphs, Basic Theorems, Digraphs, Path and Cycles, Trees, Connected and Disconnected Graph, Complete Graph, Euler and Hamiltonian Graph, Spanning tree and Minimal Spanning Tree for weighted Graph.	
Module 5 Algebraic Structure Semi-Group, Monoid, Group, Sub-Group, Ring and Field.	10

TEXT BOOKS:

1. Kolman, B.; Busby, R. and Ross, Discrete Mathematical Structures (6e), Pearson Education India –ISBN 978-9332549593.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Applications, PHI, ISBN-978-8120301450

REFERENCE BOOKS:

1. Rosen Kenneth H., “Discrete Mathematics and its Applications”, 6th edition, McGraw-Hill, ISBN 978-0-07-288008-3.
2. Lipschutz Seymour & Lipson Marc, “Discrete Mathematics”, McGraw-Hill, 3rd Special Indian Edition, ISBN-13: 978-0-07-060174-1.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

Pos met through the 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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
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In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
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CO3	2	3	3	1	3	1	1	1	1	1	2	3	3	1	1
CO4	2	2	2	3	3	1	1	1	2	1	3	3	3	2	1
CO5	2	2	3	2	3	1	1	1	3	2	3	3	3	2	1

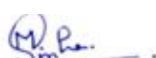
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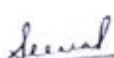
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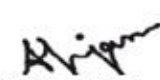
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	
CD2	Tutorials/ Assignments	CO2	
CD3	Seminars	CO3	
CD4	Mini Projects/ Projects	CO4	
CD5	Laboratory Experiments/Teaching Aids	CO5	
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25130
CourseTitle		: Programming with MATLAB
Pre-requisite(s)		: Basic knowledge of programming concepts and fundamental mathematics, including matrices and functions.
Co-requisite(s)		: Concurrent enrollment in courses involving numerical methods or applied mathematics is recommended
Credits:3	L:0	T:1 P:4

Class schedule per week**: T(1) P(4)****Class****: BCA****Semester/Level****: II/I****Branch****: Bachelor of Computer Applications****Course Objectives**

This course enables the students to:

A.	To introduce students to the MATLAB environment, command window operations, and script file creation.
B.	To enable understanding and manipulation of arrays, matrices, and mathematical functions.
C.	To develop skills in data visualization using 2D and 3D plotting tools in MATLAB.
D.	To equip students with programming constructs like conditional statements and loops in MATLAB.
E.	To apply MATLAB for solving algebraic equations, ordinary differential equations, and basic numerical techniques.

Course Outcomes

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

CO1	Understand and navigate the MATLAB interface, including command operations and variable management.
CO2	Perform matrix operations and apply built-in mathematical functions for computation.
CO3	Create and customize 2D and 3D plots for data visualization and interpretation.
CO4	Write MATLAB programs using control structures and user-defined scripts.
CO5	Solve algebraic and differential equations using numerical methods within MATLAB.

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Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction to MATLAB: Starting MATLAB, working in command window, arithmetic operations, display formats, elementary maths built in functions, defining scalar variables, useful command for managing variables, script files	6
Module2 Basic mathematical operations with arrays : 1 and 2 dimensional arrays, addition and subtraction, array multiplication and division, element-by-element operations, generation of random numbers, analyzing arrays using built-in maths functions	6
Module3 Graphics with MATLAB: Basic plot commands: plot, fplot, formatting a plot, subplots, basic 2D and 3D plots: Line plots, mesh and surface plots, contour, View command	6
Module4 Programming in MATLAB : Conditional statements, loops, nested loops, application of break and continue commands	6
Module5 Mathematical computing with MATLAB: Algebraic equations: Eigen values, Eigen vectors, solution of a system of linear equations. Introduction to ordinary differential equations (ODE), solution of first order ODE, numerical techniques: Trapezoidal rule, Simpson's rule.	6

Implementation of the above modules in the lab experiments.

List of Programs as Assignments

- To understand the MATLAB Workspace a) start up MATLAB b) type commands in main window c) change current directory
- To use MATLAB as a calculator: a) perform some arithmetic calculations b) understand the importance of operators, and functions c) use MATLAB's help files d) use functions like $\sin x$, $\cos x$, or $|x|$ to solve problems
- To understand the purpose of variables and how to create variables.
- To write a script M-File (a list of MATLAB commands, saved in a file) with an emphasis on using appropriate comments
- To learn how to create 1 and 2-D arrays, understand the advantages of the different ways of creating arrays, including the standard format and the linspace command.
- To access specific numbers in arrays using their position.
- To use array commands to perform different arithmetic operations on arrays
- To generate of random numbers
- To perform exercises on using basic commands to plot 2D and 3D plots as mentioned above.
- To learn different ways of formatting the plots using basic commands like xlabel, ylabel, axis, etc.
- To learn how to have multiple graphs on the same figure using hold on/off commands
- To create subplots and application of view command
- To write simple programs involving loops using commands like for, while, if-else, return, etc.
- To evaluate Eigen values and Eigen vectors of a given matrix
- To solve a system of linear equations using Gauss elimination method and Gauss Seidel method
- To solve a first-order ODE by Euler's method and Runge-Kutta method
- To evaluate numerical integration by using Trapezoidal and Simpson's rule.

TEXT BOOKS:

- Rudra Pratap, *Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers*, Oxford University Press, 2010.

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(Dr. Sheel Shalini)

Dr. P.S. Bishnu

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2. Amos Gilat, *MATLAB: An Introduction with Applications*, Wiley India

REFERENCE BOOKS:

1. A Guide to MATLAB - for Beginners and Experienced Users”, 2nd Ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press, 2006.
2. Wolfram S., *The Mathematica*, Cambridge University Press, 2003.
3. Steven C. Chapra, *Applied Numerical Methods with MATLAB for Engineers and Scientists*, McGraw-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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	2	3	3	3	2	3	2	1	3	2	3	3
CO2	2	3	2	3	2	2	1	1	1	2	3	2	3	2	2
CO3	1	2	3	3	2	3	2	1	3	2	3	2	3	3	3
CO4	2	2	2	3	2	3	3	2	3	2	2	3	2	3	3
CO5	3	2	3	2	3	3	3	3	2	2	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 COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture using Boards/LCD Projectors	CO1	CD1, CD2
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD3, CD8
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD5
CD5	Laboratory Experiments/Teaching Aids	CO5	CD2, CD4, CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

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CourseCode		: CA25132
CourseTitle		: LateX Lab
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:0	T:1 P:4

Class schedule per week : T(1) P(4)
Class : BCA
Semester/Level : II/1
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	To introduce students to the LaTeX typesetting system and its application in academic and scientific document preparation
B.	To enable students to create structured documents including reports, articles, CVs, and presentations.
C.	To enable learners to format documents with sections, tables, figures, and references using LaTeX commands and environments
D.	To familiarize students with writing and formatting mathematical expressions, equations, and symbols in LaTeX.
E.	To provide exposure to Overleaf and LaTeX-based publication templates

Course Outcomes

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

CO1	Install and use LaTeX environments like TeXstudio and Overleaf.
CO2	Write well-structured documents including titles, sections, mathematical content, and tables.
CO3	Incorporate figures, references, citations, and bibliographies using BibTeX.
CO4	Create scientific presentations using Beamer.
CO5	Utilize LaTeX for specialized formatting like chemical structures and graphics using TikZ.

Syllabus

MODULE	(No. of Lecture Hours)
Module 1: Getting Started with LaTeX: Introduction to LaTeX and document preparation system, Installing TeXStudio and accessing Overleaf, LaTeX IDEs and their features, Structure of a LaTeX document, Document classes and the \documentclass command, Packages and environments, Writing the first LaTeX document	6
Module 2: Formatting and Document Structure: Creating title pages, chapters, sections, and subsections, Page styles and formatting text (fonts, sizes, styles), Labeling and cross-referencing, Table of Contents, special characters, line and page breaks, Columns, multi-columns, minipages, Footnotes, headers, footers, and fancyhdr package, Defining custom commands and shortcuts	6



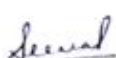
Dr. Archana
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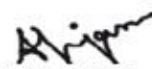
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Module 3: Mathematical Typesetting with LaTeX: Introduction to math mode and environments, Writing Greek letters, subscripts, superscripts, Fractions, summation, integrals, overline, underline, Matrices, determinants, arrays, Referencing equations, Using the amsmath package and math symbols	6
Module 4: Tables, Figures, Citations, and Bibliographies: Creating and formatting tables (tabular, cases, enumerate), Inserting images with \includegraphics, Creating figures and captions, Citations using BibTeX, Creating .bib files, Bibliography styles and referencing in text	6
Module 5: Advanced Topics and Applications: Creating presentations using the Beamer class, Themes and slide structures, Drawing graphics using TikZ: lines, shapes, annotations, Chemical structure typesetting using chemfig, Orbital diagrams, Overleaf templates for CVs, journal articles, reports, Best practices for collaborative writing	6

Implementation of the above modules in the lab experiments.

List of Programs as Assignment

1. Create a basic LaTeX document that includes the title, author name, date, and a simple paragraph. Use \documentclass{article} and compile using TeXstudio or Overleaf.
2. Design a multi-section document with at least two chapters, each having multiple sections and subsections. Use labeling and cross-referencing to refer to sections.
3. Demonstrate different page styles and text formatting, including font types, sizes, bold, italic, underlined text, and color. Include both inline and displayed text.
4. Create a document with a Table of Contents, footnotes, and customized headers/footers using the fancyhdr package.
5. Write a LaTeX document demonstrating math expressions like fractions, subscripts/superscripts, roots, summations, and integrals using both inline and display math modes.
6. Create matrices and determinants using bmatrix, pmatrix, and explain the difference. Add a labeled equation and reference it in the text.
7. Insert a figure and a table into your document, add appropriate captions, labels, and center them. Ensure the figure is imported from an external file.
8. Create a complex table using tabular and multirow/multicolumn, and apply formatting like borders, alignment, and cell spacing.
9. Prepare a .bib file and cite at least three references using BibTeX. Use a predefined style (e.g., plain, IEEE) and generate the bibliography in your document.
10. Create a simple Beamer presentation with a title slide, outline slide, and at least 4 content slides using a predefined theme and color theme.
11. Draw a geometric shape (e.g., triangle or rectangle) using the TikZ package. Add labels, lines, and nodes to illustrate parts of the figure.
12. Use the chemfig package to draw a basic organic chemical structure (e.g., benzene or ethanol) and demonstrate orbital or structural notations.

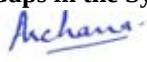
TEXT BOOKS:

1. Stefan Kottwitz, *LaTeX Beginner's Guide*, Packt Publishing
2. Tobias Oetiker et al., *The Not So Short Introduction to LaTeX2ε*, Available online (free)

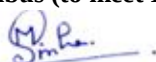
REFERENCE BOOKS:

1. H. Kopka & P.W. Daly, *A Guide to LaTeX*, Fourth Edition, Addison - Wesley, Pearson Education, 2004.
2. Leslie Lamport, *LaTeX: A Document Preparation System*, Addison-Wesley
3. Gratzner, George, *More Math Into LaTeX*, Springer

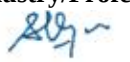
Gaps in the Syllabus (to meet Industry/Professional requirements)



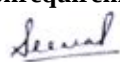
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Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

POs met through Gaps in the Syllabus

Topics beyond syllabus/ Advanced topics/ Design

Postmet through Topics beyond syllabus/ Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between Cos and ProgramOutcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	2	2	3	3	2	3	3	1	2	2	3	3
CO2	2	3	2	2	2	2	1	1	1	2	3	2	3	2	2
CO3	1	2	3	3	1	3	2	1	3	2	3	2	3	3	3
CO4	2	2	2	3	2	3	3	2	3	2	2	3	2	3	3
CO5	3	1	3	2	3	3	3	3	2	2	3	3	3	3	3

Correlation Levels1, 2or3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between Cos and Course Delivery(CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture using Boards/LCD Projectors	CO1	CD1, CD2
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD3, CD8
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD5
CD5	Laboratory Experiments/Teaching Aids	CO5	CD2, CD4, CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as use of NPTEL materials and the Internets		
CD9	Simulation		

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CourseCode		: CA25122
CourseTitle		: DATA STRUCTURES LAB
Pre-requisite(s)		:
Co-requisite(s)		: Introduction to Data Structures
Credits:1.5	L:0	T:0 P:3

Class schedule per week : 03
Class : BCA
Semester/Level : II/1
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Assess how the choice of data structures and algorithm design methods impact the performance of programs.
B.	Choose the appropriate data structure and algorithm design method for a specific application.
C.	Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.
D.	Familiarity with major algorithms and data structures and analyze performance of algorithms.
E.	Implementation of different sorting and searching technique and analyze their performance.

Course Outcomes

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

CO1	Have practical knowledge on the applications of data structures.
CO2	Choose an appropriate data structure given a computational problem.
CO3	Design and analyze the time and space efficiency of various data structures.
CO4	Analyze run-time execution of various searching and sorting methods, including insertion sort, selection sort, merge sort, heap sort and Quick sort.
CO5	Justify the choice of data structure for a given problem.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Arrays Arrays: Implement Static and Dynamic Arrays, perform array operations -Accessing elements, Reversing an array, Insertion and Deletion, Implement two-dimensional array, perform Addition, Multiplication, Transpose operations on 2D arrays.	
Module2 Stacks & Queues Stacks: Implement Static and Dynamic stacks, Perform Push and Pop operations. Queues: Implement Static and Dynamic queues, Perform Enqueue and Dequeue operations	
Module3 Linked Lists Singly Linked List: Create singly linked list, perform operations -Traversing, Insertion and Deletion, Searching, Doubly Linked List: perform operations-Create, Traversing, Insertion and Deletion, Circular Linked list: perform operations- Create, Traversing, Insertion, Deletion, Searching, Implement stacks and queues using linked list.	

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Module4 Searching and Sorting Perform searching algorithms-Linear Search, Binary search, Perform sorting algorithms, -Insertion Sort, Selection sort, Quick sort, Merge sort, Heap sort.	
Module5 Trees and Graphs Create Binary Search Tree, transverse tree using Preorder, Inorder, Postorder, perform basic binary search tree operations-Insertion and Deletion, Searching, Compute leaf count, height and depth count. Graphs: Create Adjacency Matrix, Perform Graph Transversal operations– DFS and BFS.	

Implementation of the above modules in the lab experiments.

TEXT BOOKS:

1. Pai G A V, “Data Structures and Algorithms: Concepts, Techniques and Applications”, Tata McGraw-Hill.
2. Horowitz E., Sahni S., Susan A., “Fundamentals of Data Structures in C”, University Press.

REFERENCE BOOKS:

1. Tremblay, J. P., & Sorenson, P. G. An Introduction to Data Structures with Applications McGraw-Hill.
2. Lipschutz, S. Data Structures. Tata McGraw-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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

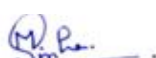
Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	2	3	2	3	2	3	3	3	2	3
CO2	2	2	2	3	2	1	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	1	1	1	2	1	1	1	2	2	2	3
CO4	3	3	3	3	2	1	2	2	3	3	3	3	3	3	3
CO5	3	3	3	3	2	2	2	2	1	1	3	3	3	3	3

Correlation Levels1, 2 or 3 as defined below:

- 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



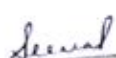
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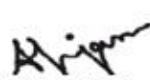
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Dr. Umesh Prasad



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Mapping Between Cos and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code			: CA25225
Course Title			: Business Intelligence
Pre-requisite(s)			:
Co-requisite(s)			:
Credits: 3	L:3	T:0	P:0

Class schedule per week**: 03****Class****:BCA****Semester/Level****:II/1****Branch****:Bachelor of Computer Applications****Course Objectives**

This course enables the students to:

A.	Understand the fundamental concepts and components of Business Intelligence and its role in decision-making.
B.	Gain knowledge of data preparation techniques including cleaning, transformation, and standardization.
C.	Apply data mining techniques such as classification, clustering, and association to extract business insights.
D.	Develop skills in using BI tools for creating dashboards, reports, and data visualizations.
E.	Explore predictive analytics methods and emerging trends in Business Intelligence including real-time and AI-driven analytics.

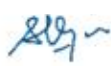
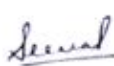
Course Outcomes

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

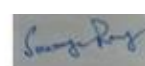
CO1	Explain the architecture, components, and applications of Business Intelligence systems.
CO2	Perform data cleaning, transformation, and preparation for analysis.
CO3	Apply data mining techniques such as classification, clustering, and association rule mining for business decision-making.
CO4	Design and develop dashboards and visual reports using BI tools.
CO5	Use predictive analytics methods and interpret results to support future business planning.

Syllabus

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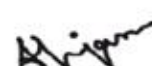

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Dr. Umesh Prasad



Dr. Amrita Priyam

MODULE	(No. of Lecture Hours)
Module 1: Introduction to Business Intelligence (BI): Definition, scope, and importance of Business Intelligence (BI), BI vs. Business Analytics, Components of BI architecture and BI lifecycle, Applications of BI in various industries, Overview of BI tools and platforms.	7
Module 2: Data Preparation and Transformation: Data collection, integration, and cleaning, Handling missing and inconsistent data, Data standardization and normalization, Data transformation: log, root, square root.	7
Module 3: Data Mining Techniques: Classification, clustering, and association rule mining, Anomaly detection and pattern recognition, Decision trees, k-means clustering, Apriori algorithm, Interpreting mining results for business insights.	7
Module 4: BI Tools and Dashboards: Introduction to BI tools: Power BI, Tableau, Excel, Building dashboards and interactive reports, Key Performance Indicators (KPIs), Data visualization principles and best practices.	7
Module 5: Predictive Analytics and BI Trends: Regression, classification, and time series forecasting, Real-time analytics, and AI in BI.	7

TEXT BOOKS:

1. Sharda, R., Delen, D., & Turban, E. (2024). Business Intelligence, analytics, data science, and AI, Global edition (5th ed.). Pearson Education Limited.

REFERENCE BOOKS:

1. Howson, C. (2013). Successful Business Intelligence (2nd ed.). McGraw-Hill.
2. Shmueli, G., Patel, N. R., & Bruce, P. C. (2017). Data Mining for Business Analytics: Concepts, Techniques, and Applications in R (1st ed.). Wiley.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

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Course outcome	Program Outcomes(PO)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	1	3	1	2	1	1	3	2	3	3	3	2	1	1	2
CO2	2	2	2	1	2	3	1	1	1	1	1	1	3	3	1
CO3	3	1	1	3	3	2	2	2	2	3	3	1	2	1	2
CO4	1	3	2	3	2	1	3	1	1	1	2	3	1	1	1
CO5	3	3	2	3	2	1	2	2	3	3	3	1	2	1	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD2,CD8
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD5,CD8,CD9
CD3	Seminars	CO3	CD1, CD2, CD5,CD8,CD9
CD4	MiniProjects/Projects	CO4	CD1, CD2, CD5,CD8,CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

SEMESTER III

Course Code		: CA25201
Course Title		: JAVA PROGRAMMING
Pre-requisite(s)		: Programming and Problem-solving using C/C++
Co-requisite(s)		: JAVA Lab
Credits:3	L:3	T: 0 P: 0

Class schedule per week

: 03

Class

: BCA

Semester/Level

: III/2

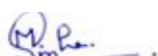
Branch

: Bachelor of Computer Applications

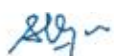
Course Objectives



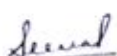
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



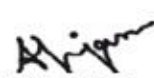
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

This course enables the students to:

A.	Learn about Object oriented programming concepts.
B.	Learn how to use the JDK for java programming.
C.	Improve their programming skills in core Java using various methods, overloading and overriding of methods.
D.	Use java interfaces, packages and exception handling to do java-based projects.
E.	Use the knowledge of java to do applet programming and GUI designing.

Course Outcomes

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

CO1	Get clear idea about the JDK and its evolution and use it for program execution.
CO2	Understand the concepts of OOP and identify the latest know-how related to the new developments in the field of Java.
CO3	Apply core java to design programming-based solutions.
CO4	Get clear knowledge on Dynamic memory management, generalization and specialization in Java.
CO5	Do applet programming and create basic GUI in Java.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Procedure-Oriented Programming, Object-Oriented programming, Benefits of OOP, Applications of OOP, Basics, Evolution of Java, Structure of JAVA Program, Simple Java Program, Tokens, Comments, Identifiers, Operators, Literals, Control Structures. Java Environment Setup, Compiling a Java Program, Java Virtual Machine, Philosophy of Java and Benefits.	6
Module2 Data types: Primitive and reference data types, variables and constants, enumerated constants. Control Structure in Java. Program statements: labelled statement, expression and null statements, compound statement, control statement – decision and loops, jump statement, try-catch-finally statement, declaring and creating arrays, accessing array elements, assigning values to array elements, multidimensional arrays.	8
Module3 Functions: Declaration, definition and call, main method arguments, reference variables, method overloading, parameter passing by value for primitive types, object references and arrays, scope of variables, return from methods. Class and object, class members and initialization, access rights of members – public, private and protected access modifiers, constructor and copy constructor, mutability, finalization, dynamic memory management, garbage collection, this keyword, static members, scope of variables, interface – declaration, implementation and extending, package and package visibility.	9
Module4 Inheritance and Collection classes: multi-level and single inheritance, multiple inheritance of interfaces, Object class, access rights in subclasses and packages, constructor calling sequence, super keyword, dynamic binding of methods, abstract class, overriding, finalize, association, aggregation, and composition.	8

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(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Module5**9**

Basics of Applet programming, applet code example, HTML tags for applet, applet life cycle, color, font, and basic GUI handling, basic graphics, and animation. Input/Output and JAVA Applets: Stream classes–Input Stream, Output Stream, Buffered Stream, file classes and handling, push back streams, reader and writer classes, file reader and writer, serialization.

TEXT BOOKS:

1. Balagurusamy E., “Programming in Java”, 2nd Edition, Tata McGraw-Hill Publication, New Delhi.
2. Jana D., Java and Object-Oriented Programming Paradigm, PHI,2010.

REFERENCE BOOKS:

1. Naghton Patrick & Schildt H., “The Complete Reference Java 2”, Tata McGraw-Hill Publication, New Delhi.
2. Dietel Harvey M & Dietel Paul J., “Java How to program”, 7th edition, Pearson Education, New Delhi.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Multithreading processing in Java.
2. Detailed Applet Programming.

POs met through Gaps in the Syllabus: 3, 11, 12 Topics beyond syllabus/Advanced topics/Design:

1. Concepts of multithreading in Java
2. Detailed knowledge on GUI design in Java
3. Database connectivity with frontend

POs met through Topics beyond syllabus /Advanced topics/ Design**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure****Direct Assessment**

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher’s Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

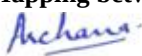
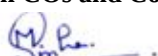
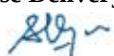
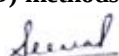
Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	3	1	3	2	1	2	3	2	3	1	1	2	2
CO2	3	2	3	2	3	2	2	2	3	2	3	2	2	3	2
CO3	3	3	3	3	2	3	3	2	2	2	3	3	3	2	3
CO4	3	3	3	3	3	3	2	2	2	2	2	3	2	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	2	3	3

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) methodsDr. Archana
BhatnagarDr. Madhavi
SinhaDr. Shripal
VijayvargiyaMrs. Seema
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PaulDr. Soumya
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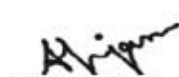
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CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD3
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD3
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD3, CD5
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25203
Course Title		:DATABASE MANAGEMENT SYSTEMS
Pre-requisite(s)		:
Co-requisite(s)		:DBMS Lab
Credits:3	L:3	T: 0 P: 0

Class schedule per week 03
Class : BCA
Semester/Level : III/2
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the structure of databases.
B.	Learn Query processing and decomposition.
C.	Understand how to create a database.
D.	Learn transaction processing in databases.
E.	Understand how concurrency control is performed in a database.

Course Outcomes

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

CO1	Design a database for a given set of requirements.
CO2	Use SQL.
CO3	Apply normalization techniques on given database.
CO4	Have knowledge of indexing and hashing mechanisms in a database management system.
CO5	Have idea of the backend activities involved in extracting data from a database. Have knowledge of transaction and concurrency control mechanisms in a database management system.

Syllabus



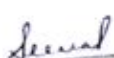
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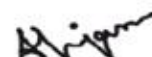
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MODULE	(No. of Lecture Hours)
Module1 Introduction: Purpose of Database Systems, View of Data, Data Models, Database Languages, Relational Database, Database Architecture, Database Users and Administrators, Transaction Management.	7
Module2 Relational Data Models and Languages: Basic Concepts, Constraints, Keys, Entity- Relationship Diagram, Weak Entity Sets, Extended E-R Features, Reduction of an E- R Diagram to Tables, The Relational Algebra, The Tuple Relational Calculus and The Domain Relational Calculus.	7
Module3 Relational-Database Design: Pitfalls in Relational-Database Design, Functional Dependencies, Decomposition, Desirable Properties of Decomposition, First Normal Form, Second Normal Form, Third normal Form, Boyce-Codd Normal Form, Fourth Normal Form and More Normal Forms.	7
Module4 Query Processing and Optimization: Overview, Measures of Query Cost, Selection Operation, Join Operation, Other Operations, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results, and Choice of Evaluation Plans.	7
Module5 Transactions and Concurrency Control: Transaction Concept, Transaction State, Desirable Properties of Transactions, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols and Deadlock Handling.	7

TEXT BOOKS:

1. Silberschatz, Korth, & Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill.

REFERENCE BOOKS:

1. Elmasri, & Navathe, "Fundamentals of Database Systems, 5th Edition, Pearson Education, 2008.
2. Date C.J., "An Introduction to Database System", Pearson Education, New Delhi, 2005.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

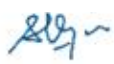
In Direct Assessment



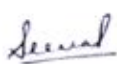
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Vijayvargiya



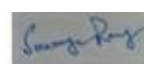
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Ray



(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	2	2	1	1	2	1	1	2	2	3
CO2	3	3	3	2	1	2	2	1	1	2	1	1	2	2	3
CO3	2	2	2	1	1	2	1	1	1	1	1	1	2	2	3
CO4	1	2	1	3	1	1	1	2	2	1	2	2	2	2	3
CO5	3	3	3	1	2	1	1	1	2	2	2	2	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD5,CD2
CD4	Mini Projects/ Projects	CO4	CD1,CD8,CD9, CD5
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD8,CD9
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25205
Course Title		: Computer Organization & Architecture
Pre-requisite(s)		: Computer Fundamental & Digital Logic Design
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week

: 03

Class

: BCA

Semester/Level

: III/2

Branch

: Bachelor of Computer Applications

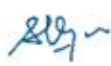
Course Objectives



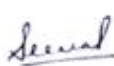
Dr. Archana
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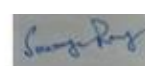
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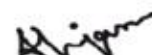
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

This course enables the students to:

A.	Understand the Truth Table.
B.	Identify the number of variables and their simplification importance.
C.	Understand different circuits for the implementation of Boolean equations.
D.	Identify Register Transfer, Micro-operations and Central Processing Unit
E.	Describe performance evaluation of computers, computer architecture and organization, computer arithmetic, Memory and CPU design.

Course Outcomes

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

CO1	Minimize the circuit diagrams by use of K-Map concepts and Boolean Algebra.
CO2	Analyse the outcome of the circuit designed.
CO3	Create a complex circuit with use of modular block interconnection.
CO4	Analyse I/O system and interconnection structures of a computer.
CO5	Develop independent learning skills and be able to learn more about different computer architectures and hardware.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Digital Logic Circuits: Digital Computers, Logic Gates, Boolean algebra, Complement of a Function, Map Simplification, Product-of-sum simplification, Don't care conditions, Combinational Circuits, Half Adder, Full Adder, Flip-Flops, Sequential Circuits Digital Components: Decoders, Encoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Unit, RAM, ROM, Types of ROMs. Data Representation: Number System, Complements, Subtraction of Unsigned Numbers, Fixed-Point Representation, Floating-Point Representation, , Error Detection Codes	7
Module2 Register Transfer and Micro-operations: Register Transfer language, Register Transfer Bus and Memory Transfers, Three-State Bus Buffers, Memory Transfer, Arithmetic Micro-operations, Binary Adder, Binary Adder-Subtractor, Binary incrementer, Arithmetic Circuit Logic, Micro-operations, Shift Micro-operations, Hardware Implementation, Arithmetic Logic Shift Unit.	7
Module3 Basic Computer Organization and Design -Instruction Codes ,Computer Registers, Computer Instructions , Instruction Cycle,, Memory Reference Instructions ,InputOutput and Interrupt, Design of Basic Computer, Design of Accumulator Logic	7
Module4 Central Processing Unit: Introduction, General Register Organization, Stack Organization, Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expressions, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Program Interrupt, Types of Interrupts, Reduced Instruction Set Computer (RISC).	7
Module5 Memory Organization: Memory Hierarchy, Main Memory, RAM and ROM Chips, Memory Address Map, Memory Connection to CPU, Auxiliary Memory, Magnetic Disks and Tape, Associative Memory, Hardware Organization, March Logic, Read/Write Operation, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Virtual Memory, Address Space and Memory Space, Address Mapping Using Pages, Associative Memory Page Table, Page Replacement, Memory Management Hardware.	7

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TEXT BOOKS:

1. Mano M., "Computer System Architecture", Prentice Hall of India, New Delhi, 1995.(T1)

REFERENCE BOOKS:

1. Morris Mano M & Ciletti M.D., "Digital Design", 4th Edition, PHI, 2008.(R1)
2. Hayes, J.P., "Computer Architecture and Organization", 3rd Edition, McGraw-Hill, London, 2000, (R2)
3. Ram. B., "Computer Fundamentals: Architecture and Organization", 3rd Edition, New Age International Publication, New Delhi, 2000.(R3)

Gaps in the Syllabus (to meet Industry/Professional 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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between Cos and Program Outcomes

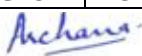
Course Outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	2
CO2	3	3	3	1	3	1	1	1				2	2	2	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		



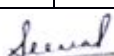
Dr. Archana
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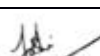
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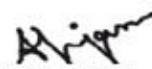
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Dr. P.S. Bishnu



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CourseCode		:CA25207
CourseTitle		:MATHEMATICS FOR COMPUTING II
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week : 03
Class : BCA
Semester/Level : III/2
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand and apply the fundamental concepts of propositional logic, including truth tables, logical equivalence, and normal forms.
B.	Develop logical reasoning skills through various methods of proof, such as direct proof, contradiction, contraposition, and mathematical induction.
C.	Gain foundational knowledge in number theory, including divisibility, greatest common divisors, and prime factorization.
D.	Solve systems of linear equations and perform matrix operations, including finding inverses, ranks, and eigenvalues using linear algebra techniques.
E.	Apply basic concepts of discrete probability to compute probabilities, analyze distributions, and evaluate expected values and variances.

Course Outcomes

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

CO1	Analyze and evaluate logical statements using propositional logic, truth tables, and normal forms.
CO2	Apply various proof techniques including inference rules, contradiction, and mathematical induction in problem-solving.
CO3	Solve problems in number theory involving divisibility, greatest common divisors, and the fundamental theorem of arithmetic.
CO4	Perform matrix operations and solve linear systems using Gauss Elimination and Gauss-Jordan methods, and determine matrix rank and eigenvalues.
CO5	Compute probabilities, expectations, and variances for discrete distributions and apply probability rules to solve real-world problems.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Propositional Logic: Propositions, Logical Operations (basic connectives), Compound Statements, Construction of Truth Tables, Quantifiers, Conditional and Biconditional Statements, Tautology, Contradiction, Contingency, Logical Equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF).	8
Module2 Methods of proofs: Rules of inference for propositional logic, Modus Ponens, Modus Tollens, Syllogism, etc., Consistency, Contraposition, Proof by Contradiction, Mathematical Induction.	8

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Module3 Number Theory: Division algorithm, Greatest Common Divisor, Least Common Multiple, Fundamental Theorem of Arithmetic.	8
Module4 Linear Algebra: System of linear equations, Gauss Elimination method, Matrices, Gauss-Jordan method for finding matrix inverse, Elementary matrices, Matrix rank, Eigenvalues and Eigenvectors	8
Module5 Discrete Probability, Sample Space, Events, Probability of an Events, Addition and Multiplication Rule of Probability, Probability Distribution, Expectation, Standard Deviation, Binomial, Poisson and Normal Distribution	8

TEXT BOOKS:

1. Kolman, B.; Busby, R. and Ross, S.: Discrete Mathematical Structures (6 Edition), Pearson Education India –ISBN 978-9332549593.
2. Rosen Kenneth H. and Krithivasan Kamala: Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. Vasishtha A. R. and Vasishtha A. K.: Matrices, Krishna Prakashan, 2022.
4. Das N. G.: Statistical Methods, Combined Edition, Tata McGraw Hill, 2010.
5. Ross Sheldon M.: Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.
6. S. B. Malik: Basic Number Theory, Vikash Publishing House Pvt. Ltd., 2nd Revised Edition.

REFERENCE BOOKS:

1. J.H.Gallier: Logic for Computer Science, JohnWiley & Sons, 1987.
2. Elliott Mendelson: Introduction to Mathematical Logic, Chapman & Hall; London, 1997
3. Murray R. Spiegel, John J. Schiller, R. Alu Srinivasan: Probability and Statistics, Schaum's Outline Series.
4. Grewal, B.S.: "Higher Engineering Mathematics,"Khanna Publication

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/ Advanced topics/ Design

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

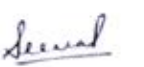
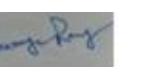
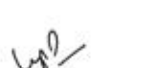
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
MidSemester Examination	25
Second Quiz	10
Teacher's Assessment	5
EndSemester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	1	1	2	1	1	1	1	2	2	2	1	1	1
CO2	2	2	2	1	2	1	1	1	1	1	2	2	1	1	1
CO3	2	3	3	1	3	1	1	1	1	1	2	3	3	1	1
CO4	2	2	2	3	3	1	1	1	2	1	3	3	3	2	1
CO5	2	2	3	2	3	1	1	1	3	2	3	3	3	2	1

Correlation Levels 1, 2 or 3 as defined below:

1:Slight(Low)

2:Moderate (Medium)

3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	CourseDelivery Method Used
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CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/ In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

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(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

CourseCode		:CA25209
CourseTitle		:STATISTICS WITH R
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:2	T:0 P:2

Class schedule per week

L(2)

Class

:BCA

Semester/Level

:III/2

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the importance of data and how to collect,organize and summarise those data.
B.	Describe preliminarystatistical techniques to solve problems.
C.	Understand how to create a database.
D.	Explain the merits and limitations of different statistical techniques.
E.	Understand the statistical concepts, interpreting results, and using R for data manipulation and analysis.

Course Outcomes

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

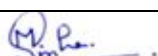
CO1	Evaluate the need for data analysis.
CO2	Formulate the statistical problem and solve it with R language.
CO3	Design and describe problems of inferential statistics with R language.
CO4	Understand the statistical concepts for data manipulation and analysis.
CO5	Understand Basics of statistical modeling and model selection using R.

Syllabus

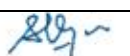
MODULE	(No. of Lecture Hours)
ModuleI Introduction to Statistics: Definition of Statistics, Scope of Statistics, Types of Data. Methods of collecting Data, Diagrammatic and Graphic Presentation of Data, Graphs of Frequency Distribution.	8
ModuleII Measures of Central Tendency: Need for measuring central tendency of data; Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode.meritsand demerits. Numerical exercises.	6
ModuleIII	6



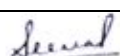
Dr. Archana
Bhatnagar



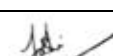
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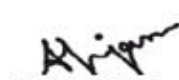
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Measures of Dispersion: Need for measuring dispersion of data; Range, Mean Absolute Deviation, Quartile Deviation, Standard deviation, Coefficient of Variation: their properties, vector, merits and demerits. Numerical exercises.	
Module IV Probability and Probability Distribution Basic probability concepts, Normal Distribution, Binomial Distribution, Poisson Distribution. Other Distributions using R for probability calculations and distribution plots.	6
Module V Correlation and Covariance. T-Tests, ANOVA. Linear Models. Simple Linear Regression, Multiple Regression, Generalized Linear Models, Logistic Regression, Poisson Regression, Other Generalized Linear Models.	6

List of Programs as Assignments

1. Write an R program to take input from the user and display the values.
2. Write an R program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91.
3. Write an R program to create a vector which contains 10 random integer values between -20 and +20.
4. Write an R program to find the maximum and the minimum value of a given vector.
5. Write an R program to create a list of random numbers in normal distribution and count the occurrences of each value.
6. Write an R program to read the file and display the content.
7. Write an R program to create three vectors numeric data, character data and logical data. Display the content of the vectors and their type.
8. Write an R program to create a 5x4 matrix, 3x3 matrix with labels and fill the matrix by rows and 2 x 2 matrix with labels and fill the matrix by columns.
9. Write an R program to create an array, passing in a vector of values and a vector of dimensions. Also provide names for each dimension.
10. Write an R program to draw an empty plot and an empty plot specifies the axes limits of the graphic.
11. Write an R program to create a simple barplot of five subjects' marks.
12. Create a scatter plot of the data points and overlay the regression line using the function plot () and abline ().
13. Customize the plot by adding axis labels, a title, and appropriate visual enhancements.
14. Perform Multiple Linear Regressions: Extend the analysis by including multiple independent variables ("x1", "x2", etc.) in the regression model. Use the function lm() with the appropriate formula.
15. Conduct model diagnostics to evaluate the assumptions of linear regression. This can include examining residual plots, checking for multicollinearity, and testing for heteroscedasticity.

TEXT BOOKS:

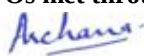
1. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, The Addison-Wesley Data and Analytics Series.
2. Gupta S.P. and Gupta M.P. (2015), Business Statistics. (Sultan Chand & Sons: New Delhi). 18th ed.
3. Das N.G. (2017). Statistical Methods (combined volumes). (Tata McGraw-Hill: New Delhi).

REFERENCE BOOKS:

1. Richard I. Levin, David S. Rubin, Masood H. Siddiqui (2017), Statistics for Management. (Pearson: New Delhi) 8th ed.
2. Hogg Robert V., McKean Joseph, Craig Allen T. (2017), Introduction to Mathematical Statistics (Pearson: New Delhi) 7th ed.

Gaps in the Syllabus (to meet Industry/Professional requirements) POs met through Gaps in the Syllabus Topics beyond syllabus/ Advanced topics/ Design

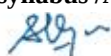
POs met through Topics beyond syllabus /Advanced topics/ Design



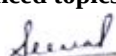
Dr. Archana
Bhatnagar



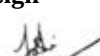
Dr. Madhavi
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Dr. Soumya
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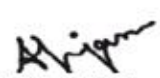
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	2	2	1	1	2	1	1	2	2	3
CO2	3	3	3	2	1	2	2	1	1	2	1	1	2	2	3
CO3	2	2	2	1	1	2	1	1	1	1	1	1	2	2	3
CO4	1	2	1	3	1	1	1	2	2	1	2	2	2	2	3
CO5	3	3	3	1	2	1	1	1	2	2	2	2	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1:Slight(Low)

2:Moderate (Medium)

3:Substantial(High)

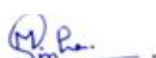
Mapping Between Cos and Course Delivery(CD) methods

CD Code	Course Delivery Methods	Course Outcome	CourseDelivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD5,CD2
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CD6	Industrial/GuestLectures		
CD7	Industrial Visits/ In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

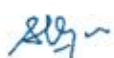
CourseCode		: CA25215
CourseTitle		: COMPUTER-ORIENTED NUMERICAL METHODS
Pre-requisite(s)		:
Co-requisite(s)		:C, C++,Language
Credits:3	L:2	T:0 P:2



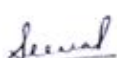
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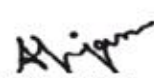
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

C schedule per week :L(2) P(4)
Class:BCA
Semester/Level:I/1
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the concepts of numerical approximation, error analysis, and their significance in scientific computing.
B.	Apply various numerical methods to find the roots of algebraic and transcendental equations.
C.	Solve systems of linear equations and perform matrix operations using direct and iterative numerical techniques.
D.	Use interpolation and numerical differentiation/integration techniques to estimate and evaluate functions based on discrete data.
E.	Solve ordinary differential equations numerically using initial value methods for engineering and scientific problems.

Course Outcomes

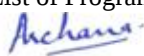
After the completion of this course, students will be able to:

CO1	Identify and analyze different types of numerical errors and their propagation in computations.
CO2	Apply root-finding techniques such as Bisection, False Position, and Newton-Raphson methods to solve nonlinear equations.
CO3	Solve systems of linear equations and perform matrix inversion using direct and iterative numerical methods.
CO4	Construct interpolation polynomials and perform numerical differentiation and integration on tabulated data.
CO5	Implement numerical methods for solving ordinary differential equations using Euler and Runge-Kutta techniques.

Syllabus

MODULES	(No. of Lecture Hours)
Module1 Errors and Root-Finding Methods – Absolute, relative, and round-off errors; Bisection Method, False Position Method, Newton-Raphson Method.	6
Module2 Linear Algebraic Equations – Gauss Elimination Method, Gauss-Jordan Method, Matrix Inversion using Gauss-Jordan.	6
Module3 Interpolation Techniques – Newton's Forward and Backward Interpolation, Lagrange Interpolation.	6
Module4 Numerical Differentiation and Integration – Numerical Differentiation using Interpolation, Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule.	6
Module5 Numerical Solution of ODEs – Euler's Method, Modified Euler's Method, Runge-Kutta Method (2nd and 4th order).	6

List of Programs as Assignments:



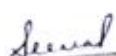
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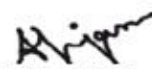
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



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1. Compute absolute, relative, and percentage errors given exact and approximate values.
2. Implement the Bisection Method to find a root of a non-linear equation (e.g., $f(x) = x^3 - 4x - 9$).
3. Implement the Newton-Raphson Method with iteration tracking and error convergence plot.
4. Solve a system of linear equations using the Gauss Elimination Method.
5. Solve the same system using the Gauss-Seidel Iterative Method and compare the results.
6. Implement Newton's Forward Interpolation and estimate the function value at a given point.
7. Implement Lagrange Interpolation for a given set of data points.
8. Compute the derivative of a function using Newton's Divided Difference Table.
9. Approximate the integral of a function using Simpson's 1/3 Rule and compare with the exact value.
10. Solve a first-order ODE using the 4th-order Runge-Kutta Method for a given initial value problem (e.g., $dy/dx = x + y, y(0) = 1$).
11. Write a program to compute the inverse of a given square matrix using the Gauss-Jordan elimination method.
12. Implement the Modified Euler's method (Heun's method) to solve a first-order ODE and compare it with the exact solution.

TEXT BOOKS:

1. Jain, M. K., Iyengar, S. R. K., & Jain, R. K. (2016). Numerical methods: Problems and solutions (3rd ed.). New Age International Publishers.

REFERENCE BOOKS:

1. Sastry, S. S. (2012). Introductory methods of numerical analysis (5th ed.). PHI Learning Pvt. Ltd.

Gaps in the Syllabus (to meet Industry/Professional requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/ Advanced topics/ Design

POs met through Topics beyond syllabus /Advanced topics/ Design

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2. Student Feedback on Course Outcome

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

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CD7	Industrial Visits/ In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode	: CA25202
CourseTitle	: JAVA LAB
Pre-requisite(s)	: Programming and problem-solving using C/C++ Lab
Co- requisite(s)	: Java Programming
Credits: 1.5	L:0 T:0 P:3

Class schedule per week

03

Class

:BCA

Semester/Level

:III/2

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Study the concepts of Object-oriented programming.
B.	Implementation and usage of JDK for java programming.
C.	Improve programming skills in core Java using various methods, overloading and overriding of methods.
D.	Use java interfaces,packages and exception handling for java-based projects.
E.	Apply the knowledge of java to implement applet programming and GUI designing.

Course Outcomes

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

CO1	Elaborate the use of JDK of various versions for programming.
CO2	Identify the latest know-how related to the new developments in the field of Java.
CO3	Apply the knowledge gained for their project work as well as to develop some GUI applications.

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CO4	Design solutions in JAVA.
CO5	Apply features of Java Applets through programming.

Syllabus

List of Programs as Assignments:

MODULE	(No. of Lecture Hours)
Module1 1. WAJP to show the characteristic of a number. {E.g.24it hastwocoefficients2intens positionand4inunitsposition.Itiscomposedof2and3.Itisapositivenumber. Also show whether it is odd or even. Tell the number of digits.} 2. WAJPtotakeinput throughcommandlineargument anddothe following: a) Checkwhetherthenumberisprimeor not. b) Countthenumberof digits. 3. WriteamenudrivenprogramusingswitchinJavatoperform following: a) Forinput of1, check whetherthenumberisprimeor not b) Forinput of3,find thefactorsofthe number c) Forinput of5, checkthenumberisodd or even. d) Forinput of7 generatethereverseofthe number 4. Writeaprogram inJavato generate a) Hexadecimalequivalent ofanumberwithoutusing array. b) Hexadecimalequivalent ofanumberusing array. 5. WAJPtotaketwonumberinputsthroughcommandlineargumentanddothe following: a) Check whether two numbers are prime to each other or not OR evaluate the HCF of two numbers. b) Find LCM of two numbers.	6
Module2 1. WAJP to compute and display the count of occurrence of 4 in a number. E.g. 4564 will compute 2. 2. WAJP to sort a list of numbers in ascending order. 3. WAJP to generate Pascal's Triangle using a square matrix. 4. Write a program in Java to take input of two 3×3 matrices through command line argument and then: a) Add them up and display the result b) Subtract them and display the result c) Generate the transpose of the matrix d) Multiply them and display product 5. WAJP to count the number of words, characters in a sentence. 6. Write a program in Java to display the Floyd's triangle. 7. Write a program in Java to search an element using the principle of binary search (without using any built-in method) 8. Write a program in Java to print the smallest number in an array. 9. Write a program in Java to check for duplicate entries in an array.	6

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10. Write a program in Java to take input of a sentence and then count the number of words and vowels.	
Module3 1. WAJP to handle the Exception using try and multiple catch block; the exceptions that you will handle are, number format error, array bound error and divide by zero. 2. WAJP to create a class called Room with two data member length and width and then implement constructor overloading in it. 3. WAJP to create a class called Fraction with data member numerator and denominator; take input (through command line argument) of two fractions and then add, subtract, multiply and divide, finally display the result in reduced term. 4. Write a program in Java to create a class for Employee having 2 data member code and name. Then create 3 classes Officer , AdminStaff and MStaff . The Officer class has data members designation and pay-scale; the AdminStaff has data members grade and pay-band; the MStaff has data member department and two sub-classes Regular and Casual . The Regular staff has data members level and consolidated-pay and Casual has data member daily-wage. Take all inputs through constructors and write appropriate methods for displaying one data for each type of class. 5. WAJP to design a class called Account using the inheritance and static that show all function of bank (withdrawal, deposit) and generate account number dynamically. 6. WAJP to design an application <i>Password.java</i> that produces and prints a random password depending upon name of an individual. If the input is Abdul Kalam then the password would be 33421LAM. Note: take the first name A=1, B=2, D=4, U=21 where 2+1=3, and L=12, where 1+2=3; so the number equivalent to ABDUL comes to be 12433, and last 3 alphabets of the last name, so u can find out.	6
Module4 1. WAJP to take a string count all vowels and then delete the same from the string. 2. Write a Patient class which inherits from the Person class. Patient can again be of two types, indoor and outdoor. The Patient class requires the following: a) a variable to store the patient ID for the patient b) a variable to store the department of hospital c) a variable to store the ward of hospital d) a variable to store the patient's date of joining the hospital e) a variable to store the patient's address f) a variable to store the medical fees that the patient pays g) constructor methods, which initialize the variables h) a method to calculate the medical fees (for both indoor and outdoor patient) 3. WAJP to take a string as password and check whether it contains at least two numbers, 3 alphabets and no space in it. If any contrary throw message. 4. Write a class called Shape which contains a user-defined interface for Computation , which contains methods for calculation of area, perimeter and volume. Write four classes for circle , rectangle , sphere and rectangular parallelepiped , and all these classes inherit from Shape. Now take input for the following: a) radius of circle and compute its area and perimeter b) Length and breadth of rectangle and compute its area and perimeter c) Length, breadth and height for rectangular parallelepiped and compute its area and volume, where $A = 2(wl + hl + hw)$ and $V = lwh$ d) Radius of sphere and compute its area and volume 5. Write a class called Employee , which requires the following: a) a variable to store the employee ID employee ID should be of format EMPM1234, EMPS1234, EMPA1234, EMPC1234, where M=manager, S=supervisor, A=analyst, C=clerk; number can be any no. but first three characters should be EMP b) variable to store the employee name c) a variable to store the department	6

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Dr. Umesh Prasad

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d) avariabletostorecity e) avariable to store basic salary f) amethodto calculatethe salaryofemployee i. ifthecityis metrothen theHRAwould be30%else20% ii. iftheemployeeIDcontainMthenDAwouldbe120%,ifSthenDAwould be 110%, if A then DA would be 100%, and if C then DA would be90% g) constructor methods, which initialize the variables 6. Write a program in Java to find the second largest element in an array.	
Module5 1. Write an applet program to display a simple message: "Welcome to Java Applet". 2. Create an applet that draws a rectangle, circle, and line with different colors. 3. Develop an applet that displays your name, college name, and enrollment number. 4. Write an applet that takes user name as parameter and displays a personalized welcome message. 5. Create an applet that changes the background color on init() and draws a message on paint(). 6. Write an applet that draws a bar chart for 3 subjects' marks. 7. Create an applet to demonstrate use of get Parameter() to input and display user age and city. 8. Develop an applet to animate a bouncing ball. (Optional Advanced) 9. Write a program to input a string and display its reverse. 10. Check whether a given string is a palindrome or not. 11. Write a program to count the number of vowels and consonants in a string. 12. Develop a program to compare two strings using equals() and compareTo(). 13. Write a program to convert a string to uppercase and lowercase. 14. Find the frequency of each character in a given string. 15. Write a program to count the number of words in a string. 16. Write a program to replace all spaces in a string with hyphens (-). 17. Create a program to remove all vowels from a string. 18. Write a program to check whether two strings are anagrams.	6

TEXT BOOKS:

1. BalagurusamyE., "Programming in Java", 2nd Edition, Tata McGraw-Hill Publication, New Delhi.
2. JanaD., Java and Object-Oriented Programming Paradigm, PHI, 2010.

REFERENCE BOOKS:

1. NaghtonPatrick&SchildtH., "The Complete Reference Java 2", Tata McGraw Hill Publication, New Delhi.
2. Dietel Harvey M & Dietel Paul J., "Java How to program", 7th edition, Pearson Education, New Delhi.

Gaps in the Syllabus (to meet Industry/Profession requirements)

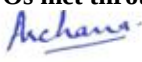
1. Multithreading process in Java.
2. Detailed applet programming.

POs met through Gaps in the Syllabus 3, 11, 12

Topics beyond syllabus/ Advanced topics/ Design

1. Concepts of multithreading in Java
2. Detailed knowledge on GUI design in Java
3. Database connectivity with frontend

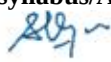
POs met through Topics beyond syllabus/Advanced topics/Design



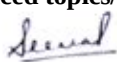
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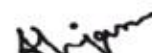
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Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD2
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD3
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/Projects	CO4	CD1,CD2,CD3
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD3, CD5
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

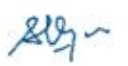
CourseCode	:CA25204
CourseTitle	:DBMS LAB
Pre-requisite(s)	:
Co- requisite(s)	: Database Management Systems
Credits: 1.5	L:0 T:0 P:3



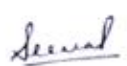
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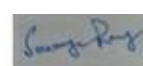
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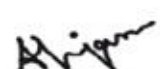
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



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Class schedule per week	03
Class	: BCA
Semester/ Level	:III/2
Branch	: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the structure of databases
B.	Learn Query processing and decomposition
C.	Understand how to create a database
D.	Learn transaction processing in databases
E.	Understand how concurrency control is performed in a database

Course Outcomes

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

CO1	Design a database for a given set of requirements
CO2	Use SQL Commands
CO3	Apply normalization techniques on given database
CO4	Have knowledge of indexing and hashing' mechanisms in a database management system.
CO5	Have idea of the backend activities involved in extracting data from a database. Have knowledge of transaction and concurrency control mechanisms in a database management system

Syllabus

Consider the following tables:

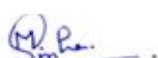
emp(empno, ename, job, mgr, hiredate, sal, comm, deptno, gr)
dept(deptno, dname, loc)

Write the following queries:

- List all information about all departments from emp table.
- List all employee names along with their salaries from emp table.
- List all department numbers, employee numbers and their managers' numbers in descending order of deptno and sal from emp table.
- List department names and locations from the dept table.
- List the employees belonging to the department 20.
- List the name and salary of the employees whose salary is more than 1000.
- List the names of the clerks working in the department 20.
- List the names of analysts and salesmen.
- List the details of the employees who have joined before the end of September 81.
- List the names of employees who are not managers.
- List the names of employees whose employee number are 7369, 7521, 7839, 7934, 7788.
- List the employee details not belonging to the department 10, 30, and 40.
- List the employee name and salary, whose salary is between 1000 and 2000.
- List the employee names, who are not eligible for commission.(salary having >15,000 eligible for commission)
- List the employees who are eligible for commission.
- List the details of employees, whose salary is greater than 2000 and commission is NULL.
- List the employees whose names start with an "S" (not's").
- List the name, salary and PF amount of all the employees(PF is calculated as 10% of salary).
- List the empno, ename, sal in ascending order of salary.



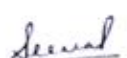
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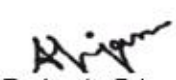
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

21. Display name, and sal and commission of all employees whose monthly salary is greater than their commission.

Create following tables from Book “Database System Concepts” , KORTH BOOK

1. Account_table
2. Branch_table
3. Depositor_table
4. Customer_table
5. Borrower_table

Solve the following queries using SQL.

1. Find all account numbers for account at the Redwood branch with assets greater than 300000.
2. Find the customer names, account numbers, balance for all accounts at the Perryridge branch.
3. Find the names of all branches that have assets greater than at least one branch located in Brooklyn.
4. Find the names of all customers whose street address includes the substring ‘North’.
5. To find all customers having a loan, account, or both at the bank .
6. Find the average account balance at the Brighton branch.
7. Find the number of depositors for each branch.
8. Find the number of depositors for each branch where average account balance is more than 1200.
9. Find the average balance for each customer who lives in Palo Alto and has at least two accounts.
10. Find the names of customers who do not have a loan at the bank, and whose names are neither Smith nor Jones.

TEXT BOOKS:

1. SQL, PL/SQL The Programming Language of Oracle, Ivan Bayross, 4th edition

REFERENCE BOOKS:

1. Beginning Oracle SQL: For Oracle Database 12c , Tim Gorman, Inger Jorgensen, Melanie Caffrey · 2014

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

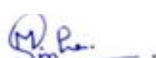
In Direct Assessment

- Student Feedback on Faculty
- Student Feedback on Course Outcome

Mapping between Cos and Program Outcomes



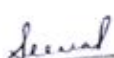
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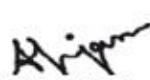
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Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	2	3	2	3	2	3	3	3	2	3
CO2	2	2	2	3	2	1	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	1	1	1	2	1	1	1	2	2	2	3
CO4	3	3	3	3	2	1	2	2	3	3	3	3	3	3	3
CO5	3	3	3	3	2	2	2	2	1	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 COs and Course Delivery(CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

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Dr. Umesh Prasad

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SEMESTER IV

CourseCode	:CA25221		
CourseTitle	:SOFTWARE ENGINEERING		
Pre-requisite(s)	:		
Co- requisite(s)	:Software Engineering Lab		
Credits: 3	L:3	T:1	P:0

Class schedule per week	04
Class	: BCA
Semester/Level	: IV/2
Branch	: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the fundamentals, evolution, and importance of software engineering as a discipline.
B.	Analyze and apply various software development life cycle models for project planning and execution.
C.	Learn techniques for software project management, including estimation, scheduling, and risk assessment.
D.	Design and model software systems using structured and object-oriented approaches, including UML.
E.	Explore software quality assurance, maintenance strategies, and DevOps practices for continuous improvement.

Course Outcomes

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

CO1	Explain the role and significance of software engineering in system development.
CO2	Compare and apply suitable software life cycle models for given software projects.
CO3	Develop project plans with appropriate estimation techniques, scheduling, and risk analysis.
CO4	Design software systems using structured and object-oriented methodologies including UML diagrams.
CO5	Evaluate software quality, reliability, and maintenance strategies including DevOps practices.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction: The Software Engineering Discipline – Evolution and Impact, Programs vs. Software Products, Why Study Software Engineering? Emergence of Software Engineering, Notable Changes in Software Development Practices and Computer Systems Engineering. Software Life Cycles Models: Classical Waterfall Model, Iterative Waterfall Model, Prototyping Model, Evolutionary Model, Spiral Model and Comparison of Different Life Cycle Models.	8
Module2 Software Project Management: Responsibilities of a Software Project Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO – A Heuristic Estimation Technique, Scheduling and Risk Management. Requirement Analysis and Specifications: Requirements Gathering and Analysis and Software Requirements Specification.	8

Anchana

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Module3 SoftwareDesign: What is a Good Software Design? Cohesion and Coupling, Neat Arrangement. Software Design Approaches, Object-Oriented vs. Function-Oriented Design, Overview of SA/SD Methodology, Structured Analysis, Data Flow Diagrams, Structured Design, Object Modelling Using UML: Overview, UML, UML Diagrams, Use Case Model, Class Diagrams Design Patterns, Object-Oriented analysis and Design Process.	8
Module4 Coding and Testing: Coding, Code Review, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Integration Testing and System Testing. Software Reliability and Quality Management: S/W Reliability, Statistical Testing, S/W Quality, S/W Quality Management System, ISO 9000, SEICMM, Personal Software Process, Six Sigma.	8
Module5 Software Maintenance: Characteristics, S/W Reverse Engineering, S/W Maintenance Process Models, Estimation of Maintenance Cost. Software Evolution: Legacy systems, Lehman's Laws of Software Evolution, Software rejuvenation; Impact of software evolution on maintenance and project planning. DevOps Practices and Maintenance Automation: Introduction to DevOps culture, Continuous Integration (CI), Continuous Deployment (CD), tools and automation in software maintenance.	8

TEXT BOOKS:

1. Rajib Mall, Fundamentals of Software Engineering, 4th Edition, PHI, 2014.

REFERENCE BOOKS:

1. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa, 2005.
2. Ian Sommerville, Software Engineering, 9th Edition, Pearson Education, 2011.
3. Pressman, Roger S., Maxim, Bruce R.. (2015). Software engineering: a practitioner's approach (8th ed. International student ed.). New York: McGraw-Hill Education.

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

1. Model-driven software development
2. Aspect-oriented software development

POs met through Topics beyond syllabus/ Advanced topics/ Design-2,3,4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

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Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
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CO1	3	3	2	3	2	2	2	1	2	2	1	1	3	3	1
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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

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

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CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Coursecode		: CA25223
Coursetitle		: PYTHON PROGRAMMING
Pre-requisite(s)		:
Co-requisite(s)		: Python Programming Lab
Credits:4	L:3	T:1 P:0

Class schedule per week

04

Class

: BCA

Semester/Level

: IV/2

Branch

: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand computer programming concepts using python language.
B.	Explore basic data types, control structures and standard library functions.
C.	Explore the basic data structures: List, Tuple, Sets, and Dictionaries available in python.
D.	Learning Object oriented concept of programming and its implementation in python.
E.	Handle disk data file for input output operations.

Course Outcomes

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



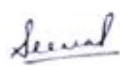
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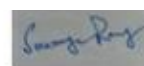
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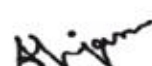
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CO1	Solve the basic mathematical problem using python programming.
CO2	Use basic data types, control structures and utility functions from standard library for faster programming.
CO3	Use the basic and user defined data structures as per the need of problem.
CO4	Design and implement the problem using OOP concept of python.
CO5	Store, retrieve and manipulate data with disk file.

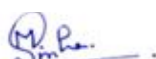
Syllabus

MODULE	(No. of Lecture Hours)
Module- I Introduction to Computers, Programs, and Python: Introduction, Programming Languages, Operating Systems, The History of Python, Features of python language, Getting Started with Python, Programming Style and Documentation, Programming Errors. Elementary Programming: Introduction, Writing a Simple Program, Reading Input from the Console, Identifiers, Variables, Assignment Statements, and Expressions, Simultaneous Assignments, Named Constants, Numeric Data Types and Operators, Evaluating Expressions and Operator Precedence, Augmented Assignment Operators, Type Conversions and Rounding.	8
Module- II Mathematical Functions, Strings and Objects: Introduction, Common Python Functions, Strings and Characters, Introduction to Objects and Methods, Formatting Numbers and Strings. Control Structures: Selections: Introduction, Boolean Types, Values, and Expressions, if Statements, Two-Way if-else Statements, Nested if and Multi-Way if-elif-else Statements, Logical Operators, Conditional Expressions, Loops: Introduction, The while Loop, The for Loop, Nested Loops, Keywords break and continue	8
Module- III Functions: Introduction, Defining a Function, Calling a Function, Functions with/without Return Values, Positional and Keyword Arguments, Passing Arguments by Reference Values, Modularizing code, The Scope of Variables, Default Arguments, Returning Multiple Values. Lists: Introduction, List Basics, Copying Lists, Passing Lists to Functions, Returning a List from a Function, Searching Lists, Sorting, Processing Two- Dimensional Lists, Passing Two-Dimensional Lists to Functions, Multi dimensional Lists.	8
Module- IV Tuples, Sets, and Dictionaries: Introduction, Tuples: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Tuple methods, Sets: Creating Sets, Manipulating and Accessing Sets, Subset and Superset, Set Operations, Comparing the Performance of Sets and Lists, Dictionaries: Creating a Dictionary, Adding, Modifying, and Retrieving Values, Deleting Items, Looping Items, The Dictionary Methods.	8
Module- V Objects and Classes: Introduction, Defining Classes for Objects, Immutable Objects vs. Mutable Objects, Hiding Data Fields, Class Abstraction and Encapsulation, Object-Oriented Thinking. Inheritance and Polymorphism: Introduction, Super-classes and Subclasses, Overriding Methods, The object Class, Polymorphism and Dynamic Binding, The isinstance Function. Class Relationships: Association, Aggregation, composition. Files and Exception Handling: Introduction, text input and output: opening a file, Writing Data, Testing a File's Existence, Reading All Data from a File, Writing and Reading Numeric Data, Binary IO Using Pickling, Exception Handling, Raising Exceptions.	8

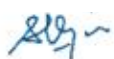
TEXT BOOKS:



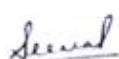
Dr. Archana
Bhatnagar



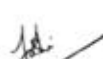
Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



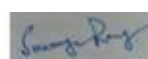
Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



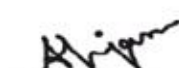
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson Education;

REFERENCE BOOKS:

1. Martin C. Brown, "Python: The Complete Reference", McGraw-Hill Education; Fourth edition (2018)
2. Mark Lutz, "Learning Python" O'Reilly Fifth edition (2013).
3. Mark Summerfield, "Programming in Python 3: A Complete Introduction to the Python Language," Pearson Education; Second edition (2018).

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Working on real-life project programming.

POs met through Gaps in the Syllabus -6, 9, 11 and 12

Topics beyond syllabus/Advanced topics/Design

1. Coverage of some third parties python libraries like: numpy, pandas etc
2. Graphical visualization using matplotlib library etc

POs met through Topics beyond syllabus/ Advanced topics/Design -4, 5, 8, and 11

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
MidSemester Examination	25
Second Quiz	10
Teacher's Assessment	5
EndSemester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/ Assignments	CO2	CD1, CD8, CD9
CD3	Seminars	CO3	CD1, CD2, CD5

Dr. Archana Bhatnagar

Dr. Madhavi Sinha

Dr. Shripal Vijayvargiya

Mrs. Seema Sharma

Mr. Anurag Joshi

Dr. Sounak Paul

Dr. Soumya Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

CD4	Mini Projects/Projects	CO4	CD1,CD5,CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25225
CourseTitle		:COMPUTER NETWORKS
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week 03
Class : BCA
Semester/Level : IV/2
Branch :Bachelor of Computer Applications

Course Objectives:

This course enables the students to:

A.	Have a broad understanding of computer network models, software and hardware.
B.	Learn different transmission mediums, digital and analog signals and their transmission techniques.
C.	Explore error detection and correction techniques, data link protocols and standards.
D.	Understand network layer and transport layer protocols.
E.	Implement and analyze routing and congestion issues in network design, Familiarize with network security, DNS, email, and encryption algorithms.

Course Outcomes

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

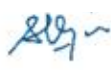
CO1	Understand basic concepts of networks, network hardware, and network software and describe various standard network models.
CO2	Understand data communication, various transmission media and familiarize with digital transmission and multiplexing techniques.
CO3	Analyze error detection and correction,data link protocols, and understand the role of data link layer protocols.
CO4	Implement and analyze routing and congestion issues in network design.
CO5	Familiarize with network security,DNS and network management algorithms.



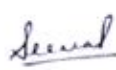
Dr. Archana
Bhatnagar



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Vijayvargiya



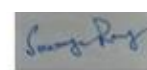
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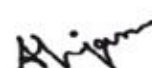
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction: Uses of Computer Networks, Needs and Advantages, Network Hardware: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless networks. Network Topology: Star, Bus, Ring, Tree, Mesh and Hybrid. Network Software: Protocol Hierarchies, Design Issues for the Layers, Interfaces and services, Connection-Oriented Versus Connectionless Service. Reference Models: The OSI Reference Model, The TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models.	8
Module2 Physical Layer: Transmission Media: Guided transmission media, wireless transmission, Communication satellites. Multiplexing: TDM, FDM, and WDM. Analog and Digital Signals: Characteristics and their transmission. Transmission impairment. Digital Transmission: Line coding, Block coding.	8
Module3 Data Link Layer: Services Provided to the Network Layer: Framing, Error Control, Flow Control. Error Detection and Correction: Error-Correcting Codes, Error-Detecting Codes. Elementary Data Link Protocols: Simplest, Stop-and-wait, Stop-and-wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ. HDLC Protocol. IEEE standard 802 For LANs And MANs: Ethernet, 802.4 – Token Bus, 802.5 – Token Ring) Working and frame formats. Wireless LANs: IEEE 802.11: Working and frame format.	8
Module4 Network Layer: Logical Addressing: IPv4 addresses, IPv6 addresses. Need for network layer. Internet Protocol: IPv4, IPv6. Routing Algorithms: Unicast and Multicast routing Protocols. Transport Layer: Protocols: UDP, TCP. Congestion controls.	8
Module5 Application Layer: Domain Name System: Name Space, Distribution, DNS in the Internet, Resolution. Network Management: System, SNMP. Network Security: Cryptography: Introduction, Symmetric, Asymmetric. Security Services. Digital Signature.	8

TEXT BOOKS:

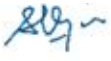
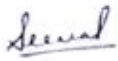
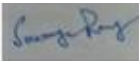
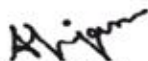
1. Forouzan, B., "Data Communication and Networking", TMH.
2. Andrew S Tanenbaum—Computer Networks—PHI.

REFERENCE BOOKS:

1. William Stallings — Data and Computer Communications I – Pearson Education Asia, Seventh Edition, 2001
2. Douglas E Comer—Computer Networks and Internets I, -Pearson Education, 2014.
3. Larry L. Peterson, Bruce S Davie—Computer Networks: A Systems Approach I, Fourth Edition, 2007 (The Morgan Kaufmann Series in Networking)

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/ Advanced topics/ Design

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (Pos)												Program Specific Outcomes		
	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 COs and Course Delivery (CD) methods

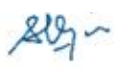
CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD6
CD2	Tutorials/Assignments	CO2	CD1,CD6,CD7
CD3	Seminars	CO3	CD1,CD2,CD3, CD6, CD7
CD4	Mini Projects/Projects	CO4	CD1,CD3,CD6, CD7
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1,CD2,CD3, CD4, CD5, CD7
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/ In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		



Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



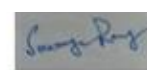
Mrs. Seema
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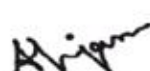
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CourseCode		:CA25227
CourseTitle		:INTRODUCTION TO DATA SCIENCE
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week 03
Class :BCA
Semester/Level :IV/2
Branch :Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the fundamental concepts of data science.
B.	Understand the concept of Exploratory Data Analysis.
C.	Understand basics of Statistical methods.
D.	Know about the different types of regression techniques.
E.	Understand about inferential statistics and model evaluation.

Course Outcomes

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

CO1	Demonstrate key concepts related to Data Science.
CO2	Apply data pre-processing techniques.
CO3	Do exploratory data analysis on datasets.
CO4	Apply regression techniques.
CO5	Apply the inferential statistics.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction: Definition, Data science in various fields, Facets of data, The data science process, The big data eco system and data science, An introductory working example of Hadoop.	8
Module2 Understanding Data: Types of data – Numeric, Categorical, and Ordinal. Classification of data: Structured, Semi-structured and Unstructured. Sources of data: Time series, Transactional data, Spatial Data, Social Network data – Date evolution. Data Pre-processing: Overview, Data cleaning, Data Integration and Transformation. Data Reduction. Data Discretization.	8
Module3 Exploratory Data Analytics: Descriptive Statistics–Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics – ANOVA.	8
Module4 Model development: Regression models: Simple linear regression, least-squares principle, MLR, Multiple regressions, Multiple correlation, Partial correlation, Model Evaluation using Visualization.	8
Module– 5 Statistical Inference: Developing Initial Hypotheses, Identifying Potential Data Sources, Testing hypotheses on means, proportions, and variances. Model Evaluation: Cross-validation, Underfitting and Overfitting, Model Selection.	8

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

TEXT BOOKS:

1. DavyCielen, ArnoDBMeysman, MohamedAli, "Introduction to Data Science", Dreamtech Press.
2. Gupta S.P.and Gupta M.P., Business Statistics, Sultan Chand & Sons.

REFERENCE BOOKS:

1. Hastie, Trevor, et."The Elements of Statistical Learning", Springer.
2. Practical Statistics for Data Scientists, 2nd Edition, Peter Bruce, Andrew Bruce, and Peter Gedeck.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	1	1	1	1	2	1	1	1	1	1	3	3	1	1
CO2	3	3	3	2	2	2	2	3	2	2	2	3	3	3	2
CO3	3	3	2	3	2	2	2	3	2	2	2	3	3	3	2
CO4	3	3	3	2	2	2	2	3	2	2	2	3	3	3	2
CO5	3	3	2	2	2	2	2	3	2	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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD3, CD8
CD3	Seminars	CO3	CD1,CD2,CD5, CD6, CD9
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD3, CD7
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

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Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

CourseCode		:CA25229
CourseTitle		:INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week : 03
Class : BCA
Semester/Level : IV/2
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the concepts of artificial intelligence.
B.	Understand the various types of searching methods used in AI problems.
C.	Learn about basic concepts of knowledge representation.
D.	Learn about reasoning in the uncertain domains.
E.	Understand artificial neural networks.

Course Outcomes

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

CO1	Understand the various approaches of artificial intelligence and Intelligent agent.
CO2	Apply different search techniques for solving real world problems and finding solutions.
CO3	Representing knowledge using predicate logic and a reasoning process.
CO4	Explain the concepts of reasoning in the uncertain knowledge domains.
CO5	Develop neural network models for various applications.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction: Overview of Artificial Intelligence, Applications, Agent and Environment, Different types of Agents, Problem Space & Search, Problem Characteristics.	8
Module2 Searching Techniques: Solving Problems by Searching, Problem Solving Agents, Uninformed Searching Strategies: BFS, DFS, Hill Climbing Search, Simulated Annealing Search, Informed Searching Strategies: Best First Search, A* Search.	8
Module3 Using Predicate Logic: Types of Knowledge and Representation, Representing Simple Facts in Predicate Logic, Conversion to Clausal Form, Resolution, Forward Reasoning, and Backward Reasoning.	8
Module4 Probabilistic Reasoning: Representing Domain in an Uncertain Domain, Truth Maintenance System, Default Reasoning and the Closed World Assumption, Bayesian Networks.	8
Module5	8

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Artificial Neural Networks: What is a Neural Network? Human Brain, Models of Neuron, Artificial Neural Network Architecture, Feed Forward and Feedback Network Architecture, Back Propagation Algorithm, Convolution Networks.	
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TEXT BOOKS:

1. Russel S. and Norvig P., "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education, 2010.
2. Rich E. & Knight K., "Artificial Intelligence", 3rd Edition, Tata McGraw-Hill Publishing Company Limited, 2008.

REFERENCE BOOKS:

1. Dan W. Patterson, "Introduction to Artificial Intelligence Expert Systems", Prentice Hall India New Delhi, 2006.
2. D.W. Rolston, "Principles of AI and Expert System Development", Tata McGraw-Hill Publishing Company Limited, 2015.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
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CO3	3	3	3	2	3	1	2	2	2	2	2	2	3	2	3
CO4	3	2	3	2	3	1	2	2	3	2	2	2	3	3	3
CO5	3	3	3	2	3	1	2	2	2	2	2	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

2: Moderate (Medium)

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Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
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CD2	Tutorials/Assignments	CO2	CD1, CD6, CD3, CD8
CD3	Seminars	CO3	CD1, CD3, CD6, CD8
CD4	Mini Projects/Projects	CO4	CD1, CD3, CD6, CD8

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Dr. Soumya Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

CD5	Laboratory Experiments/Teaching Aids	CO5	CD2,CD6,CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Coursecode		: CA25231
Coursetitle		: ENTERPRISE RESOURCE PLANNING
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule/week : 03
Class : BCA
Semester/Level : IV/2
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Develop an understanding of ERP and its emerging trends.
B.	Explain the role of communication in ERP.
C.	Develop the knowledge on ERP and its related technologies.
D.	Explain mechanism for control, maintenance, and implementation of ERP and its life cycle.
E.	Explain the emerging trends of next generation enterprise.

Course Outcomes

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

CO1	Evaluate a good understanding of basic issues in Enterprise Systems.
CO2	Analyze the scope of common Enterprise Systems (e.g., MM, SCM, CRM, HRM, procurement.
CO3	Explain the challenges associated with implementing enterprise systems and their impacts on organizations.
CO4	Describe the selection, acquisition and implementation of enterprise systems.
CO5	Communicate and assess an organization's readiness for enterprise system implementation with a professional approach in written form.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Overview of ERP Introduction of ERP, Need, Advantages, and Growth of ERP, MIS Integration, ERP drivers. Communication in ERP Systems: Enterprise Integration Application Tools for ERP, Network Structure of ERP System, and ERP Work flow, Process modeling for ERP Systems.	8

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Vijayvargiya

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Joshi

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Module2 ERP and Related Technologies Business process Reengineering (BPR), Management Information System (MIS), Decision Support Systems (DSS), Executive Support Systems (ESS), Data Warehousing, Data Mining, Online Analytical Processing (OLTP), Supply Chain Management (SCM), and Customer Relationship Management (CRM).	8
Module3 Control and Maintenance of ERP Finance, Production planning, Sales and Distribution, Human Resource Management, Inventory Control System, Quality Management, ERP Implementation Life Cycles: Evaluation and selection of ERP package, Project planning, Implementation team training & testing, End user training & Going Live, Post Evaluation and Maintenance.	8
Module4 ERP- Resource Management Perspective Business Modules in ERP Packages, Finance, Production, Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution, Resource Management.	8
Module5 Next generation enterprise: Emerging trends, information mapping, role of centralized /distributed databases, Linkages of the enterprise customer-enterprise, vendor enterprise, link within the enterprise and links with environment Client/server architecture.	8

TEXT BOOKS:

1. ERP Demystified, Alexis, Leon, Tata McGraw-Hill.

REFERENCE BOOKS:

1. Enterprise Resource Planning, Shankar, Ravi & Jaiswal, S., Galgotia Publications.
2. Enterprise Resources Planning and Beyond. Langanalter, A.Gary, St.LuciePress, USA.
3. Building the Customer Centric Enterprise, Imhoff, C. Loftis Lisa & Geiger, G. JonathanJohn Wiley & Sons.
4. Enterprise Resource Planning: A Manager's Guide, Diwan, Parag & Sharma, Sunil, Excel Books

Gaps in the Syllabus (to meet Industry/Professionrequirements) 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 & Evaluation Procedure

Direct Assessment

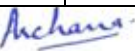
Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

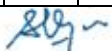
Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	1	3	1	3	2	1	2	3	2	3	1	1	2	2
CO2	3	2	3	2	3	2	2	2	3	2	3	2	2	3	2



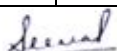
Dr. Archana Bhatnagar



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Dr. Shripal Vijayvargiya



Mrs. Seema Sharma



Mr. Anurag Joshi



Dr. Sounak Paul



Dr. Soumya Ray



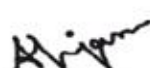
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



Dr. Amrita Priyam

CO3	3	3	3	3	2	3	3	2	2	2	3	3	3	2	3
CO4	3	3	3	3	3	3	2	2	2	2	2	3	2	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	2	3	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1
CD2	Tutorials/ Assignments	CO2	CD1,CD2,CD3
CD3	Seminars	CO3	CD1,CD2,CD4
CD4	Mini Projects/ Projects	CO4	CD1,CD2,CD3, CD8
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD4
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode	:CA25222
CourseTitle	:SOFTWARE ENGINEERINGLAB
Pre-requisite(s)	:
Co-requisite(s)	:Software Engineering
Credits: 1.5	L:0 T:0 P:3

Class schedule per week : 03

Class :BCA

Semester/Level :IV/2

Branch :Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	To understand the concept of UML
B.	To gain knowledge of various diagrams.
C.	Learn about software requirement specification.
D.	To gain knowledge about software design specification
E.	To learn about the relationships among different UML diagrams.

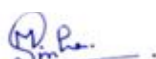
Course Outcomes

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

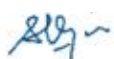
CO1	Identify the software requirement capturing process.
CO2	Elaborate knowledge about dynamic view of system.
CO3	Analyze about static view of software system.
CO4	Analysis about the relationship among static and dynamic view of system.
CO5	Identify the process of deployment of software system



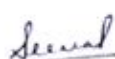
Dr. Archana
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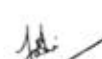
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Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Syllabus

List of Programs as Lab Assignments

1. Draw use case diagram for online banking system.
2. Draw use case diagram for online library system
3. Draw use case diagram for online railway reservation system
4. Draw use case diagram for employee information system.
5. Draw use case diagram for inventory control system
6. Draw use case diagram for student information system.
7. Draw use case diagram for online hotel management system.
8. Draw use case diagram for online bus reservation system.
9. Draw use case diagram for online course registration system
10. Draw use case diagram for online teacher information system.
11. Draw sequence diagram for online banking system.
12. Draw sequence diagram for online library system.
13. Draw sequence diagram for online railway reservation system.
14. Draw sequence diagram for employee information system.
15. Draw sequence diagram for inventory control system.
16. Draw sequence diagram for student information system.
17. Draw sequence diagram for online hotel management system.
18. Draw sequence diagram for online bus reservation system.
19. Draw sequence diagram for online course registration system.
20. Draw sequence diagram for online teacher information system.
21. Draw activity diagram for online banking system.
22. Draw activity diagram for online library system.
23. Draw activity diagram for online railway reservation system.
24. Draw activity diagram for employee information system.
25. Draw activity diagram for inventory control system.
26. Draw activity diagram for student information system.
27. Draw activity diagram for online hotel management system.
28. Draw activity diagram for online bus reservation system.
29. Draw activity diagram for online course registration system
30. Draw activity diagram for online teacher information system.
31. Draw class diagram for online banking system.
32. Draw class diagram for online library system
33. Draw class diagram for online railway reservation system
34. Draw class diagram for employee information system.
35. Draw class diagram for inventory control system
36. Draw class diagram for student information system.
37. Draw class diagram for online hotel management system.
38. Draw class diagram for online bus reservation system.
39. Draw class diagram for online course registration system .
40. Draw class diagram for online teacher information system

Text Books:

1. Mall Rajib, "Fundamentals of Software Engineering", PHI, 2005.

Reference Books:

1. Pressman, "Software engineering A Practitioner's Approach", MGH.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Estimation of software scope feasibility and resources.
2. Develop architectural diagram, and implement by following coding principles.
3. Apply testing strategies and handle software product maintenance issues.



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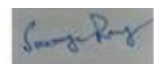
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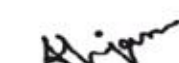
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

POs met through Gaps in the Syllabus-3, 4, 1, 2

Topics beyond syllabus/Advanced topics/ Design

1. Gather and analyze system requirements
2. Develop process models and process system models
3. Translating design into coding.
4. Applying different testing strategies

POs met through Topics beyond syllabus/Advanced topics/Design-2, 3, 4, 1, 2

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between Cos and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	3
CO2	3	3	3	1	3	1	1	1				2	3	2	3
CO3	3	3	3	3	3	1	2	2		1	1	2	3	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

1:Slight(Low)

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3:Substantial (High)

Mapping between Cos and Course Delivery(CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD7,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD9
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

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Dr. Umesh Prasad

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Coursecode		: CA25224
Course title		: PYTHON PROGRAMMING LAB
Pre-requisite(s)		:
Co-requisite(s)		:Python Programming
Credits: 1.5	L:0	T: 0
		P:3

Class schedule per week 03
Class : BCA
Semester/Level : IV/2
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand computer programming concept using python language
B.	Explore basic data types, control structures and standard library functions.
C.	Explore the basic data structures: List, Tuple, Sets, Dictionaries available in Python.
D.	Learning Object oriented concept of programming and its implementation in python.
E.	Handle disk data file for input output operations.

Course Outcomes

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

CO1	Solve the basic mathematical problem using python programming
CO2	Use basic data types control structures and utility functions from standard library for faster programming.
CO3	Use the basic and user defined data structures as per the need of problem.
CO4	Design and implement the problem using OOP concept of python.
CO5	Store, retrieve and manipulate data with disk file.

Syllabus

List of Programs as Assignments:

1. Write a program that displays "Hello to Python programming".
2. Write a program to read two integers and perform arithmetic operations on them (addition, subtraction, multiplication and division).
3. Write a program to read the marks of three subjects and find the average.
4. Surface area of a prism can be calculated if the lengths of the three sides are known.
5. Write a program that takes the sides as input (read it as integer) and prints the surface area of the prism (Surface Area = $2ab + 2bc + 2ca$)
6. A plane travels 395,000 meters in 9000 seconds. Write a program to find the speed of the plane (Speed = Distance / Time).
7. You need to empty out the rectangular swimming pool which is 12 meters long, 7 meters wide and 2 meter depth. You have a pump which can move 17 cubic meters of water in an hour. Write a program to find how long it will take to empty your pool? (Volume = $l * w * h$, and flow = volume/time).
8. Write a program to convert temperature from centigrade (read it as float value) to Fahrenheit.
9. Write a Program to Prompt for a Score between 0.0 and 1.0. If the Score Is Out of Range, Print an Error. If the Score Is between 0.0 and 1.0, Print Grade Using the Following Table

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Score	Grade
≥ 0.9	A
≥ 0.8	B
≥ 0.7	C
≥ 0.6	D
< 0.6	F

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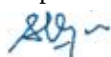
10. Write a Program to find the maximum of three numbers.
11. Suppose you want to develop a program to play a lottery. The program randomly generates a two-digit number, prompts the user to enter a two-digit number, and determines whether the user wins according to the following rules:
 - a) If the user's input matches the lottery in the exact order, the award is \$10,000.
 - b) If all the digits in the user's input match all the digits in the lottery number, the award is \$3,000.
 - c) If one digit in the user's input matches a digit in the lottery number, the award is \$1,000.
12. Write a Program to Check If a given year Is a Leap Year.
13. Program to Find the GCD of Two Positive Numbers.
14. Write a program that prompts the user to enter a four-digit integer and displays the number in reverse order.
15. Write Python Program to Find the Sum of Digits in a Number
16. Write a program to print the sum of the following series.
 - $1 + 1/2 + 1/3 + \dots + 1/n$
 - $1/1 + 2^2/2 + 3^3/3 + \dots + n^n/n$
17. Write a Program to Display the Fibonacci Sequences up to nth Term Where n is provided by the User.
18. Write a Program to find the Sum of All Odd and Even Numbers up to a Number Specified by the User.
19. Write a Program to Check Whether a Number Is Prime or Not.
20. Write a Program to Find the Factorial of a Number.
21. Write a Program to Demonstrate the Return of Multiple Values from a Function Definition.
22. Program to Demonstrate the Use of Default Parameters
23. Write Program to Demonstrate the Scope of Variables.
24. Program to Print the Characters that are Common in Two Strings.
25. Write a program to check whether a given String is palindrome or not.
26. Write Program to Count the Number of Times an Item appears in the List.
27. Write a program to create a list of integer numbers. Sort the elements using any sorting method.
28. Write a program to create a list of integer numbers and perform the linear and binary search.
29. Write a program to create a list of cities names and perform the sorting the cities name in alphabetical order.
30. Find Mean, Variance and Standard Deviation of List of Numbers
31. Write a Program to Find the Transpose of a Matrix.
32. Write a program to perform matrix multiplication.
33. Write a program to create a dictionary for country name as key and currency as value. Traverse the dictionary with key: value Pairs in using for Loop.
34. Write a program to create tuples, and perform the following operations: Merging of tuples, splitting of a tuple, comparison of two tuples.
35. Write a program to create an intersection, union, set difference, and symmetric difference of sets.
36. Write a program with "MyRectangle" class having the dimensions as data members and area () as a method member. Calculate the area of each rectangle object created by user.
37. Design a class with name "MyComplex" to represent the complex number including the constructor overloading, methods to perform the arithmetic operation over the two complex numbers. Write the complete python program for the above design.
38. Design a class with name "Distance" to represent the distance in feet and inch. Include the method to calculate the addition of two distances. Write the complete python program for the above design.
39. Write a complete program to implement the Employee and its subclasses (Salaried Employee, Daily Waged Employee, Commission based employee) given in Hierarchical and multilevel manner. The program should exhibit the use of super keyword to invoke the super class constructor.
40. Write a program to open a file and perform the reading and writing operation with the file.



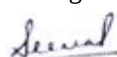
Dr. Archana
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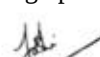
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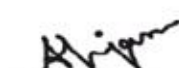
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

- TEXT BOOKS:**

- ### REFERENCE BOOKS:

- Gaps in the Syllabus (to meet Industry/ Profession requirements) POs met through Gaps in the Syllabus**

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

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

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

1: Slight (Low) 2:Moderate(Medium)3:Substantial(High)

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(Dr. Sheel Shalini)	Dr. P. S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD8
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Dr. Umesh Prasad

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SEMESTER V

CourseCode		:CA25301
CourseTitle		:FUNDAMENTALS OF COMPUTER ALGORITHMS
Pre-requisite(s)		:Introduction to Data Structures
Co-requisite(s)		:
Credits:4	L:3	T:1 P:0

Class schedule per week

04

Class

:BCA

Semester/Level

:V/3

Branch

:Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understand basic algorithm designing techniques such as recursion, greedy, dynamic programming and backtracking.
B.	Analyze the asymptotic performance of an algorithm.
C.	Demonstrate a familiarity with algorithms and data structures.
D.	Apply important algorithmic design paradigms and methods of analysis in solving real life problems.
E.	Synthesize efficient algorithms in common engineering design situations.

Course Outcomes

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

CO1	Have a clear understanding on solving the problems systematically.
CO2	Make use of linear and non-linear data structures, like, graphs and trees while designing algorithms.
CO3	Have a clear understanding of different design paradigms.
CO4	Analyze and measure the efficiency of an algorithm.
CO5	Demonstrate the basic knowledge of fundamentals of algorithms which would help them to take up an advanced course in the same field.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Introduction: Definition of algorithm, algorithm design techniques, analysis of algorithms, performance analysis-time complexity, best, worst and average cases, space complexity. Asymptotic Notations: O , Ω , Θ	10
Module2 Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem. Divide&Conquer: The general method. Binary search, merge sort, quicksort, best- and worst-case analysis, multiplication of large integers, Strassen's Matrix multiplication.	10

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Dr. Umesh Prasad

Dr. Amrita Priyam

Module3 The Greedy Method: General Characteristics of greedy algorithms, problem solving using greedy methodology: Knapsack problem, Minimum Spanning trees (Kruskal's algorithm, Prim's Algorithm), single source shortest path problem (Dijkstra's algorithm), Huffman trees.	10
Module4 Dynamic Programming: The general method, principles of dynamic programming: memorization or iterations over sub problems, all-pairs shortest path problem, 0/1 Knapsack problem.	10
Module5 Basic Traversal and search techniques on general graphs: BFS & DFS Limitations of Algorithm Power: Backtracking method: 4-Queens problem, Sum of subset problems Computational Intractability: Overview of P, NP and NP-Complete Problems	10

TEXT BOOKS:

1. Jon Kleinberg and Eva Tardos. Algorithm Design. Pearson Education (Latest Edition).
2. Anany Levitin. Introduction to The Design and Analysis of Algorithms. Pearson Education (3rd Edition).

REFERENCE BOOKS:

1. Sahni Sartaj. Computer Algorithms. Computer Science Press (Latest Edition)
2. T.H. Cormen. Introduction to Algorithms. 3rd Ed. (International Edition) (MIT press)

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Polynomials and the FFT; Approximation Algorithms

POs met through Gaps in the Syllabus -3, 4, 5

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Dr. Archana
Bhatnagar

Dr. Madhavi
Sinha

Dr. Shripal
Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	3	2	3	1	1	2	2	2	2	2	2	2
CO2	3	2	1	2	3	2	3	1	2	3	1	1	2	2	2
CO3	2	3	3	2	2	2	1	2	3	2	3	3	2	2	2
CO4	2	3	3	2	1	2	3	3	2	3	2	3	2	2	3
CO5	2	3	2	2	2	2	3	1	2	2	3	2	2	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD8
CD3	Seminars	CO3	CD1, CD5, CD8
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD3, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25303
Course Title		: INTRODUCTION TO MACHINE LEARNING
Pre-requisite(s)		:
Co-requisite(s)		: Machine Learning Lab
Credits: 3	L: 3	T: 0 P: 0

Class schedule per week

03

Class

: BCA

Semester/Level

: V/3

Branch

: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Introduce the basic concepts and techniques of Machine Learning.
B.	Familiarize the concepts of regression models.
C.	Understand the concepts of feature selection and transformation techniques.
D.	Learn the utility of classification and clustering techniques.

Dr. Archana
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Vijayvargiya

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Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

E.	Identify machine learning algorithms for real-world problems.
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Course Outcomes

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

CO1	Understand the basic concepts required for machine learning.
CO2	Apply regression models for prediction.
CO3	Identification of discriminating features for better learning and apply classification algorithm.
CO4	Evaluate and analyze the performance of a machine learning algorithm or a system based on machine learning algorithm.
CO5	Apply artificial neural network for the real-world data.

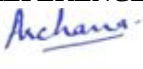
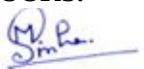
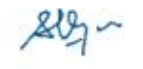
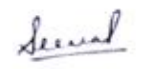
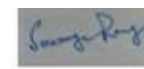
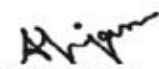
Syllabus

MODULE	(No. Of Lecture Hours)
Module1 Introduction: Machine Learning, Types of Machine Learning: Supervised, semi-supervised and unsupervised learning. Basics of Linear Algebra-matrices and vectors, Eigen value decomposition.	8
Module2 Feature selection, Feature transformation: Filter and Wrapper methods, Encoding schemes for data transformation, Principal component Analysis. Supervised Learning: Linear Regression: Prediction using Linear Regression, Linear Regression with one variable, Linear Regression with multiple variables.	8
Module3 Logistic Regression: Classification using Logistic regression, Logistic regression vs. Linear regression, Logistic regression with one and multiple variables. Classification: Classification, Issues regarding classification, Techniques: Bayesian classification, Support Vector Machine, Decision Tree. Kernel trick	8
Module4 Unsupervised Learning: Clustering: Introduction, Partitioning- K-Means, Hierarchical - agglomerative and Divisive clustering. Model Assessment and Selection: Bias, Variance and model complexity, Bias – variance tradeoff, Bayesian approach and BIC, Cross-validation, Performance of Classification Algorithms (Confusion Matrix, Precision, Recall and ROC Curve). Regularization: Regularization and its utility: the problem of Overfitting, Application of Regularization.	8
Module5 Artificial Neural Networks: Introduction, Model Representation, Perceptron, Forward propagation, Backpropagation algorithm, regularization and bias/variance. Recurrent networks.	8

TEXT BOOKS:

1. Alpaydin, Introduction to Machine Learning, Prentice Hall of India.
2. Mitchell Tom, "Machine Learning", Latest Edition, Mc-Graw Hill.

REFERENCE BOOKS:

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

1. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, “Machine Learning”, Pearson Education India.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Application of machine learning in real life problems.

POs met through Gaps in the Syllabus –PO4, PO5

Topics beyond syllabus/ Advanced topics/ Design

1. Design of machine learning system to solve complex problems.
2. Capability to optimize machine learning models with applications in real-world use cases.

POs met through Topics beyond syllabus/ Advanced topics/ Design–PO3, PO4, PO5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	1	1	2	1	1	1	1	1	2	3	1	1
CO2	3	3	3	2	3	2	2	2	2	2	2	3	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	2	3	3	3	2
CO4	2	3	2	3	3	2	1	1	2	2	1	3	3	3	2
CO5	3	3	3	3	3	2	2	2	2	2	2	3	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

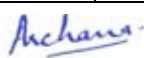
1:Slight(Low)

2:Moderate (Medium)

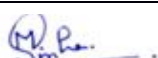
3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

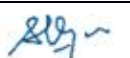
CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD3, CD5
CD3	Seminars	CO3	CD1, CD2, CD3, CD5, CD6, CD9
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD3, CD6



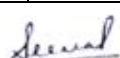
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



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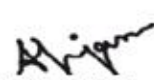
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25305
CourseTitle		: COMPUTER GRAPHICS
Pre-requisite(s)		:
Co-requisite(s)		:ComputerGraphicsLab
Credits:3	L:3	T:0 P:0

Class schedule perweek 03
Class : BCA
Semester/Level : V/3
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Acquire fundamental knowledge of the role of multimedia and graphics in computer science.
B.	Learn various object modeling algorithms and computations related to it.
C.	Learn to model and colour 2D and 3D objects.
D.	Learn to develop a simple Graphical User Interface.
E.	Learn to create realistic images using color and shading techniques.

Course Outcomes

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

CO1	Perform visual computations for geometrical drawings.
CO2	Model 2D objects.
CO3	Apply geometrical transformation of the modeled objects.
CO4	Develop a simple Graphical User Interface.
CO5	To create realistic images using color and shading techniques.

Syllabus

MODULE	(No. Of Lecture Hours)
Module1 Introduction and Overview of Graphics Systems: Overview of graphics systems, Application areas of Computer Graphics, Video Display Devices, Raster and Random Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard Copy Devices, and Graphics Software. Three-Dimensional Viewing Devices, Stereoscopic & Virtual Reality Systems.	8

Dr. Archana
Bhatnagar

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Vijayvargiya

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Dr. Amrita Priyam

Module2 Output Primitives: Points and Lines, Line Drawing Algorithms (DDA and Bresenham's Algorithms), Circle Generating Algorithm, Filled Area Primitives – Scan-line Polygon Fill Algorithm, Inside-Outside Tests, Boundary-Fill Algorithm, Flood-Fill Algorithm, Color Tables.	8
Module3 2D Geometric Transformation: Two-dimensional transformations and their matrix representations-Translation, Rotation, Scaling, Reflection, Shears, Homogeneous Coordinates, and Composite Transformations (Translations, Rotations, Scalings). 2D Viewing: The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Clipping- Point, Line Clipping -Cohen- Sutherland Line Clipping and Polygon Clipping -Sutherland- Hodgeman Polygon Clipping.	8
Module4 3D Geometric Transformations and Viewing: Translation, Rotation-Coordinate Axes Rotation, General 3-Dimensional Rotations, Rotations with Quaternions, Scaling, The Viewing Pipeline, Viewing Coordinates.	8
Module5 Color Models: Properties of Light, Standard primaries and chromaticity diagram, XYZ color model, RGB color model, YIQ color model, HSV color model, HLS color model Visible Surface Detection Method: Classification of visible surface detection algorithms, Back Face Detection, Depth- Buffer method, A-Buffer method, and Scan line method.	8

TEXT BOOKS:

1. D.Hearn and M.P.Baker, "Computer Graphics: C Version", 2nd Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Foley J.D., Dam A. Van, Feiner S.K., and Hughes. F., "Computer Graphics: Principles and Practice in C", 3rd Edition, Pearson Education, 2013.

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 & Evaluation Procedure

Direct Assessment

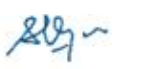
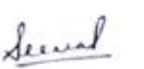
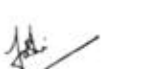
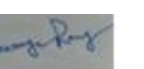
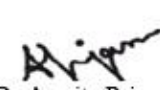
Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)	Program Specific Outcomes
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Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards /LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects /Projects	CO4	CD1,CD5,CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD4, CD5
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits/ In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25307
CourseTitle		: WEB PROGRAMMING
Pre-requisite(s)		:
Co-requisite(s)		Web Programming Lab
Credits:4	L:3	T:1 P:0

Class schedule per week

:03

Class

:BCA

Semester/Level

: V/3

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Learn about the basics of web programming.
B.	Learn HTML, JavaScript, and XML for scripting.
C.	Learn web-based programming using ASP.NET.
D.	Learn PHP-based programming.
E.	Learn Making static and dynamic websites.

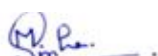
Course Outcomes

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

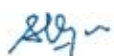
CO1	Understand the elements of HTML and design static web pages.
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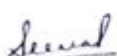
Dr. Archana
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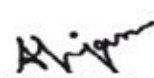
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CO2	Get familiarized with .NET Framework.
CO3	Develop interactive web pages using XML.
CO4	Design dynamic website using ASP.NET.
CO5	Learn basics of PHP and apply it to develop dynamic websites.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction to Internet and HTML: Introduction to Internet, Internet Services, Web Server, Web Client, Domain Registration, Internet Security. HTML Tags, HTML Documents, Header Section, Body Section, Headings, Link Documents using AnchorTag, FormattingCharacters, Fonttag, ImagesandPictures, Listing, Tables in HTML, HTML iframes, HTML Forms.	8
Module2 JavaScript: Use of JavaScript in Web Pages, Advantages of JavaScript, DataTypes, Variables, Operators and Expressions, ConditionalStatements, ArrayObjects, Date Objects, String Objects, Type Casting, Functions, DOM. Introduction to JavaScript Frameworks, Libraries and Runtime Environments: React, Angular, Node.js, Express.js.	8
Module3 Understanding XML: Overview of XML, XML Families of Technology, Creating XML Documents, Rules for Well-Formed XML, Discerning Structure, Working with Mixed Content, Adding Comments, CDATA Sections, Creating a DTD Concept of a Valid XML Document, Creating a DTD for an existing XML File	8
Module4 ASP NET: Building Web Forms Using ASP. .NET, Exploring ASP NET Server Controls, Using ASP.NET Server Controls to Create Web Forms, Understanding the Code behind the Page. Using Validation Controls to Improve Web Forms.	8
Module5 PHP: Preparing the Use PHP, Exploring PHP for the First Time, Understanding PHP Basics, Displaying PHP Output, Managing PHP Program Flow. Planning a PHP Web Application, Creating and Using a Logon Window, Managing System Data, Updating a PHP Web Application.	8

TEXT BOOKS:

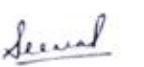
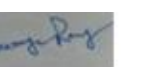
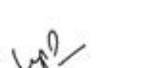
1. Xavier C., "Web Technology & Design", New Age International Publishers, New Delhi.
2. Bai Xue, Ekedahl Michael, Farrell Joyce, Gosselin Don, Zak Diane, Kaparthi Shashi, Macintyre Peter, Morrissey Bill, "The Web Warrior Guide to Web Programming", India Edition, Thomson Education.
3. Steven Holzner, PHP: The Complete Reference, McGraw-Hill Education Pvt Ltd.

REFERENCE BOOKS:

1. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP", BPB Publication
2. Mac Donald, the Complete Reference ASP.Net, Tata McGraw-Hill
3. James Jaworski, "Mastering JavaScript and JScript", BPB Publication.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

POs met through Gaps in the Syllabus.

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	2	2	1	1	2	1	2	2	3	3	3	3
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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)

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3: Substantial(High)

Mapping Between Cos and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD6
CD2	Tutorials/ Assignments	CO2	CD7
CD3	Seminars	CO3	CD2, CD3, CD6, CD7
CD4	Mini Projects/Projects	CO4	CD3,CD6,CD7
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CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25309
Course Title		:SOFTWARE TESTING
Pre-requisite(s)		:Software Engineering
Co-requisite(s)		:

Dr. Archana
Bhatnagar

Dr. Madhavi
Sinha

Dr. Shripal
Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Credits:4	L:3	T:1	P:0
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Class/schedule/week **04**
Class **:BCA**
Semester/Level **:V/3**
Branch **:Bachelor of Computer Applications**

Course Objectives

This course enables the students to:

A.	Have a broad understanding of software requirements in context to end user expectations.
B.	Familiarize with testing environments and test processes.
C.	Describe to the students the impact and methods to overcome programming errors.
D.	Devise strategies to detect and rectify common programming errors.
E.	Conceptualize the role of testing in estimating software quality.

Course Outcomes

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

CO1	Understand the types and effects of errors and bugs on a software and the testing process.
CO2	Apply testing strategies to detect software bugs.
CO3	Analyze approaches of verification and validation including static analysis, and reviews as well as software testing approaches such as unit testing and integration testing.
CO4	Evaluate the software quality and apply test suites like JUnit and selenium for testing software.
CO5	Summarize best practices for coding to ensure good quality software, quality products by applying quality metrics.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction: Software Testing – Psychology of Testing, Verification and Validation, Testing Team and Development Team, Characteristics of Test Engineers, Levels of Testing Principles of Software Testing, Error, Fault, Failure, Incident, Error and Fault Taxonomies, Test Cases, Limitations of Testing Code inspections, deskchecking, group walkthroughs and peer reviews. Overview of Graph Theory for tester.	8
Module2 Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique. Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, GraphMetrics, Data Flow Testing, Slice-based testing.	8
Module3 Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Regression Testing, Extreme Testing.	8
Module4 Object Oriented Testing: Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing. Testing Internet applications: Overview, challenges, and strategies of testing Internet applications.	8

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Ray

(Dr. Sheel Shalini)

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Dr. Umesh Prasad

Dr. Amrita Priyam

Module5 Overview of Testing Tools – Need for Automated Testing Tools, Taxonomy of Testing Tools, Functional/Regression Testing Tools, Performance Testing Tools, Testing Management Tools, Source Code Testing Tools, How to select a Testing Tool. WinRunner – Overview of WinRunner, Testing Applications using WinRunner.	8
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TEXT BOOKS:

1. Jorgensen, Paul C., “Software Testing-A Craftsman’s Approach”, Second Edition, CRC Press, 2008.
2. Ammann, Paul and OffuttJeff, “Introduction to Software Testing”, Cambridge University Press, Cambridge, UK, ISBN 0-52188-038-1, 2008.

REFERENCE BOOKS:

1. Tamres Louise, “Software Testing”, Pearson Education Asia, 2002.
2. Pressman R.S., “Software Engineering – A Practitioner’s Approach”, Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
3. Aggarwal K.K.& Singh Yogesh, “Software Engineering”, New Age International Publishers, New Delhi, 20034. Tamres Lauise, “Introducing Software Testing”, Pearson Education

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Combination of manual and automated testing.

POs met through Gaps in the Syllabus-3, 5, 12

Topics beyond syllabus/Advanced topics/Design

1. Testing for emerging applications such as Machine learning, Bigdata etc.
2. Digital transformation with Agile.

POs met through Topics beyond syllabus/ advanced topics/ Design-5, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

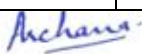
Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher’s Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

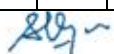
Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	3	2	3



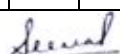
Dr. Archana
Bhatnagar



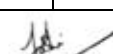
Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul

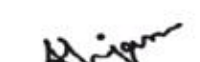


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(Dr. Sheel Shalini)


Dr. P.S. Bishnu


Dr. Umesh Prasad


Dr. Amrita Priyam

CO2	3	3	3	1	3	1	1	1				2	2	3	2
CO3	3	3	3	3	3	1	2	2		1	1	2	3	2	3
CO4	3	3	3	1	3		1	1		1	1	2	3	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD7,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD9
CD3	Seminars	CO3	CD1,CD2, CD3
CD4	MiniProjects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1, CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25304
CourseTitle		:MACHINE LEARNING LAB
Pre-requisite(s)		:PythonProgrammingLab
Co-requisite(s)		:IntroductiontoMachineLearning
Credits:1.5	L:0	T:0 P:3

Class schedule per week

: 03

Class

: BCA

Semester/Level

: V/3

Branch

: Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understand the fundamental concepts of machine learning, its types, and the mathematical foundations required, including matrix operations and eigen decomposition.
B.	Apply feature engineering techniques such as manual encoding, transformation, and dimensionality reduction using PCA for effective model input preparation.
C.	Develop regression and classification models including linear regression, logistic regression, Naive Bayes, and decision trees using foundational algorithms.
D.	Implement unsupervised learning techniques like K-means clustering and evaluate models using standard performance metrics such as confusion matrix, precision, recall, and accuracy.
E.	Design and simulate artificial neural networks, including perceptrons and feedforward networks, using NumPy, gaining a practical understanding of forward and backpropagation mechanisms.

CourseOutcomes

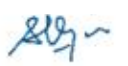
After the completion of this course, students will be able to:



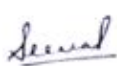
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Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



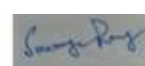
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Dr. Soumya
Ray



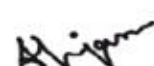
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Dr. Umesh Prasad



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CO1	Apply matrix operations and eigen decomposition techniques to understand and solve mathematical foundations of machine learning algorithms.
CO2	Perform feature encoding, transformation, and dimensionality reduction to preprocess data for learning models.
CO3	Develop and implement regression and classification algorithms such as linear regression, logistic regression, Naive Bayes, and decision trees using Python.
CO4	Apply unsupervised learning techniques like K-Means clustering and evaluate model performance using appropriate validation metrics.
CO5	Design and simulate artificial neural networks using NumPy to understand the functioning of perceptrons, forward propagation, and backpropagation.

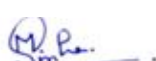
Syllabus

MODULE	(No. of Lecture Hours)
Module 1: Introduction to ML & Linear Algebra Topics: ML types, matrix operations, eigen decomposition 1. Perform addition, multiplication, and transpose of two matrices using NumPy. 2. Compute eigenvalues and eigenvectors of a 2×2 matrix using NumPy's linalg module.	4
Module 2: Feature Engineering & Linear Regression Topics: Feature selection, transformation, regression 3. Convert a categorical list (e.g., ['red', 'green', 'blue']) to numerical form using a dictionary (manual label encoding). 4. Apply Principal Component Analysis using covariance matrix and eigen decomposition with NumPy. 5. Implement simple linear regression (one variable) using the least squares method with NumPy.	4
Module 3: Logistic Regression & Classification Topics: Logistic regression, classification, kernel methods 6. Build logistic regression from scratch using the sigmoid function and gradient descent for binary classification. 7. Implement a basic text classifier using Naive Bayes with manual probability calculation. 8. Simulate a simple decision tree using if-else logic for classifying small structured data.	4
Module 4: Clustering, Evaluation, and Regularization Topics: Clustering (K-Means), model evaluation, bias-variance, regularization 9. Implement K-Means clustering using NumPy with random initialization and centroid updates. 10. Manually compute the confusion matrix, accuracy, precision, and recall from given predicted and actual labels. 11. Implement Ridge Regression using the normal equation with an L2 regularization term.	4
Module 5: Artificial Neural Networks Topics: Perceptron, forward pass, backpropagation, RNN 12. Implement a single-layer perceptron for binary classification using NumPy. 13. Simulate forward propagation and backpropagation of a feedforward neural network with one hidden layer.	4

TEXT BOOKS:



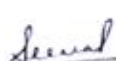
Dr. Archana
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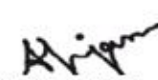
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Dr. Amrita Priyam

CD4	Mini Projects/Projects	CO4	CD5,CD6,CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD5,CD6,CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25306
CourseTitle		COMPUTER GRAPHICS LAB
Pre-requisite(s)		:
Co-requisite(s)		:Computer Graphics
Credits: 1.5 L:0	T:0	P:3

Class schedule per week : 03
Class : BCA
Semester/Level : V/3
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Learn computer graphics by practical.
B.	Learn to code for various graphics tools.
C.	Learn the various theory by implementation using programming.
D.	Identify the limitations of C Language for graphics-related problems.
E.	Know the practical application of computer graphics.

Course Outcomes

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

CO1	Code programs efficiently.
CO2	Translate the graphics algorithm to programs.
CO3	Test and execute the graphical syntax and logical errors.
CO4	Apply programming to solve simple graphical problems using functions.
CO5	Write the C program efficiently for transformation problems.

Syllabus

List of Programs as Assignments:

Write a program

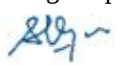
1. To get the background color.
2. To set the background color.
3. To plot a point of coordinates (100,100).
4. To draw a line using the line function.
5. To draw a line using the line function. Take the end coordinates from the user.
6. To draw a triangle using the polygon function.
7. To draw a polygon of n edges using the polygon function.



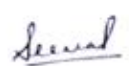
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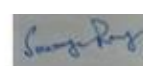
Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



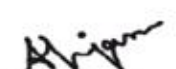
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

8. To draw a polygon of n edges taken from the user using the polygon function.
9. To draw a circle using the circle function.
10. To draw a circle of radius 'r' taken from the user using the circle function.
11. To draw a line using the DDA algorithm.
12. To draw a line using Bresenham's line algorithm.
13. To draw a circle using the mid point circle algorithm.
14. To draw a line using Bresenham's line algo, where end points are taken from the user.
15. To draw a line using DDA algo, where end points are taken from the user.
16. To draw 'n' concentric circles taken from the user using the mid point algorithm.
17. Write a program to implement polygon filling.
18. To create a line and increase its size with a value taken from the user.
19. To create an equilateral triangle.
20. To draw a line and rotate it with an angle of 45.
21. To create a circle and translate it.
22. To create a circle and translate it with a value taken from the user.
23. To create an equilateral triangle and rotate it with an angle of 45.
24. To create an equilateral triangle and create reflection.
25. To scale a rectangle.
26. To shear a rectangle, take the shear factor from the user.
27. To create an equilateral triangle and translate, rotate, and scale it.
28. To draw a line with shear and translation.

TEXT BOOKS:

1. D. Hearn and M.P. Baker, "Computer Graphics: C Version", 2nd Edition, Pearson Education, 2013.
2. Roger T. Stevens, Advanced Graphics Programming in C and C++, BPB Publication

REFERENCE BOOKS:

1. Foley J.D., Dam A., Van, Feiner S.K., and Hughes F., "Computer Graphics: Principles and Practice in C", 3rd Edition, Pearson Education, 2013.
2. S. Harrington - Computer Graphics - A Programming Approach, McGraw Hill Publication, New Delhi, 1994.
3. J.D. Foley et al. A Fundamentals 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 & Evaluation Procedure

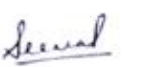
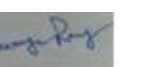
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between Cos and Program Outcomes

						
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(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/ Assignments	CO2	CD1, CD8, CD9
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/ Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1, CD2, CD9
CD6	Industrial/ Guest Lectures		
CD7	Industrial Visits /In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25308
CourseTitle		:WEB PROGRAMMING LAB
Pre-requisite(s)		:
Co-requisite(s)		:Web Programming
Credits:1.5	L:0	T:0 P:3

Class schedule per week : 03
Class : BCA
Semester/Level : V/3
Branch : Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Learn about basics of web programming skills.
B.	Learn HTML, Java Script, XML for scripting.
C.	Learn server sideweb-based programming using ASP.NET.
D.	Learn Server Side Scripting using PHP.
E.	Learn Making static and dynamic websites using PHP or ASP.NET

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(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Course Outcomes

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

CO1	Know the fundamentals of web programming.
CO2	Identify .NET technology and framework.
CO3	Elaborate on the web-based programming.
CO4	Perform web-based programming.
CO5	Design static and dynamic websites.

Syllabus

List of Programs as Assignments:

1. Write HTML code to develop a Web page having the background in red and title "My First Page" in any other colour.
2. Create a page to show different attributes of Font tag.
3. Create a page to show different attributes: italics, bold, underline
4. Design a page having background colour yellow, giving text colour red and using all the attributes of font tag.
5. Write an HTML code to create a Web page of blue color and display links in red colour.
6. Create a Web page using href attribute of anchor tag & the attribute: alink, vlink etc.
7. Write HTML code to create a Web page of pink colour and display a moving message in red colour.
8. Create a Web page, showing an ordered list of the names of five of your friends.
9. Create a web page, showing an unordered list of names of five of your friends.
10. Write a JavaScript code to accept radius & display the area of the circle.
11. Use the date function get Date & set Date to prompt the user for an integer b/w 1 – 31 & return day of the week it represents.
12. Display time and print message accordingly e.g., 'Good Morning' in Morning etc.
13. Design simple HTML pages to illustrate Ordered, Unordered & Definition Lists Tables Frames Form elements
14. Web page validation using Java script.
15. Create web page using CSS.
16. Event handling using DHTML.
17. Demonstrate the significance of cookies using PHP.
18. Develop a home page for a website using PHP.
19. Demonstrate Constructor Overloading.
20. Demonstrate Method Overloading.
21. Demonstrate Method Overriding.
22. Demonstrate Multilevel Inheritance.
23. Create a web page to demonstrate server controls in asp.net.
24. Demonstrate validation controls in asp.net.
25. Develop web application to view and update data in database.
26. Develop web application to insert data in to database.
27. India is a large country. Different regions observe variations in climate. The spoken language of one state is quite different from that of another. They wear different types of garments. They celebrate different festivals and perform varied religious rites. People belonging to diverse cultures belong to different religious faiths. In spite of these diversities, Indians feel a sense of unity and oneness among them. Thus, we conclude that India is a land of Unity in Diversity.
 - a) All the headings should be H2 and green colour.
 - b) Main heading should be H1 and centre aligned.
 - c) The background should be yellow colour.
 - d) There are 10 paragraphs so each of them should be made using P tag.

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- e) The Introduction and Conclusion paragraphs should have “Times New Roman” font, the size should be 12 and colour should be blue.
- f) All the remaining paragraphs text should be pink and magenta coloured in an alternate way.
28. Create a webpage having a list as shown below: • Food, Fruit Apple Mango *Vegetable Potato Tomato Carrot • Dress Ethnic wear Kurta Sherwani Western wear suit jeans • Sports a. Indoor sports carom table tennis b. Outdoor sports Cricket Hockey
29. Create a webpage with the following: a) A superscript and subscript tag b) Pre tag c) Paragraph tag d) Anchor tag Page 91 of 243 e) Image tag f) Definition list tag g) Marquee tag h) Horizontal line tag i) Break tag j) Heading tag
30. Create a webpage having 10 divisions each having separate background color and text color using tag. At the top right corner there should be an image hyperlink opening in a new webpage. 5. Create a webpage with a form loaded into it and take input of three strings through three textboxes and then concatenate them without using any built-in function.
31. Create a webpage with two tables. First one should have 1 row and 5 columns and the second one with 3 rows and 4 columns. The contents of the first table should be center aligned and contents of the second table should be right aligned. Each column of the first table should have separate colors and each row of the second table should have separate colors.
32. Write a JavaScript program to calculate and display the aggregate and percentage of three subjects’ (Physics, Chemistry and Mathematics) marks along with the name of a student. The name and individual marks input shall be taken by textbox in the webpage.
33. Write a JavaScript program to search the element 4 in the array [2, 6, 4, 10, 4, 0, -2] using any method.
34. Create a framed webpage with different frames as below: 1 2 3 4 5 6 7 8 Contents of 1st, 3rd, 5th, 7th frame should be same again 2nd, 4th, 6th and 8th should be same.
35. Write a JavaScript program to calculate the percentage of three subjects’ (English, Mathematics, and Science) marks along with the name of a student. The name and individual marks input shall be taken by form in the webpage.
36. Create a webpage to take input of two strings and concatenate them without using any builtin function.
37. Write a JavaScript program to calculate and display the aggregate and percentage of three subjects’ (Physics, Chemistry and Mathematics) marks along with the name of a student. The name and individual marks input shall be taken by textbox in the webpage.

TEXT BOOKS:

1. Bai Xue, Ekedahl Michael, Farrell Joyce, Gosselin Don, Zak Diane, Kaparthi Shashi, Macintyre Peter, Morrissey Bill, “The Web Warrior Guide to Web Programming”, India Edition, Thomson Education.
2. Xavier C., “Web Technology & Design”, New Age International Publishers, 1st Edn, New Delhi.

REFERENCE BOOK

1. Ross Ivan Bay, “Web Enable Commercial Application Using HTML, DHTML”, BPB Publication.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Detailed learning of HTML and XHTML
2. Detailed learning of JavaScript
3. Detailed learning of XML

POs met through Gaps in the Syllabus 3, 4, 12

Topics beyond syllabus/ Advanced topics/ Design

1. Concepts of XSLT
2. Knowledge about Active Server Pages
3. Designing interactive server pages

POs met through Topics beyond syllabus/ advanced topics/ Design-2, 3, 4, 12

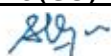
Course Outcome (CO) Attainment Assessment Tools & Evaluation



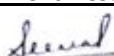
Dr. Archana
Bhatnagar



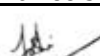
Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



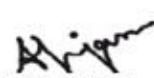
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Direct Assessment

Assessment Tool	% Contribution during COA sssessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	1	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	CourseDeliveryMethods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	
CD2	Tutorials/Assignments	CO2	
CD3	Seminars	CO3	
CD4	Mini Projects/Projects	CO4	
CD5	LaboratoryExperiments/Teaching Aids	CO5	
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Dr. Archana
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SinhaDr. Shripal
VijayvargiyaMrs. Seema
SharmaMr. Anurag
JoshiDr. Sounak
PaulDr. Soumya
Ray

(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

SEMESTER VI

CourseCode		: CA25331
CourseTitle		: ADVANCED JAVA PROGRAMMING
Pre-requisite(s)		: Java Programming
Co-requisite(s)		: Advanced JavaProgrammingLab
Credits:4	L:3	T:1 P:0

Class schedule per week : 04
Class : BCA
Semester/Level : VI/3
Branch : Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Build GUI interfaces for user interaction.
B.	Connect database with front end applications.
C.	Understand various mechanisms to apply constraint in the applications.
D.	Explain the existing classes and objects/groupof objects.
E.	Build different applications.

Course Outcomes

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

CO1	Construct different applications usingSwing.
CO2	Connect the database to build front-end and backend applications.
CO3	Incorporate constraints and conditional statements using JSP.
CO4	Encapsulate many objects into a single object.
CO5	Extend the capabilities of servers that host applications accessed by means of a request-response programming model.

Syllabus

MODULE	(No.of Lecture Hours)
Module1 Swing: Origin, Basic concepts of AWT, Two key swing features, The MVC connection, Components and Containers, The Swing packages, Event Handling, Create a Swing Applet, Painting in Swing.	8
Module2 ExploringSwing: JLabel and ImageIcon, JTextField, The Swing Buttons, JTabbedPane, JScrollPane, JList, JComboBox JDBC: Introduction, JDBCDriver, DatabaseConnectivity, Access with and without DSN.	8

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Paul

Dr. Soumya
Ray

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Module3 JSP: Lifecycle of JSP, JSPAPI, JSP Scripting elements: Scriplettag, Expression tag, Declaration tag, Use of Implicit Objects: JSP Request, JSP Response, JSP Config, JSP Session, JSP Exception, JSP Directive elements	8
Module4 Java Beans: Advantages of Java Beans, Introspection-Design patterns for properties and events, Methods, use of the BeanInfo Interface, Bound and Constrained properties, Persistence, Customizers Java Beans API: Introspector, PropertyDescriptor, EventSetDescriptor, MethodDescriptor	8
Module5 Servlets: Background, The life cycle of Servlet, Servlet Development options, Using Tomcat, The Servlet API, using Cookies, Session Tracking	8

TEXT BOOKS:

- Herbert Schildt, Java-TheCompleteReference, Ninth Edition, Oracle Press.

REFERENCE BOOKS:

- Uttam Roy, ADVANCED JAVA PROGRAMMING, Oxford University Press.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/ Advanced topics/ Design

- Implementation of frontend-backend-based applications

POs met through Topics beyond syllabus/ Advanced topics/ Design-PO2, PO3, PO4, PO11

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	2	3	1	1	1	1	1	2	1	3	1	2	1	1
CO2	2	1	2	2	1	1	1	1	1	1	2	1	1	1	1
CO3	1	2	2	2	1	1	1	1	2	1	2	1	2	1	1
CO4	2	1	2	2	1	1	1	1	2	1	2	1	2	1	1
CO5	2	2	2	2	1	1	1	1	1	1	2	1	2	2	1

Correlation Levels 1, 2 or 3 as defined below:

Dr. Archana
Bhatnagar

Dr. Madhavi
Sinha

Dr. Shripal
Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

1:Slight(Low)

2:Moderate (Medium)

3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2,CD4
CD2	Tutorials/ Assignments	CO2	CD1,CD2,CD4, CD5
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/Projects	CO4	CD1
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1,CD2,CD4, CD5
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25333
Course Title		: DATA ANALYTICS
Pre-requisite(s)		:
Co-requisite(s)		Data Analytics Lab
Credits:4	L:3	T:1 P:0

Class schedule per week**: 04****Class****: BCA****Semester/Level****: VI/3****Branch: Bachelor of Computer Applications****Course Objectives**

This course enables the students to:

A.	Understand business intelligence and data analytics.
B.	Understand the methods of pre-processing data and performing activities related to data analytics.
C.	Know the various applications of data analysis.
D.	Know the business data analysis through the powerful tools of data analytics.
E.	Choose data analysis techniques.

Course Outcomes

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

CO1	Illustrate about business intelligence and data analytics.
CO2	Explore different aspects of data analysis technologies.
CO3	Elaborate the methods of data mining and creation of decision tree.
CO4	Implement data analysis through the powerful tools of data applications.
CO5	Apply R to implement various data analytics methods.

SyllabusDr. Archana
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SinhaDr. Shripal
VijayvargiyaMrs. Seema
SharmaMr. Anurag
JoshiDr. Sounak
PaulDr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

MODULES	(No. of Lecture Hours)
Module 1 Introduction to data analytics and its applications, Overview of the data analytics process .use of programming languages and tools for data analytics, Analysis using Descriptive and Pictorial Statistics: mean, median, mode, harmonicmean, geometric mean, variance and standard deviation, quantiles, skewness, moments and kurtosis.	8
Module 2 Data Relationships, Transformation, and Data Cleaning: Relationships between different typesof data: Relationship between two categorical data, Relationship between categorical and quantitative data, Relationship between two quantitative data Transformation: The logarithm transformation, Root and square root transformation Standardization (Z-transformation), Min-maxnormalization. Data cleaning: missing values, noisy data.	8
Module 3 Analysisusing Inferential Statistics: Sampling, Sampling Distribution, and Estimation of Parameters, Sampling distribution of: means, proportions, difference of means, difference of proportions. Hypothesis testing about: population mean, the difference between two means, about a population proportion, difference between two proportions.	9
Module 4 Advanced Topics inData Analytics: Time series analysis and forecasting Text mining, Text data analysis and informational retrieval. Dimensional reduction for text. Natural language processing, Social network analysis, Mining on social networks, Characteristics of social network, Link miningTasks and challenges.	9
Module 5 Data Visualization, Principles of data visualization, Visualization libraries and tools, Effective visualization techniques for different datatypes.	6

TEXT BOOKS:

1. Gupta and Gupta, “Business Statistics”, Sultan Chand and Sons.
2. Bishnu and Bhattacharjee, Data Analysis: Using Statistics and Probability with R Language, PHI Learning,2019.
3. HanJandKamberM, “Data Mining: Concepts and Techniques”, MorganKaufmann Publishers.

REFERENCE BOOKS:

1. Maheshwari Anil, “Data Analytics”, McGraw-Hill publication,2017.
2. TanPang-Ning, SteinbachMichael, and KumarVipin, “Introduction to Data Mining, Pearson Education”, New Delhi.Dunham
3. H.M.& SridharS., “Data Mining”, Pearson Education, New Delhi,2006.

Gaps in the Syllabus (to meet Industry /Profession requirements)

1. Use of various data to implement all the data analysis concepts.
2. Interactionwithdomainknowledgeconceptswiththeactual algorithmicimplementation.
3. Handling real data using data analytics algorithms.

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 & Evaluation Procedure

Dr. Archana
Bhatnagar

Dr. Madhavi
Sinha

Dr. Shripal
Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	1	3	3	1	3	1	1	1	1	2	1	2	2	2	3
CO2	3	2	3	1	3	3	1	2	1	1	1	2	3	2	2
CO3	1	3	3	3	3	1	2	1	1	1	1	2	2	2	2
CO4	3	2	2	1	3	1	2	2	2	1	1	2	2	3	2
CO5	1	3	3	3	3	1	1	1	2	2	1	2	2	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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD5,CD7, CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD2,CD5, CD8
CD3	Seminars	CO3	CD1,CD2,CD5, CD8
CD4	Mini Projects/ Projects	CO4	CD1,CD2,CD5, CD8
CD5	Laboratory Experiments/Teaching Aids	CO5	CD2,CD3,CD4, CD6, CD7, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/ In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25335
CourseTitle		: DISTRIBUTED COMPUTING
Pre-requisite(s)		: Basics of Operating Systems & Computer Networks
Co-requisite(s)		:

Dr. Archana
BhatnagarDr. Madhavi
SinhaDr. Shripal
VijayvargiyaMrs. Seema
SharmaMr. Anurag
JoshiDr. Sounak
PaulDr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Credits:3	L:3	T:0	P:0
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Class schedule per week : 03
Class : BCA
Semester/Level : VI /3
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Know about Different forms of Computing.
B.	Understand Interprocess Communications.
C.	Learn and understand Distributed Computing Paradigms.
D.	Know about the Client-Server Paradigm.
E.	Implement Distributed Objects.

Course Outcomes

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

CO1	Justify the presence of concurrency within the framework of a distributed system.
CO2	Explain the range of requirements that modern distributed systems must address.
CO3	Describe how the resources in a parallel and distributed system are managed by software.
CO4	Understand the memory hierarchy and cost-performance trade-offs.
CO5	Explain what virtualization is and how it is realized in hardware and software.

Syllabus

MODULE	(No. of Lecture Hours)
Module 1 Distributed Computing: An Introduction: Definitions, The History of Distributed Computing, Different Forms of Computing, The Strengths and Weaknesses of Distributed Computing, Basics of Operating Systems, Network Basics, Software Engineering Basics. Interprocess Communications: An Archetypal IPC Program Interface, Event Synchronization, Timeouts and Threading, Deadlocks and Timeouts, Data Representation, Data Encoding, Text-Based Protocols, Request-Response Protocols, Connection-Oriented versus Connectionless IPC.	8
Module 2 Distributed Computing Paradigms: Paradigms and Abstraction, Paradigms for Distributed Applications, Trade-offs. The Socket API: Background, The Socket Metaphor in IPC, The Datagram Socket API, The Stream-Mode Socket API, Sockets with Nonblocking I/O Operations, Secure Socket API.	8
Module 3 The Client-Server Paradigm: Background, Client-Server Paradigm Issues, Software Engineering for a Network Service, Connection-Oriented and Connectionless Servers, Iterative Server, and Concurrent Server, Stateful Servers.	8
Module 4	8

Dr. Archana
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Ray

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Group Communication: Unicasting versus Multicasting, An Archetypal Multicast API, Connectionless versus Connection-Oriented Multicast, Reliable Multicasting versus Unreliable Multicasting, The Java Basic Multicast API, Reliable Multicast API.	
Module 5 Distributed Objects: Message Passing versus Distributed Objects, An Archetypal Distributed Object Architecture, Distributed Object Systems, Remote Procedure Calls, Remote Method Invocation, Client Callback, Stub-downloading, RMI Security Manager Advanced Distributed Computing Paradigms.	8

TEXT BOOKS:

1. M.L.Liu, "Distributed Computing, Principles and Applications", Pearson Education.

REFERENCE BOOKS:

1. Altiya H., Welch J., "Distributed Computing Fundamentals, Simulations and Advanced Topics", 2nd edition, Wiley – India Edition, 2006.
2. Distributed Computing, S. Mahajan and S. Shah, Oxford University Press.
3. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani and Mukesh Singhal, Cambridge, 2010.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

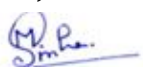
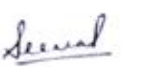
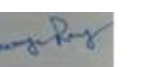
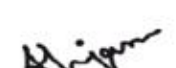
In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

1:Slight(Low)

2:Moderate (Medium)

3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	CourseDelivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/ Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/ Projects	CO4	CD1,CD5,CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25337
CourseTitle		INTRODUCTION TO DATA MINING
Pre-requisite(s)		: DatabaseManagementSystems
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week**: 03****Class****: BCA****Semester/Level****: VI/3****Branch****: Bachelor of Computer Applications****Course Objectives**

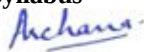
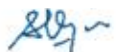
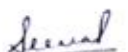
This course enables the students to:

A.	Learn about data mining concepts and study the different data mining tasks and issues.
B.	Introduction to data warehouse and basic operations for identifying similarities between data objects.
C.	Know the various techniques for data pre-processing.
D.	Familiarize the concepts of classification and clustering.
E.	Decide how to evaluate a model.

CourseOutcomes

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

CO1	Identify data mining related applications,tasks and issues.
CO2	Understand the concept of data warehouse and similarity dissimilarity measures.
CO3	Mathematically perform pre-processing operations on datasets to ensure thevalidity of the data is improved.
CO4	Understand the algorithms of classification and clustering.
CO5	Analyse and evaluate algorithms.

SyllabusDr. Archana
BhatnagarDr. Madhavi
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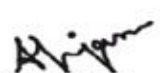
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

MODULE	(No. of Lecture Hours)
Module 1 Data Mining: Introduction, Relational Databases, Data Warehouses, Data Mining, Tools of datamining, Applications of data mining, Transactional databases, Advanced database Systems, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.	8
Module 2 Data Warehouse: Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data warehousing to Data Mining. OLTP system, OLAP, types of OLAP, different types of schema and measures, DMQL Measures of Similarity and Dissimilarity: Basics. Similarity and Dissimilarity between Simple Attributes. Dissimilarities between Data Objects. Similarities between Data Objects.	8
Module 3 Data Processing: Data Cleaning: Missing values, Noisy data. Data cleaning as a process. Data Integration: Entity identification problem, Redundancy detection using Correlation. Data Transformation: Discretization, Normalization, and Concept Hierarchy Generation. Data Reduction: Numerosity reduction – Histogram, clustering, sampling.	8
Module 4 Classification: Basic Concepts and Techniques. Decision Tree Classifier. A Basic Algorithm to Build a Decision Tree. Measures for Selecting an Attribute Test Condition. Algorithm for Decision Tree Induction. Cluster Analysis: Basic Concepts and Algorithms. Different Types of Clustering. Different Types of Clusters. K-means. Basic K-means Algorithm.	8
Module 5 Model Evaluation: Metrics for evaluating classifier performance, Cross-validation, ROC curve. Association Analysis: Basic Concepts and Algorithms Preliminaries. Frequent Itemset Generation. The Apriori Principle. Frequent Itemset Generation in the Apriori Algorithm. Candidate Generation and Pruning Support Counting. Rule Generation.	8

TEXT BOOKS:

1. TanPang-Ning, Steinbach Michael, and Kumar Vipin, “Introduction to Data Mining”, Pearson Education, New Delhi.
2. Data Mining: Introductory and Advanced Topics: M.H.Dunham, Pearson Education.

REFERENCE BOOKS:

1. Jiawei Han & Micheline Kamber-Data Mining Concepts & Techniques, Publisher Harcourt India. Private Limited.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Use of massive data to implement all the data mining concepts.
2. Handling various data using same data mining algorithms.

POs met through Gaps in the Syllabus

Topics beyond syllabus/ Advanced topics/ Design

1. Text Mining, Outlier Mining
2. Advanced clustering algorithms



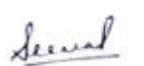
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Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



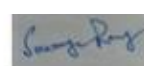
Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



(Dr. Shree Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	%Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	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

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/Projects	CO4	CD1,CD5,CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as use of NPTEL Materials and Internets		
CD9	Simulation		

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CourseCode		:CA25339
CourseTitle		:INTERNET OF THINGS
Pre-requisite(s)		:Computer Networks
Co-requisite(s)		:InternetofThings Lab
Credits:3	L:3	T:0
		P:0

Class schedule per week

03

Class

:BCA

Semester/Level

:VI/3

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Learn about the basic concepts of IoT.
B.	Learn the present state of technology of IoT architecture.
C.	Get to know various types of IoT Protocols.
D.	Learn about Data Analytics in the field of IoT.
E.	Learn and evaluate different applications of IoT in Smart City concept.

Course Outcomes

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

CO1	Identify different parts of IoT and their uses.
CO2	Explain the IoT architectures and their functions.
CO3	Demonstrate the role of Wireless sensor network and Smart objects and in the field of IoT.
CO4	Identify the emerging research challenges in the field of IoT.
CO5	Design basic IoT application.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 What Is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and OT, IoT Challenges IoT Network Architecture and Design: Drivers behind New Network Architectures, Comparing IoT architectures, A Simplified IoT Architecture.	9
Module2 Smart Objects, The Things of IoT: Sensors, Actuators and Smart Objects, Wireless Sensor Networks, Connecting Smart Objects: Communications criteria, IoT Access Technologies.	8
Module 3 IP as the IoT Network Layer: Business Case of IP, Need for Optimization, Optimizing IP for IoT, Profiles and Compliances.	9
Module 4 Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods, SCADA, Generic Web-Based Protocols, COAP, MQTT, Introduction to Data Analytics for IoT, Structured and Unstructured Data, IoT Data Analytics Overview and Challenges.	8

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Dr. Umesh Prasad

Dr. Amrita Priyam

Module 5 Case Studies/ Industrial Applications: IoT Applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment's.	6
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TEXT BOOKS:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press.

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-on Approach)", University Press India Pvt. Ltd.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Pearson Education (Cisco Press Indian Reprint).
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw-Hill Education.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program-Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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



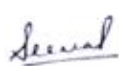
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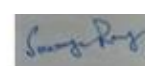
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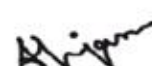
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Dr. Umesh Prasad



Dr. Amrita Priyam

CD Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/ Projects	CO4	CD1,CD5,CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25341
CourseTitle		: OPTIMIZATION TECHNIQUES
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:4	L:3	T:1 P:0

Class scheduleperweek 04
Class :BCA
Semester/Level :VI/3
Branch : Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understand optimization models and techniques used in solving real-world problems and acquire skills to formulate and solve linear programming problems.
B.	Apply the Simplex and Duality Methods to handle standard and special LPP cases
C.	Analyze and solve transportation and assignment problems using structured techniques
D.	Implement algorithms for solving network optimization problems analytical approachesand apply CPM and PERT for efficient project planning and time management.
E.	Develop mathematical skills to analyze and solve network models arising from a wide range of applications.

CourseOutcomes

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

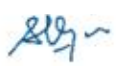
CO1	Understand optimization fundamentals,and the theoretical foundations of various issues related to linear programming modeling to formulate real-world problems as a LP model.
CO2	Explain the theoretical workings of the graphical, simplex and analytical methods for making effective decision on variables so as to optimize the objective function.
CO3	Apply appropriate methods to solve Transportation and Assignment problems
CO4	Analyze network optimization models and evaluate project schedules using various techniques
CO5	Appraise the need of Network Analysis, PERT and CPM.



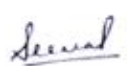
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Bhatnagar



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Dr. Shripal
Vijayvargiya



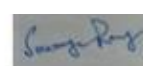
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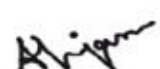
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Syllabus

MODULES	(No. of Lecture Hours)
Module 1 Linear Programming: Introduction, LP Formulations, Graphical method for solving LPs with 2 variables, Special Cases in Graphical Methods.	8
Module 2 Simplex Method, Big-M method, Two-phase method, Revised Simplex Method, Duality in Linear programming.	8
Module 3 Dynamic Programming: Basic Concepts, Bellman's optimality principles, Dynamic programming approach in decision making problems, optimal subdivision problem.	8
Module 4 Transportation Problems, Basic Feasible Solution of a Transportation Problem, Unbalanced Transportation Problem, Degenerate Transportation Problem, Assignment Problems.	8
Module 5 Network Analysis: Basic components of Network, Rules for drawing Network diagram, Time calculation in Networks. Critical Path Method and PROJECT Evaluation and Review Techniques. Algorithm and flow chart for CPM and PERT.	8

TEXT BOOKS:

1. Kanti Swarup, Gupta, P.K. and Manmohan, Operations Research, Sultan Chand.

REFERENCE BOOKS:

1. Hamdy A. Taha, Operations Research; Pearson, 10th Ed.
2. Operations Research Theory & Application, J.K. Sharma, Macmillan, 3rd Ed.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

Integer Programming and Non-Linear Programming Problems to be covered in Advanced Topic

POs met through Gaps in the Syllabus - 3, 4, 12

Topics beyond syllabus/Advanced topics/Design

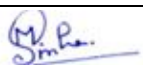
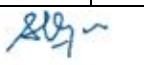
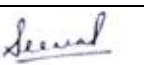
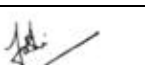
1. Advanced Optimization Theory

POs met through Topics beyond syllabus/ Advanced topics/ Design - 2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

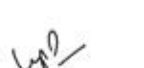
Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50



Dr. Archana Bhatnagar Dr. Madhavi Sinha Dr. Shripal Vijayvargiya Mrs. Seema Sharma Mr. Anurag Joshi Dr. Sounak Paul Dr. Soumya Ray






(Dr. Sheel Shalini) Dr. P.S. Bishnu Dr. Umesh Prasad Dr. Amrita Priyam

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	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

Correlation Levels 1, 2, or 3 as defined below:

1:Slight(Low)

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3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/ LCD Projectors	CO1	CD1,CD2,CD3
CD2	Tutorials/ Assignments	CO2	CD1,CD2
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/ Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1,CD2
CD6	Industrial/ Guest Lectures		
CD7	IndustrialVisits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25332
CourseTitle		: ADVANCED JAVA PROGRAMMING LAB
Pre-requisite(s)		: Java Programming Lab
Co-requisite(s)		: AdvancedJavaProgramming
Credits:1.5 L:0	T:0	P:3

Class schedule pe rweek

03

Class

: BCA

Semester/Level

: VI/3

Branch

: Bachelor of Computer Applications

Course Objectives

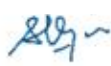
This course enables the students to:



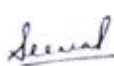
Dr. Archana
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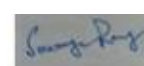
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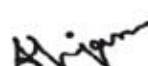
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

A.	Implement GUI interfaces for user interaction.
B.	Apply database connectivity with frontend applications.
C.	Solve basic problems using JSP.
D.	Use existing classes and objects/group of objects for different applications.
E.	Design various applications using Advanced Java Programming concepts.

Course Outcomes

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

CO1	Implement different applications using Swing.
CO2	Write programs to connect the database to build frontend-backend-based applications.
CO3	Implement solutions of different problems using JSP.
CO4	Use JavaBean for implementation.
CO5	Implement client-server framework and solve different problems.

Syllabus

MODULE	(No. of Lecture Hours)
Module 1 - Write a Swing program to create a simple login form using JLabel, JTextField, and JButton. - Create a Swing applet that displays a welcome message using the paint method. - Demonstrate the use of a container and component by placing multiple buttons in a panel. - Write a program to show the difference between AWT and Swing components using a simple form. - Create a basic GUI application using Swing that displays your name and a picture using JLabel and Image Icon. - Implement event handling in Swing using ActionListener for button clicks. - Create a simple Swing application that uses multiple panels and layouts. - Write a Swing program that uses MVC architecture to separate logic and view.	6
Module 2 - Write a Swing program using JTabbedPane to display different content in each tab. - Create a form using JList, JComboBox, and JScrollPane. - Implement an event for a JComboBox to display selected value in a label. - Design a registration form using JTextField, JRadioButton, and JCheckBox. - Write a program to connect Java with a MySQL/Oracle/Access database using JDBC. - Develop a program to insert, update, delete, and retrieve data from a database using JDBC. - Create a login form that validates user credentials from a database using JDBC without DSN. - Demonstrate database access using a DSN in Java with MS Access.	6
Module 3 - Write a JSP program to print "Welcome to JSP" using scriptlet and expression tags. - Create a JSP page that displays current date and time using implicit objects. - Develop a registration form using JSP and display submitted data on another JSP page. - Use JSP implicit objects to get client request information (IP, browser type, etc.). - Create a JSP page to handle exceptions using isErrorPage and errorPage directives. - Demonstrate the use of declaration tag to define and call a method in JSP. - Write a JSP program to display session data like username and visit count. - Create a JSP page using directives to include a header and footer.	6

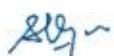
TEXT BOOKS:



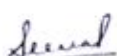
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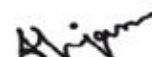
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Module 4 1. Create a simple Java Bean with getter and setter methods for name and age. 2. Demonstrate introspection by accessing bean properties through reflection. 3. Write a Java Bean that raises a property change event using PropertyChangeListener. 4. Develop a constrained property example where change is vetoed based on conditions. 5. Create a bean and use persistence to save and restore the bean state. 6. Implement a customizer for a Java Bean to allow UI-based property setting. 7. Use BeanInfo interface to expose selected properties and methods of a bean. 8. Demonstrate the use of PropertyDescriptor and MethodDescriptor.	6
Module 5 1. Write a simple servlet that displays &quot;Hello from Servlet&quot;. 2. Create a servlet that accepts user name and password and displays it. 3. Develop a servlet that demonstrates request and response handling. 4. Implement session tracking using cookies in a servlet. 5. Write a servlet that counts the number of times it has been accessed using HttpSession. 6. Create a registration form and save the data in a database using servlet and JDBC. 7. Demonstrate servlet lifecycle methods: init(), service(), and destroy(). 8. Deploy and run a servlet using Apache Tomcat server.	6

1. Gayatri Patel, Advanced JAVA Laboratory Manual, Osmora Incorporated, 2016.

REFERENCE BOOKS:

1. Herbert Schildt, Java - The Complete Reference, Ninth Edition, Oracle Press.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus 3, 11, 12

Topics beyond syllabus/Advanced topics/Design

1. Implementation of client-server-based applications with the support of database connectivity.

Pos met through Topics beyond syllabus/Advanced topics/Design PO2, PO3, PO4, PO11

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	%Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	10
Second Quiz	20
Teacher's Assessment	30
End Semester Examination	30

Indirect Assessment

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

Mapping between Cos and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO2	2	3	2	1	1	1	1	1	2	1	1	2	2	1	1

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CO3	2	1	2	2	1	1	1	1	1	1	2	1	1	1	1
CO4	1	2	2	2	1	1	1	1	2	1	2	1	2	1	1
CO5	2	1	2	2	1	1	1	1	2	1	2	1	2	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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD4
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD4, CD5
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD4, CD5
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25334
Course Title		: DATA ANALYTICS LAB
Pre-requisite(s)		:
Co-requisite(s)		: Data Analytics
Credits: 1.5	L: 0	T: 0 P: 3

Class schedule per week

03

Class

: BCA

Semester/Level

: VI/3

Branch

: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand and apply descriptive statistical techniques and visualizations to summarize and interpret datasets.
B.	Explore relationships among variables and perform data cleaning and transformation for effective data preprocessing.
C.	Apply inferential statistical methods including estimation, hypothesis testing, and confidence intervals for decision-making.
D.	Analyze time series and textual data using fundamental methods of forecasting, preprocessing, and basic network analysis.
E.	Develop clear and insightful visual representations using standard plotting tools to communicate data-driven insights effectively.

Dr. Archana
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Mrs. Seema
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Mr. Anurag
Joshi

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Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Course Outcomes

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

CO1	Compute and interpret descriptive statistics and create basic visualizations to summarize dataset characteristics.
CO2	Analyze relationships between variables and perform data preprocessing techniques including transformation and cleaning.
CO3	Apply inferential statistical methods such as hypothesis testing, parameter estimation, and confidence interval calculation.
CO4	Perform basic time series analysis, text preprocessing, and analyze structured data from social networks.
CO5	Design and develop effective visualizations using appropriate tools to represent different data types and analytical results.

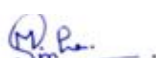
Syllabus

Module 1: Descriptive and Pictorial Statistics: Topics: Introduction to Python for data analytics, Descriptive statistics: mean, median, mode, variance, standard deviation, skewness, kurtosis, Visualizations: histogram, boxplot, bar chart, pie chart Exercises: 1. Load a dataset and compute mean, median, mode, and standard deviation. 2. Calculate skewness and kurtosis of quantitative variables. 3. Plot bar chart, pie chart, and histogram. 4. Create boxplots to detect outliers.	4
Module 2: Data Relationships, Transformation & Cleaning: Topics: Bivariate analysis: categorical vs categorical, categorical vs numeric, numeric vs numeric, Data transformation: log, root, square root, standardization, min-max scaling, Data cleaning: handling missing values, detecting and treating noisy data. Exercises: 5. Explore correlation between two numerical variables (scatter plot, correlation coefficient). 6. Perform min-max normalization and Z-transformation. 7. Handle missing values using mean/mode imputation and drop methods.	4
Module 3: Inferential Statistics: Topics: Sampling methods and distributions, Estimation and confidence intervals, Hypothesis testing: t-test, z-test, chi-square test. Exercises: 8. Perform one-sample and two-sample t-tests. 9. Test population proportions and differences in proportions. 10. Apply chi-square test for independence on categorical data. 11. Create confidence intervals for population mean and proportion.	4
Module 4: Advanced Data Analytics Topics: Time series decomposition and forecasting, Text data analysis and preprocessing, Social network data analysis Exercises: 12. Load and visualize time series data (trend, seasonality). 13. Preprocess text data (tokenization, stopword removal).	4
Module 5: Data Visualization Techniques: Topics: Principles of effective data visualization, Visualization tools: Matplotlib, Seaborn, Plotly, Visualizing different data types: categorical, continuous, time-series, multivariate Exercises: 14. Create comparative bar charts and grouped histograms for categorical data. 15. Plot heatmaps to visualize correlation matrices.	4

TEXT BOOKS:



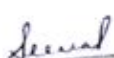
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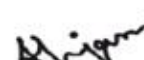
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

1. RforEveryone:AdvancedAnalyticsandGraphics,BookbyJaredP.Lander
2. Python for data analysis O'Reilly Media by W. McKinney

REFERENCE BOOKS:

1. Data analysis: Using statistics and probability with R language, PHI, New Delhi by Bishnu, P. S., & Bhattacharjee, V. 2021
2. Storytelling with data: A data visualization guide for businessprofessionals. Wiley, C. N. Knaflic

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	1	1	2	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	1	1	1	2	1	1	2	3

Correlation Levels 1,2 or 3 as defined below:

1: Slight (Low)

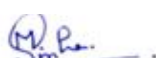
2: Moderate (Medium)

3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods



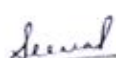
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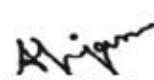
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CD Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1	CD1,CD5,CD8, CD8
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD5, CD8
CD3	Seminars	CO3	CD1,CD2,CD3, CD5, CD8
CD4	Mini Projects/Projects	CO4	CD1,CD5,CD8
CD5	LaboratoryExperiments/TeachingAids	CO5	CD2,CD3,CD4, CD6, CD7, CD9
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25338
CourseTitle		:DATA MINING LAB
Pre-requisite(s)		:
Co-requisite(s)		:Introduction toDataMining
Credits:1.5	L:0T:0	P:3

Class schedule per week 03
Class :BCA
Semester/Level :VI/3
Branch :Bachelor of Computer Applications

Course Objectives

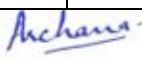
This course enables the students to:

A.	Explain about the necessity of preprocessing and its procedure.
B.	Generate and evaluateAssociation patterns.
C.	Solve problems usingvarious Classifiers.
D.	Learn the principles of Data mining techniques and various mining algorithms.
E.	Learn about traditional and modern data driven approach and problem-solving techniques for various datasets.

CourseOutcomes

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.



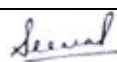
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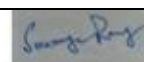
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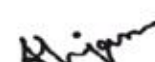
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Dr. Umesh Prasad



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CO3	Identify appropriate Classification techniques for various problems with high dimensional data.
CO4	Implement appropriate Clustering techniques for various problems with high dimensional data sets.
CO5	Implement various mining techniques on complex data objects.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Understanding and implementation of data mining concepts using a tool.	4
Module2 Use the concepts of similarity and dissimilarity matrix to understand relationships in data.	4
Module3 Implement various data processing techniques to make raw data ready for generating accurate insights and building reliable models.	4
Module4 Implement classification and clustering algorithms.	4
Module5 Demonstrate performing association rule mining on datasets.	4

TEXT BOOKS:

1. Tan Pang-Ning, Steinbach Michael, and Kumar Vipin, "Introduction to Data Mining", Pearson Education, New Delhi.
2. Data Mining: Introductory and Advanced Topics: M.H. Dunham, Pearson Education.

REFERENCE BOOKS:

1. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques Publisher Harcourt India. Private Limited.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10



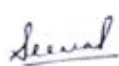
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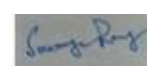
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Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	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	3	2	2	1	2	2	2	1	2	2	2
CO2	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

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 Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	Lecture by use of Boards/LCDProjectors	CO1	CD1, CD3
CD2	Tutorials/Assignments	CO2	CD4, CD5
CD3	Seminars	CO3	CD1, CD4, CD5
CD4	Mini Projects/Projects	CO4	CD2, CD4, CD5
CD5	LaboratoryExperiments/TeachingAids	CO5	CD2, CD4, CD5
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learningssuchasuseofNPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25340
CourseTitle		:INTERNET OF THINGS LAB
Pre-requisite(s)		:
Co-requisite(s)		:Internet of Things
Credits:1.5 L:0	T:0	P:3

Class schedule per week

03

Class

:BCA

Semester/Level

:VI/3

Branch

:Bachelor of Computer Applications



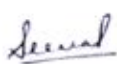
Dr. Archana
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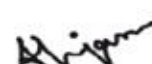
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Course Objectives

This course enables the students to:

A.	Understand the basic concept and the IoT Paradigm.
B.	Know the state of art architecture for IoT applications.
C.	Learn the available protocols used for IoT.
D.	Design basic IoT Applications.
E.	Evaluate optimal IoT applications.

Course Outcomes

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

CO1	Identify the IoT Components and its capabilities
CO2	Explain the concepts of the Internet of Things and gain knowledge to design IoT applications
CO3	Demonstrate the process of capturing and analyzing data in the Internet of Things.
CO4	Examine the various components involved in IoT design methodology.
CO5	Design an IoT application

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Internet of Things (IOT) ,Characteristics of the IOT, Communications in IoT Arduino/ Raspberry PI in IoT.	4
Module2 Arduino Uno/ Raspberry PI, Features of the Arduino/ Raspberry PI, Arduino IDE (Integrated Development Environment) Installation of Arduino Software (IDE)/ Raspberry PI installation	4
Module3 1.Start Raspberry Pi and try various Linux commands in command terminal window: ls,cd,touch,mv,rm,man,mkdir,tar,gzip,cat,more,less,ps,sudo,cron,chown,chgrp,ping etc. 2. Run some python programs on Pi like: a) Read your name and print Hello message with name b) Read two numbers and print their sum, difference, product, and division. c) Word and character count of a given string d) Area of a given shape (rectangle, triangle, and circle) reading shape and appropriate values from standard input.	4

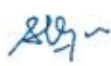
TEXT BOOKS:



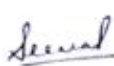
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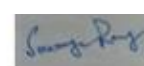
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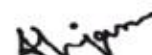
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Module4 Practical 1 .Controlling the Light Emitting Diode (LED) with a push button. Practical 2 Interfacing the RGB LED with the Arduino Practical 3 Controlling the LED blink rate with the potentiometer interfacing with Arduino Practical 4 Detection of the light using photo resistor	4
Module5 Run some Python programs on Pi like: a) Print a name 'n times. Where name and n are read from standard input, using for and while loops. b) Handel Divided by Zero Exception c) Print current time for 10 times with an interval of 10 seconds	4

1. Internet of Things with Arduino Cookbook Marco Schwartz Packt Publishing Ltd.
2. Internet of Things: A Hands On Approach Arshdeep Bahga and Vijay Madiseti Universities Press (India) Private Limited

REFERENCE BOOKS:

1. Internet of Things with Arduino Blueprints Pradeeka Seneviratne Packt Publishing Ltd
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD).
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

1. Student Feedback on Faculty
 2. Student Feed back on Course Outcome
- Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	1	1	1	1	1	1	2	2
CO2	3	2	1	1	1	3	1	2	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	2	1	1	2	2	2	3

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CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	2	3	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8, CD9
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/ Teaching Aids	CO5	CD1, CD2, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internet		
CD9	Simulation		



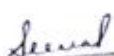
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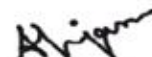
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ANNEXURE A ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
SEMESTER VII/ VIII

CourseCode		: CA25401
CourseTitle		: DEEP LEARNING
Pre-requisite(s)		:
Co-requisite(s)		:Deep Learning Lab
Credits:4 L:3	T:1	P:0

Class schedule per week	04
Class	:BCA
Semester/Level	:VII/4
Branch	:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the concepts of mathematical modelling.
B.	Explore the application areas of Neural Networks.
C.	Explore the basic concepts of Feed forward Neural Networks.
D.	Understand the idea of Convolutional Neural Networks and Recurrent Neural Networks.
E.	Understand the basic component of Machine Learning.

Course Outcomes

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

CO1	Able to differentiate between machine learning and deep learning.
CO2	Identify problems suitable for application of deep learning.
CO3	Understand the working of FF Neural Networks and their modifications.
CO4	Apply Recurrent Neural Networks to solve problems.
CO5	Apply Recurrent Neural Networks to solve problems.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 From Logic to Cognitive Science: The Beginnings of Artificial Neural Networks, The XOR Problem, From Cognitive Science to Deep Learning Neural Networks in the general AI Landscape.	8
Module2 Machine Learning Basics: Elementary Classification Problem, Evaluating Classification Results, A Simple Classifier: Naive Bayes, A Simple Neural Network: Logistic Regression, Introducing the MNIST Dataset, Learning Without Labels: K- K-Means, Learning Different Representations: PCA, Learning Language: The Bag of Words Representation.	8

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Dr.Umesh Prasad

Dr. Amrita Priyam

Module3 Feedforward Neural Networks: Basic Concepts and Terminology for Neural Networks, Representing Network Components with Vectors and Matrices, The Perceptron Rule, The Delta Rule, From the Logistic Neuron to Backpropagation. A Complete Feedforward Neural Network.	8
Module4 Convolutional Neural Networks: A Third Visit to Logistic Regression, Feature Maps and Pooling. A Complete Convolutional Network, Using a Convolutional Network to Classify Text and Sequences of Unequal Length.	8
Module5 Recurrent Neural Networks: The Three Settings of Learning with Recurrent Neural Networks, Adding Feedback Loops and Unfolding a Neural Network, Long Short-Term Memory. Using a Recurrent Neural Network for predicting words.	8

TEXT BOOKS:

1. Skansi S., Introduction to Deep Learning -From Logical Calculus to Artificial Intelligence, Springer International Publishing.

REFERENCE BOOKS:

1. Buduma N., Fundamentals of Deep Learning, O'Reilly Media.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Application of neural network in decision making.
2. Application of deep learning in real life problems.

POs met through Gaps in the Syllabus: 4,5

Topics beyond syllabus/Advanced topics/Design

1. Design of Deep Learning based system to solve problems.
2. Combine Deep Learning with other domains to solve complex system.

POs met through Topics beyond syllabus/ Advanced topics/ Design: 4,6,10

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

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Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	1	3	2	2	2	2	2	2	2	3	3	3
CO2	2	3	2	3	3	3	2	2	2	2	2	2	3	3	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO4	3	3	3	3	3	2	3	2	2	2	2	2	3	3	3
CO5	3	3	3	3	3	3	2	2	2	2	2	2	3	3	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8
CD3	Seminars	CO3	CD1,CD8
CD4	Mini Projects/Projects	CO4	CD2,CD4
CD5	Laboratory Experiments/Teaching Aids	CO5	CD3,CD1
CD6	Industrial/Guest Lectures		
CD7	Industrial/VisiIn-plant Traininging		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code : CA25411

Course Title : DATA VISUALIZATION

Pre-requisite(s) :

Co-requisite(s) :

Credits:4 L:3 T:1 P:0

Class schedule per week 04

Class :BCA

Semester/Level :VII/4

Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Know the basic of data visualization.
B.	Introduce visual perception and core skills for visual analysis.
C.	Translate and present data and data correlations in a simple way.
D.	Have an understanding of various tools for creating data visualizations.
E.	Learn to wisely use various visualization structures such as tables, spatial data, time-varying data, tree, and network.

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Dr. Shripal
Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Course Outcomes

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

CO1	Demonstrate understanding of Data Visualization and key Terms.
CO2	Demonstrate skills on creating visual representation of Data.
CO3	Apply visualization techniques for various data analysis tasks.
CO4	Demonstrate understanding of Visualization classification and its techniques.
CO5	Demonstrate skills in creating different types of representations.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Introduction to data visualization, History of data visualization, importance of data visualization in data science, Principles of data visualization, Visual mapping and Elements of data visualization. Common tools and techniques for creating data visualizations.	8
Module2 Introduction of various charts and graphs, Design principles for charts and graphs, The do's and don'ts of charts and graphs making. The process of creating visualizations and selecting the appropriate visual display.	8
Module3 Visualization as exploration, visualizing categorical data, Visualizing time series data, Visualizing Geospatial data, Visualizing multiple variables.	8
Module4 Introduction of Dash board design, various types of Dashboards, Interactive visualizations, Story Telling through Data.	8
Module5 Visualization of groups, trees, graphs, clusters, networks. Data science use cases for data visualization.	8

TEXT BOOKS:

1. Wong, D., The Wall Street Journal guide to information graphics: The dos and don'ts of presenting data, facts and figures. New York: W.W. Norton & Company.
2. Yau, N., Data Points: Visualization that means something. Indianapolis: O'Reilly.
3. Kieran Healy, Data Visualization: A Practical Introduction.

REFERENCE BOOKS:

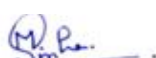
1. Few, S., Information Dashboard Design: The effective visual communication of data. Sebastopol: O'Reilly.
2. Ware, C. & Kaufman, M., Visual thinking for design. Burlington: Morgan Kaufmann Publishers.
3. Ward, Grinstein Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design



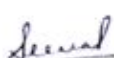
Dr. Archana
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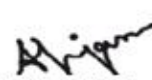
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	1	1	1	3	1	1	2	2	3	3	1	2	1
CO2	3	3	3	2	2	1	1	1	2	1	3	3	3	2	3
CO3	3	3	3	2	3	1	1	1	2	1	2	2	2	2	2
CO4	3	3	3	2	3	1	1	1	3	3	3	3	2	2	2
CO5	3	3	3	2	2	1	1	2	2	1	2	2	2	2	2

Correlation Levels 1, 2 or 3 as defined below:

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2,CD5, CD6, CD8
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD4, CD5
CD3	Seminars	CO3	CD1,CD2,CD3, CD4, CD5
CD4	Mini Projects/Projects	CO4	CD1,CD2,CD3, CD4, CD6
CD5	LaboratoryExperiments/TeachingAids	CO5	CD1,CD2,CD5, CD,6, CD8
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Anchana

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Simha.

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Sinha

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Dr. Shripal
Vijayvargiya

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Mrs. Seema
Sharma

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Mr. Anurag
Joshi



Dr. Sounak
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George King

Dr. Soumya
Ray



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Ed.

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WSP

Dr.Umesh Prasad

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CourseCode		:CA25402
CourseTitle		:DEEPLARNINGLAB
Pre-requisite(s)		:
Co-requisite(s)		:DeepLearning
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

:BCA

Semester/Level

:VII/4

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	ExploreTensorFlow, Keras.
B.	Implementbackpropagationnetworks.
C.	ImplementofConvolutions networks.
D.	Implementfeedforwardneuralnetworks.
E.	Implementation of Text Classification, Word Embeddings and Language Models.

Course Outcomes

Afterthe completionofthiscourse,students will be able to:

CO1	Understand MLP with Keras.
CO2	Implement Backpropagation in Neural Networks.
CO3	DesignConvolutionalNeuralNetworksforImageClassification.
CO4	Analyzefeed forward networks.
CO5	Implement&analyzeDeepLearningforImage Segmentation.

Syllabus

List of Programs as Assignments:

Lab Assignment No: 1

Objective:Intro to DeepLearning Neural Networks and Backpropagation

Q.1 IntrotoMLPwithKeras

LabAssignmentNo:2

Objective: Neural Networks and Backpropagation

Q.1BackpropagationinNeural Networks

LabAssignmentNo:3

Objective:ConvolutionalNeuralNetworksforImageClassification

Q.1DesignofConvolutionsNeuralnetworkforimage classification

LabAssignmentNo:4

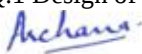
Objective:Deep Learning for Object Detection

Q.1Design of Fully Convolutional Neural Networks for object detection

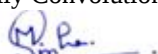
LabAssignmentNo:5

Objective:DeepLearning for Image Segmentation

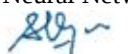
Q.1 Design of Fully Convolutional Neural Networks for Image Segmentation



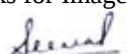
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Sinha



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Dr. Sounak
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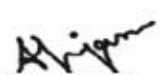
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

TEXT BOOKS:

1. Deep Learning with TensorFlow 2 and Keras: Regression, ConvNets, GANs, RNNs, NLP, and more with Tensor Flow 2 and the Keras API, by Antonio Gulli, Amita Kapoor, Sujit Pal.

REFERENCE BOOKS:

2. Learning Tensor Flow: A Guide to Building Deep Learning Systems, Tom Hope, Yehezkel S. Resheff

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**Direct Assessment**

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

MappingofCourseOutcomesontoProgramOutcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	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 COs and Course Delivery (CD) methods

CD Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1	CD1,CD5,CD9
CD2	Tutorials/Assignments	CO2	CD1,CD5,CD9
CD3	Seminars	CO3	CD1,CD5,CD9
CD4	Mini Projects/Projects	CO4	CD1,CD5,CD9
CD5	LaboratoryExperiments/TeachingAids	CO5	CD1,CD5,CD9
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		

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SinhaDr. Shripal
VijayvargiyaMrs. Seema
SharmaMr. Anurag
JoshiDr. Sounak
PaulDr. Soumya
Ray

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Dr. P.S. Bishnu

Dr. Umesh Prasad

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CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25412
Course Title		: DATA VISUALIZATION LAB
Pre-requisite(s)		:
Co-requisite(s)		: Data Visualization
Credits:2	L:0	T:0 P:4

Class schedule per week:04

Class : BCA

Semester/Level: VII/4

Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Interpret data plots and understand core data visualization concepts such as correlation, linear relationships, and log scales.
B.	Explore the relationship between two continuous variables using scatter plots and line plots.
C.	Translate and present data and data correlations in a simple way.
D.	Design interactive dashboard using Tableau.
E.	Explore all the aspects of Tableau and for solving data visualization.

Course Outcomes

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

CO1	Design effective data visualizations.
CO2	Find and select appropriate data that can be used in order to create a visualization.
CO3	Apply visualization techniques for various data analysis tasks.
CO4	Create ad-hoc reports, data visualizations, and dashboards using Tableau.
CO5	Apply visualization techniques for various real-time use cases.

SYLLABUS

List of Programs as Assignments:

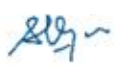
- Exploring Data Visualization Tools: Tableau, Power BI, R-Programming Language.
- Handson with Tableau
- Creating charts and graphs with Tableau and R.
- Visualization of Categorical Data using Tableau and R.
- Geospatial Data Visualization Using Tableau and R.
- Time-Series Data Visualization using Tableau and R.
- Creating word cloud using Tableau and R.
- Design an interactive dashboard using Tableau.
- Telling story with data by using Tableau.
- Solve a case study which must cover all aspects of visualization.



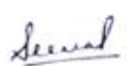
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



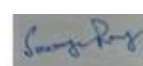
Mrs. Seema
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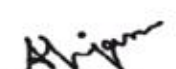
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

TEXT BOOKS:

1. Visual Analytics with Tableau by Alexander Loth, Nate Vogel, Sophie Sparkes, Wiley Publication.
2. R for data science: Import, Tidy, Transform, Visualize, And Model Data by Hadley Wickham, Garrett Golemund.

REFERENCE BOOKS:

1. Visualization Analysis & Design by Tamara Munzner.
2. Interactive Data Visualization for the Web by Scott Murray.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytoday performance	30
Exam Evaluation performance	30

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	1	2	2	3	3	1	3	2	2
CO2	3	3	3	2	1	1	1	2	2	3	3	1	3	2	2
CO3	3	3	3	3	1	1	1	2	2	3	3	1	3	2	2
CO4	3	3	3	3	2	2	1	1	2	3	3	1	3	1	2
CO5	3	3	3	3	2	2	1	1	2	3	3	1	3	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD4, CD5
CD2	Tutorials/Assignments	CO2	CD2, CD4, CD5
CD3	Seminars	CO3	CD4, CD5



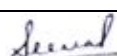
Dr. Archana Bhatnagar



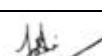
Dr. Madhavi Sinha



Dr. Shripal Vijayvargiya



Mrs. Seema Sharma



Mr. Anurag Joshi



Dr. Sounak Paul



Dr. Soumya Ray



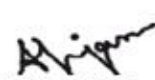
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Dr. Umesh Prasad



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CD4	Mini Projects/Projects	CO4	CD4,CD5,CD6, CD8
CD5	LaboratoryExperiments/TeachingAids	CO5	CD4,CD5,CD6, CD8
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25403
CourseTitle		: DIGITAL GAMING
Pre-requisite(s)		:
Co-requisite(s)		: Digital GamingLab
Credits:4	L:3	T:1 P:0

Class schedule per week 04
Class : BCA
Semester/Level :VII/4
Branch: Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understand the basic concepts of Digital Games and Interactive Multimedia.
B.	Define the components of a game and design a concept for a Game in game design document.
C.	Identify various stages of the Game Production process.
D.	Illustrate the interactive story of a game.
E.	Analyze the games from the perspective of a game designer.

CourseOutcomes

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

CO1	AnalysetheDigitalGamesandothermediumsof Interactive Storytelling.
CO2	DescribeGameDevelopmentProcessanditsvariousstages.
CO3	Designboardgames and documents for digital games.
CO4	Createstoryandcontentofagame.
CO5	CriticallyanalysethegameplayofthegamesandwillbeintroducedtoGame Engine software.

Syllabus

MODULE	(No. of Lecture Hours)
Module1: Understanding Games: What is a Game, History, Game vs Books and Movies,Digital Games vs Traditional Games, Elements of Game, Game Genre.	10

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Dr. Umesh Prasad

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Module2 Game Development Process: Overview of Game Development, Game Design, Pre- Production, Production, Game Art and Animation, Game User Interface, Game Audio, Quality Assurance (QA) and Testing, Game Publishing and Distribution, Project Management, Ethical Considerations (Intellectual Property, Rating System, etc.)	10
Module3 Game Design Documentation: Game Idea Generation, What is Game Design Document, Principles of Game Design, Sample Game Design Documents, Game Design Document Template, Board Game Design	5
Module4 Game Narrative: Basics, Non-Linear Game Narrative / Interactive Storytelling, Character Development, Localization, Games and Culture	7
Module5 Game Appreciation and Analysis: Game Appreciation: Game Play sessions and Discussions, Game Analysis: Tetris and Any Current Popular Game, Serious Games: Analyze serious games	8

TEXT BOOKS:

1. Monograph of Story Appreciation for Gaming, Dept. of Animation and Multimedia, BIT Mesra Ranchi.
2. Monograph on Fundamentals of Game Technology, Dept. of Animation and Multimedia, BIT Mesra Ranchi.
3. GameDesignforTeensbyLesPardew,Premier Press.

REFERENCE BOOKS:

1. Andrew Rollings and Ernest Adams on Game Design by ARollings E Adams, NewRiders Publisher.
2. Tracy Fullerton, Game Design Workshop: A Playcentric Approach to Creating Innovative Games, CRC Press.
3. DavidNixon, Unreal Game Engine for Beginners.
4. ChrisSolarski, Interactive Stories and Video Game Art: A Storytelling Framework for Game Design, Taylor and Francis Group.
5. Simon Egenfeldt-Nielsen et al, Understanding Video Games: The Essential Introduction, Routledge, Taylor and Francis, New York.

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond the syllabus/Advanced topics/Design

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome(CO) AttainmentAssessment Tools&EvaluationProcedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

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Ray

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
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CO1	3	3	1	2	2	1	1	2	3	3	3	2	3	3	3
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CO3	2	1	1	2	1	2	2	2	3	3	3	3	3	3	2
CO4	2	1	3	2	1	1	1	1	2	2	2	2	2	2	2
CO5	3	3	1	2	3	2	2	2	3	3	3	2	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

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Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
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CD2	Tutorials/Assignments	CO2	CD1, CD6, CD8,
CD3	Seminars	CO3	CD1, CD4, CD5, CD9
CD4	Mini Projects/Projects	CO4	CD1, CD6, CD8,
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD4, CD5, CD7, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25415
Course Title		: ADVANCED PYTHON PROGRAMMING
Pre-requisite(s)		: Python Programming
Co-requisite(s)		: Advanced Python Programming Lab
Credits: 4	L: 3	T: 1 P: 0

Class schedule per week

04

Class: BCA

Semester/Level

: VII /4

Branch

: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand regular expressions in Python, implementing data structures in Python, Using various time functions.
B.	Understand the concepts of threads in Python.
C.	Create GUI using Python.

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Ray

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Dr. Umesh Prasad

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D.	Understand Networking through Python.
E.	Use databases through Python, analyzing and visualizing data using Python.

Course Outcomes

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

CO1	Interpret regular expressions and various data structures in Python.
CO2	Implement the concepts of threads for developing efficient programs.
CO3	Design GUI programs.
CO4	Identify the commonly used operations involving networking.
CO5	Apply knowledge of database programming and data analysis in Python.

Syllabus

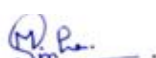
MODULE	(NO. OF LECTURE HOURS)
Module I Abstract classes and Interface in Python. Regular Expressions in Python: Regular expressions, sequence characters, quantifiers, and special characters in regular expressions, using regular expressions on files, retrieving information from a HTML file. Date and Time in Python: Date and Time Now, Combining and formatting date and time, finding duration, comparing two dates, sorting dates, working with calendar Module. Data structures in Python: Linked list, stacks, and queues.	8
Module II Threads: Multitasking, Process and threads, concurrent programming and GIL, Uses of thread, creating threads, thread class methods, thread synchronization, locks, semaphore, deadlock of threads, thread communication using notify () and wait () methods, thread communication using queue, Daemon threads.	8
Module III GUI in Python: The Root Window, Fonts, and colors, working with containers, canvas, frame, widgets: Button widgets, arranging widgets in the frame, Label widget, message widget, text widget, scrollbar widgets, checkbutton widget, radiobutton widget, entry widget, spin box widget, list box widget, menu widget, creating tables.	8
Module IV Network programming in Python: Sockets, knowing IP Address, URL, reading the source code of a webpage, downloading webpage from internet through python, ATCP/IP Server, TCP/IP client, File server, File client, two-way communication between server and client, sending a simple mail.	8
Module V Database programming using Python: Advantage of DBMS over Files, Using MySQL from Python, Creating and manipulating tables through Python. Data Analysis using Python: Series, Data Frame, creating data frames, operations on data frames. Data visualization: Bar graph, Histogram, pie chart, line graph. NumPy Library.	8

TEXT BOOKS:

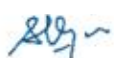
1. Core Python Programming by Dr. R. Nageswara Rao, Dream tech Press India.



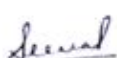
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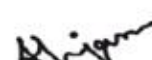
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



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2. Python: The Complete Reference by Martin C. Brown, McGraw Hill Education.

REFERENCE BOOKS:

1. Programming Python: Powerful Object-Oriented Programming, Mark Lutz O'Reilly.
2. Think Python, by Allen B. Downey, O'Reilly.

Gaps in the Syllabus (to meet Industry/ Profession requirements) POs met through Gaps in the Syllabus Topics beyond syllabus/ Advanced topics/ Design

1. Image processing with Python

POs met through Topics beyond syllabus/ Advanced topics/ Design-PO3, PO5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	3	2	2	2	2	3	2	2	3	2	2
CO2	3	3	3	2	3	2	2	2	2	3	2	2	3	2	2
CO3	3	3	3	2	3	2	2	2	2	3	2	2	3	2	2
CO4	3	3	3	2	3	2	2	2	2	3	2	2	3	2	2
CO5	3	3	3	3	3	2	2	2	2	3	2	2	3	2	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards / LCD Projectors	CO1	CD1, CD2, CD4, CD5
CD2	Tutorials/ Assignments	CO2	CD1, CD2, CD3, CD4, CD5, CD8
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CD4	Mini Projects/Projects	CO4	CD1,CD2,CD3, CD4, CD5
CD5	LaboratoryExperiments/TeachingAids	CO5	CD1,CD2,CD3, CD4, CD5, CD8
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learningssuchasuseofNPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25404
CourseTitle		:DIGITALGAMINGLAB
Pre-requisite(s)		:
Co-requisite(s)		:DigitalGaming
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

:BCA

Semester/Level

:VII/4

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	FamiliarizestudentswiththeUnrealEngineinterface, tools, and features, providing a foundation for working with the engine.
B.	Understandthefundamentalconceptsofgamedevelopment, including gamedesign principles, mechanics, and gameplay elements.
C.	Explore how to build 3D game environments using Unreal Engine, including level design, terrain creation, lighting, and asset placement.
D.	Implement the core game mechanics, such as player movement, physics, collision detection, and interactive elements.
E.	Understand Blueprint scripting, Unreal Engine's visual scripting system, enablingthem to create gameplay logic, AI behaviors, and interactions.

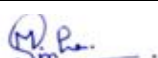
CourseOutcomes

Afterthe completionofthiscourse,students will be able to:

CO1	DesignGameLevelssusingUnrealGame Engine.
CO2	ExplorethepotentialofGameandInteractiveApplicationDevelopmentin upcoming fields like Augmented Reality, Virtual Reality and Mixed Reality.
CO3	Understandtheprocessoftesting,debugging,andrefiningtheirgamestoimprove gameplay experience and address issues.
CO4	Understandtheprojectmanagementmethodologiesspecificfogamedevelopment /MultimediaProject.



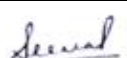
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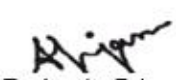
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CO5	Package and deploy their games for various platforms, such as PC, consoles, or mobile devices, and create a final showcase of their work.
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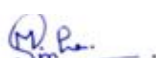
Syllabus

The following exercise are designed for Unreal Game Engine but can be done in any current prevalent Game Engines:

1. Installing the Game Engine and Understanding the interface of the game engine (UnrealEditor) software and Demo of sample game
2. Creating, Opening and Saving the Game Levels
3. Playing a Game Level
4. Understanding Actors and using them > Static Mesh Actor & Material
5. Understanding Actors > Light & Geometry Brushes
6. Viewport Navigation in 3D space: mouse navigation, WASD navigation, Focusing, Maya Navigation, Camera Speed Level Editor Overview: What is the difference between the Unreal Engine and the Unreal Editor. The different parts of the Level Editor - Viewport, Toolbar, Content Browser, Bottom Toolbar, Outliner, and Details Panel. How to customize the interface.
7. Viewport II – Moving, Rotating, and Scaling: How to use the translation, rotation, and scaling widgets. How to select multiple Actors and move them all at once. How to copy Actors. How to change the pivot point of an Actor. What is the difference between world space vs local space.
8. Viewport – Snapping: How to use snapping to perfectly align your Actors with one another within your Level. What is the difference between Surface Snapping, Grid Snapping, Rotation Snapping, Scale Snapping, and Vertex Snapping. The "Rotate to Surface Normal" and "Surface Offset" settings. What are snap sizes.
9. Viewport IV – Different Ways To View Your Level: What is Immersive Mode. What is the difference between the View Modes - Lit, Unlit, and Wireframe. What is the difference between a perspective view and an orthographic view. The Show Flags setting, Game View, and piloting Actors within the Viewport. The Viewport Options menu including Realtime, Show FPS, Show Stats, Show Toolbar, Field Of View, Far View Plane, Screen Percentage, and Bookmarks.
10. Content Browser I - Overview & Finding Content: The Sources Panel, Asset Window, Collections Panel, searching the Content Browser, and breadcrumbs. The Content Drawer, Dock in Layout button and search filters. What is the difference between static collections vs dynamic collections.
11. The Add New, Import, and Save All buttons of the Content Browser. How to use the "Add Feature or Content Pack" feature. How to migrate assets in Unreal Engine.
12. Actors > Atmosphere and Clouds, Player Start, Components, Volumes
13. Exercise: Creating Material
14. Exercise: Creating the Sky
15. Exercise: Creating the Playing Area: Construct the playing area for our game, using Brushes, Meshes, and Materials.
16. Exercise: Add the internal structures for our Level, including walls, platforms, and houses.
17. Introduction to Blueprints
18. Exercise: Use Blueprints to create our first custom Actor - a platform that will continually move up and down.
19. Exercise: Use Blueprint to create the enemies
20. Exercise: Use Blueprint to create the rotating Door
21. Exercise: Create Destructible Mesh
22. Exercise: Create a Terrain
23. Exercise: Create a Playable Character
24. Collisions: Exercise: How to use collision volumes such as a Box Collision, Capsule Collision, or Sphere Collision.
25. Emitters: Exploring various types of emitters
26. Exercise: Creating Emitters
27. Exercise: Adding audio in the game



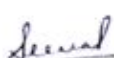
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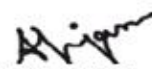
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28. Exercise:UserInterface:CreatingHUD,DamageTintandCollectItemTint,RestrictDoor Opening and Creating a Pause Menu, Game Over and Win Screen Menu etc.
29. Exercise:PackagingtheGameforvariousplatforms

TEXT BOOKS:

1. "UnrealEngine4forBeginners"byDavidNixon

REFERENCE BOOKS:

1. "Unreal Engine 4 Game Development in 24 Hours" by Aram Cookson and Ryan Dowling Soka
2. "UnrealEngine4GameDevelopmentEssentials" bySatheeshPV
3. "LearningUnrealEngineGameDevelopment"byJoannaLeeandRichardA.Hawley
4. "MasteringUnrealTechnology:TheArtofLevelDesign"byJasonBusbyandZakParrish

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Exposuretoothergameenginesuchas Unity.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	Contributionduring CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	3	3	3	2	2	2	3	2	3	3	3	3	2
CO2	2	2	1	2	3	1	1	2	3	2	3	3	3	3	2
CO3	3	3	1	3	2	1	1	2	3	2	3	3	3	3	2
CO4	3	2	1	2	2	1	1	2	3	3	3	3	3	3	2
CO5	2	2	3	2	3	2	2	2	3	2	3	3	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1:Slight(Low)

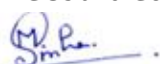
2:Moderate (Medium)

3:Substantial(High)

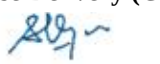
Mapping between COs and Course Delivery (CD) methods



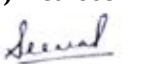
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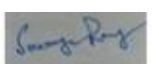
Mrs. Seema
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CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD4, CD5, CD8, CD9
CD2	Tutorials/Assignments	CO2	CD5, CD6,
CD3	Seminars	CO3	CD5, CD6,
CD4	Mini Projects/Projects	CO4	CD5, CD6,
CD5	Laboratory Experiments/Teaching Aids	CO5	CD4, CD5, CD7, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25416
Course Title		: ADVANCED PYTHON PROGRAMMING LAB
Pre-requisite(s)		: Python Programming
Co-requisite(s)		: Advanced Python Programming
Credits: 2	L: 0	T: 0 P: 4

Class schedule per week 04
Class : BCA
Semester/Level : VII/4
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Use regular expressions in Python, implementing data structures in python, using various time functions.
B.	Implement threads in Python.
C.	Create GUI programs in Python.
D.	Networking programming through Python.
E.	Create and manipulate databases in MySQL through Python. Using NumPy and Pandas to analyze and visualize data.

Course Outcomes

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

CO1	Implement various data structures using Python.
CO2	Implement the concepts of threads in a program.
CO3	Create GUI programs.
CO4	Implement networking through Python.
CO5	Store, retrieve, manipulate using MySQL in Python. Analyzing and visualizing data.

Syllabus



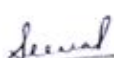
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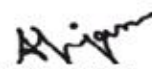
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List of Programs as Assignments:

1. Implement stack data structure.
2. Implement Queue Data structure.
3. Implement Linked list.
4. Write Python program to find the day of the year and the weekday name.
5. Write Python program to accept a date from the keyboard and display the day of the week.
6. Write Python program to find future date and time from an existing date & time.
7. Write Python program to generate random numbers in a range with some time delay between each number.
8. A program to find the currently running thread in a Python program.
9. Write Python program to pass arguments to a function and execute it using a thread.
10. Write Python program to create a thread by making our class as a subclass to the thread class.
11. Write Python program to create a thread that accesses the instance variables of a class.
12. Write Python program to create a thread that acts on the object of a class that is not derived from the thread class.
13. Write Python program to show a simple task using a thread.
14. Write Python program to perform two tasks using two threads simultaneously.
15. Write Python program where threads are acting on the same method to all together for the passenger.
16. Write Python program achieving thread synchronization using locks.
17. Write Python program to demonstrate a deadlock of threads due to locks on objects.
18. Write Python program where thread communication is done through notify() and wait().
19. Write Python program where thread communication is done using queue.
20. Write Python program to create a daemon thread.
21. Write Python program to draw various shapes in a canvas.
22. Write Python program to display images in the canvas.
23. Write Python program to display drawing in the canvas.
24. Write Python program to create a text widget with a vertical scrollbar attached to it.
25. Write Python program to create a horizontal scrollbar and attach it to a text widget to view the text from left to right.
26. Write Python program to create four checkboxes and know which options are selected by the user.
27. Write Python program to create two radio buttons and know which option is selected by the user.
28. Write Python program to create Entry widgets for entering username and password and display the entered text.
29. Write Python program to create two spin boxes and retrieve the values displayed in the spin boxes when the user clicks on a push button.
30. Write Python program to create a list box with course names and display which courses are selected by user.
31. A GUI program to display a menu and to open a file and save it through the file dialog box.
32. Write Python program to create a table with four rows and three columns.
33. Write Python program to find the IP address of a website.
34. A Python program to retrieve different parts of the URL and display them.
35. Write Python program to read source code of a web page.
36. Write Python program to download a web page from internet and save it into our computer.
37. Write Python program to download an image from the internet.
38. Write Python program to create a TCP/IP server program that sends messages to a client.
39. Write Python program to create a TCP/IP client program that receives messages from the server.
40. Write Python program to create a basic chat server program in Python.
41. Write Python program to create a basic chat client program in Python.
42. Write Python program to send email to any mail address.
43. Write Python program to retrieve and display all rows of a table in MySQL.
44. Write Python program to insert rows into a table in MySQL.

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45. Write Python program to create student table (name, roll, course name and age) in mysql.
46. Write Python program to retrieve student's information by entering his roll number.
47. Create data frame using csv file. Retrieve the data through data frame.
48. Write Python program to display student's roll number on x-axis and total marks on y-axis in the form of a bar graph.
49. Write Python program to create line graph to show year wise profit of a company.
50. Write Python program to display a pie chart showing the percentage of employees in each department of a company.

TEXT BOOKS

1. Core Python Programming by Dr. R. Nageswara Rao, Dreamtech Press India.
2. Python: The Complete Reference by Martin C. Brown, McGraw Hill Education.

REFERENCE BOOKS

1. Programming Python: Powerful Object-Oriented Programming by Mark Lutz.
2. Think Python by Allen B. Downey.

Gaps in the Syllabus (to meet Industry/Profession requirements)

3. Seaborn libraries and web scrapping module BeautifulSoup

POs met through Gaps in the Syllabus - PO3, PO5

Topics beyond syllabus/ Advanced topics/ Design

1. Image processing with Python

POs met through Topics beyond syllabus/ Advanced topics/ Design - PO3, PO5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
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Second Quiz	10
Viva voce	20
Day to day performance	30
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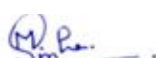
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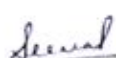
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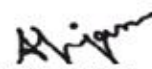
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CD8	Self-learningsuchasuseofNPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25407
CourseTitle		:RESEARCH METHODOLOGY
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:4	L:3	T:1 P:0

Class schedule per week

04

Class:BCA

Semester/Level

:VII /4

Branch

: Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Studyandunderstandtheresearchissues&challenges, research goals,scientific methods
B.	Understand the concepts of Research Design in real-world studies.
C.	Gain skills in conducting data gathering activities for research studies through Various tools
D.	Get a clear concept of sampling methods in tune with the primary data requirements of any given study.
E.	Reviewing Literature and Research Papers; Writing Research Papers, Thesis, Reportsand Project Proposals Plagiarism and Copyrights.

CourseOutcomes

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

CO1	Identify the need for and importance of Research in the context of different situations and environments.
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Dr. Amrita Priyam

CO2	The basic concepts of research and its methodologies, identify appropriate research topics, select, and define appropriate research problems and parameters.
CO3	Prepare questionnaires, interview schedules, and implement them for primary data data in context of any given study.
CO4	Decide and implement the most appropriate probability/non-probability sampling techniques for a given study.
CO5	Organize and conduct research in a more appropriate manner, writing a research report and thesis.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module I Research An Introductory Approach: Meaning, Characteristics and Importance, Types of Research, The Research process (Overview and Steps), The Research problem: Definition, need, importance, steps and related dimensions.	8
Module II Research Design: Meaning, Characteristics of a Good research Design, Types of Research Designs, Components of a research Design.	8
Module III Sources of Collection of Data: Primary Data (Method questionnaire development), Secondary Data (Sources and Precautions in the Use of Secondary Data) Sampling, Methods of Collecting Data: Meaning, Steps and Types (simple random, stratified random, systematic and cluster samplings), Survey and Observation Methods.	8
Module IV Computer Science Research Context: Nature of Computer Science (CS) Research, Scientific Methods in Computer Science, Types of Research in CS, Research Methods in Computer Science, Research Paradigms in CS, Challenges for CS Research.	8
Module V Research Skills: Reviewing Literature and Research Papers; Writing Research Papers, Thesis, Reports, and Project Proposals; Formatting, Appendices, Citation Formats and Style; General Conventions, Issues, Plagiarism, and Copyrights.	8

TEXT BOOKS:

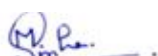
1. Ghosh, B.N. Scientific Method and Social Research (Sterling: New Delhi)
2. Kothari, C.R. Research Methodology Methods and Techniques (New Age: New Delhi)
3. Gupta, Santosh Research Methodology and Statistical Techniques (Deep and Deep Publications: New Delhi)

REFERENCE BOOKS

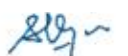
1. Research Methodology: A Step-by-Step Guide for Beginners, Kumar, Pearson Education.
2. Practical Research Methods, Dawson, C., UBSPD Pvt Ltd.
3. Montgomery, Douglas C. & Runger, George C. (2007) 3/e, Applied Statistics and Probability for Engineers (Wiley India).
4. Kothari C.K. (2004) 2/e, Research Methodology—Methods and Techniques (New Age International, New Delhi).
5. Management Research Methodology: Integration of Principles, Methods, and Techniques (Pearson Education, New Delhi).
6. Krishnaswami, O.R. Methodology of Research in Social Science (Himalaya Publishing House: Mumbai.)



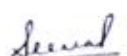
Dr. Archana
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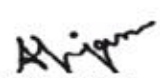
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Dr. Umesh Prasad



Dr. Amrita Priyam

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (Pos)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

2: Moderate (Medium)

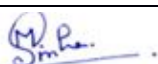
3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

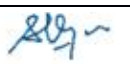
CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8, CD9
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		



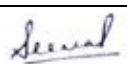
Dr. Archana
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Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



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Dr. Sounak
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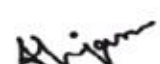
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CD9	Simulation		
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CourseCode		: CA25405
CourseTitle		:SOFT COMPUTING
Pre-requisite(s)		:
Co-requisite(s)		:SoftComputing Lab
Credits:4	L:3	T:1 P:0

Class schedule per week 04
Class :BCA
Semester/Level :VII /4
Branch :Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understandthe conceptoffuzzylogic andcontrollers.
B.	UnderstandthevariousarchitecturesofANN and itslearningmethods.
C.	Learnaboutbasicconceptsofgeneticalgorithmmandits operators.
D.	UnderstandtheArtificialNeural Networks.
E.	UnderstandtheGenetic Algorithms.

CourseOutcomes

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

CO1.	SolvenumericalonFuzzysetsandFuzzyReasoning.
CO2.	DevelopFuzzy InferenceSystem (FIS).
CO3.	SolveproblemsonGeneticAlgorithms.
CO4.	Explainconceptsofneuralnetworks.
CO5.	Developneuralnetworksmodelsforvarious applications.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module– I Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, Fuzzy types and levels, MF Formulation and Parameterization, Fuzzy Union, Intersection and Complement, Fuzzy Number, Fuzzy measure.	8
Module– II Fuzzy Logic: Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Defuzzification, Fuzzy Reasoning. Fuzzy Inference System: Introduction, Mamdani Fuzzy Models, Other Variants, Takagi-Sugeno Fuzzy Models.	8
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.	8
Module– IV	8

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Introduction to Artificial Neural Networks: What is a Neural Network? Human Brain, Models of Neuron, Neural Network viewed as Directed Graphs, Feedback, Network Architecture, Learning processes (Hebbian, Competitive, Boltzman, Supervised, Unsupervised), Perceptrons, Adaline, Madaline.	
Module– V Back Propagation Algorithm, Effect Of Tuning Parameters Of The Back Propagation Neural Network, Selection Of Various Parameters In BPN, Associative Memory and Adaptive Resonance Theory, Autocorrelators, Hetro correlators.	8

TEXT BOOKS

1. Jang J.S.R., Sun C.T. and Mizutani E., “Neuro-Fuzzy and Soft Computing” PHI/ Pearson Education, New Delhi, 2004.
2. Rajasekaran S. & Vijayalakshmi, G.A. Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", PHI, New Delhi, 2003.
3. Ross T.J., “Fuzzy Logic with Engineering Applications”, TMH, New York, 1997.
4. Haykins Simon, “Neural Networks: A Comprehensive Foundation”, Pearson Education, 2002.

REFERENCE BOOKS

1. Ray K.S., “Soft Computing and Its application”, Vol1, Apple Academic Press. 2015.
2. Lee K.H., “First Course on Fuzzy Theory and App.”, Advin Soft Computing Springer. 2005.
3. Zimmermann H.Z., “Fuzzy Set Theory and its App”, 4th Edition, Springer Science, 2001.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Application of soft computing to develop and design the adaptive controllers.
2. Application of fuzzy inference system for prediction and modelling to complex problems.

POs met through Gaps in the Syllabus-3, 5

Topics beyond syllabus/ Advanced topics/ Design

1. Concepts and features of hard computing and soft computing.
2. NN-controller for an intelligent and autonomous robot.
3. Merits and Demerits of soft computing tools.

POs met through Topics beyond syllabus/ Advanced topics/ Design-2,3,5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)	Program Specific Outcomes
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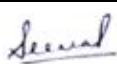
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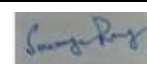
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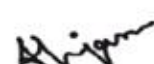
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Dr. Umesh Prasad



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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/Projects	CO4	CD1,CD5,CD8, CD9
CD5	LaboratoryExperiments/TeachingAids	CO5	CD1,CD2,CD9
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learningssuchasuseofNPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25409
CourseTitle		:NATURALLANGUAGE PROCESSING
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:4	L:3	T:1 P:0

Class schedule per week

04

Class

:BCA

Semester/Level

:VII/4

Branch

:Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	UnderstandtheN-gramlanguagemodel andNeurallanguage model.
B.	Understand the algorithms available for the processing of linguistic information andcomputational properties of natural languages.
C.	Understand basic knowledge on various morphological, syntactic, and semantic NLP tasks.
D.	Understandvariousparsingalgorithmsof language.
E.	Learntoextractfeaturesfromtext.Understand embeddingalgorithms.

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Course Outcomes

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

CO1	Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
CO2	Understanding of the relationship between NLP and statistics & machine learning.
CO3	Discover various linguistic and statistical features relevant to the basic NLP tasks such as spelling detection and correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.
CO4	Develop systems for various NLP problems with moderate complexity.
CO5	Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Introduction to NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model.	8
Module2 Language Modelling: Unigram Language Model, Bigram, Trigram, N-gram, basic Neural network for NLP, Neural Language Modelling with N-gram, smoothing techniques. Evaluating language models; Perplexity vs Entropy.	8
Module3 Parts-of-speech Tagging: basic concepts; English word classes; Tag-set; Early approaches: Rule based and TBL; POS tagging using HMM. HMM tagging as decoding. Tokenization and Sentence splitting.	8
Module4 Parsing Basic concepts: top-down and bottom-up parsing, treebank; Syntactic parsing: CKY parsing and its application. Context Free Grammar. Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.	8
Module5 Semantics Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors: SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW.	8

TEXT BOOKS:

1. Jurafsky Dan and Martin James H. "Speech and Language Processing", Pearson Education.
2. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition".

REFERENCE BOOKS:

1. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing."

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Visualize POS and NER with Spacy

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POs met through Gaps in the Syllabus-PO1, PO2 & PO3

Topics beyond syllabus/ Advanced topics/ Design

1. Deep learning models in NLP

POs met through Topics beyond syllabus/ Advanced topics/ Design-PO2 & PO3

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	1	2	1	2	1	3	2	2	2	2	2
CO2	3	3	2	2	3	3	2	2	2	2	2	2	3	2	2
CO3	3	3	3	3	3	3	2	2	2	3	2	2	3	3	2
CO4	2	3	3	3	3	3	3	3	2	2	3	3	3	2	2
CO5	2	3	2	2	3	2	2	2	1	2	2	2	2	2	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

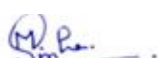
2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD8
CD3	Seminars	CO3	CD1, CD2, CD3, CD8
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD8
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD3, CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		



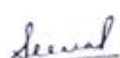
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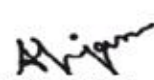
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CD9	Simulation		
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CourseCode		:CA25413
CourseTitle		:ADVANCED DATA ANALYTICS
Pre-requisite(s)		:Data Analytics
Co-requisite(s)		:Advanced Data Analytics Lab
Credits:3	L:3	T:0 P:0

Classscheduleperweek 03
Class :BCA
Semester/Level :VIII/4
Branch :Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Knowthedataandits characteristics.
B.	Understanddatarelationship,advanceddataanalysis:classificationclustering.
C.	Understandassociationrulesextractionfromthetransactiondatasetsusingvarious methods.
D.	IdentifyTimeseriesdataanalysisfor forecasting.
E.	Learntextdata analysis.

CourseOutcomes

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

CO1	Gettheinsightaboutthedata.
CO2	EstablishtheDatarelationshipandableto analyze thedatainmoreadvanceway.
CO3	Extractassociativepatternsfromthetransactionaldata.
CO4	Forecastingaboutthefutureusingthetimeseriesdata analysis.
CO5	Performtextdataanalysis.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
ModuleI Dataanalyticsoverview: Typeofdataanalytics,Descriptive,Diagnostic,Predictive andPrescriptiveAnalytics.VariousgraphicalmethodsofDatavisualization.Various Probabilistic data distributions. Data normalization Multidimensional Data ExamplesandproblemsofhighDimensionaldata.Dimensionreductiontechniques: Principal component analysis.	8
ModuleII Datarelationship: Correlationofdata,Simpleandmultipleregressionanalysis,Chi square testing, One way and two ways ANOVA analysis. PatternClassificationusing: Bayesianclassifiers,logisticregression.Data Clustering: UsingKMeansandKMedoidsmethod,UsingHierarchical methods	8

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Module III Basic concept of Association rules extractions: Market Basket Analysis example. Frequent Itemsets, Closed Itemsets, and Association Rules. Frequent Itemset Mining Methods: Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, Pattern-Growth Approach for Mining Frequent Itemsets, Mining Frequent Itemsets Using Vertical Data Format, Mining Closed and Max Patterns.	8
Module IV Time Series Data Analysis: Introduction, Method of Forecasting, Components of time series: Secular Trend, Seasonal Variations, Cyclical Variations, Irregular variations. Methods: Straight line trend, Non-linear trend, Measuring trends by logarithm: Exponential trend. Measurement of Seasonal variations, Measurement of cyclical and Irregular variations. Auto regression method of forecasting.	8
Module V Text data analysis: Processing and understanding text-Text tokenization and normalization, Text classification: Multinomial naïve bayes and SVM method, Text Similarity and clustering: Analyzing term and document similarities, document clustering. Semantic and Sentiment Analysis.	8

TEXT BOOKS:

1. Han J and Kamber M, "Data Mining: Concepts and techniques", Morgan Kaufmann Publishers. 2nd and 3rd Edition.
2. Gupta and Gupta, "Business Statistics", Sultan Chand and Sons, 2014.

REFERENCE BOOKS:

1. Sayan Mukhopadhyay, "Advanced Data Analytics Using Python", Apress, 2018
2. Maheshwari Anil, "Data Analytics", McGraw Hill publication, 2017.
3. Dipanjan Sarkar, "Text Analytics with Python", Apress, 2016

Gaps in the Syllabus (to meet Industry/ Profession requirements)

Working on real life data collected from the industries and institutions.

POs met through Gaps in the Syllabus -6, 9, 11 and 12

Topics beyond syllabus/ Advanced topics/ Design

1. Some other classification and clustering techniques
2. Web data scraping and its analysis

POs met through Topics beyond syllabus/ Advanced topics/ Design -5, 8, 11, and 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

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Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	2	2	2	1	1	1	1	1	2	3
CO2	3	3	2	2	1	3	1	1	2	1	1	2	3	2	3
CO3	3	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	3	3	3	3	3	1	3	1	3	1	3	3	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD4 CD8 CD5, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD4 CD8 CD5, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25421
Course Title		:REINFORCEMENT LEARNING
Pre-requisite(s)		:Introduction to Machine Learning, Deep Learning
Co-requisite(s)		:Reinforcement Learning Lab
Credits:3	L:3	T:0 P:0

Class schedule per week

03

Class

:BCA

Semester/Level

:VIII/4

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.
----	---

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Mrs. Seema
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Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

B.	Given an application problem (e.g. from computer vision, robotics, etc), decide if it should be formulated as a RL problem; if yes be able to define it formally (in terms of the state space, action space, dynamics and reward model), state what algorithm (from class) is best suited for addressing it and justify your answer
C.	Describe (list and define) multiple criteria for analyzing RL algorithms and evaluate algorithms on these metrics: e.g. regret, sample complexity, computational complexity, empirical performance, convergence, etc
D.	Describe the exploration vs exploitation challenge and compare and contrast at least two approaches for addressing this challenge (in terms of performance, scalability, complexity of implementation, and theoretical guarantees)
E.	Be able to apply these concepts to solve real world problems.

Course Outcomes

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

CO1	Learn how to define RL tasks and the core principals behind the RL, including Markov decision processes, policies, value functions, deriving Bellman equations
CO2	Understand and work with tabular methods to solve classical control problems.
CO3	Understand and work with approximate solutions (e.g. Q-networks).
CO4	Learn the policy gradient methods from vanilla to more complex cases.
CO5	Recognize current advanced techniques and applications in RL.

Syllabus

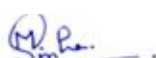
MODULE	(No. of Lecture Hours)
Module1 Introduction to Reinforcement Learning – Overview of reinforcement learning concepts and terminology, Markov Decision Processes (MDPs) and Bellman equations, Dynamic programming relation to RL, Value and policy iteration algorithms.	6
Module2 Temporal Difference Learning – TD prediction and TD(0) algorithm, SARSA and Q-learning algorithms, Off-policy and on-policy learning.	6
Module3 Function Approximation in RL – Linear function approximation, Feature engineering for RL, Deep Q-Networks (DQN).	6
Module4 Policy Gradient Methods – Policy parameterization and policy gradients, REINFORCE algorithm, Proximal Policy Optimization (PPO).	6
Module5 Exploration strategies: epsilon-greedy, UCB, Thompson sampling, Multi-armed bandits and contextual bandits, Upper Confidence Bound (UCB) algorithm.	6

TEXT BOOKS:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019



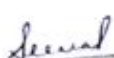
Dr. Archana
Bhatnagar



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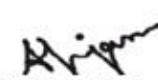
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

REFERENCE BOOKS:

- Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
- Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." *Adaptation, learning, and optimization* 12 (2012): 3..
- Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach." Pearson Education Limited, 2016.
- Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

[illegible]

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 Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1, CO2, CO3, CO4	CD1,CD7,CD8
CD2	Tutorials/Assignments	CO2-CO5	CD1,CD9
CD3	Seminars	CO5	CD1,CD2,CD3

Anchana

Dr. Archana
Bhatnagar

Simha.

Dr. Madhavi
Sinha

2021 ~

Dr. Shripal
Vijayvargiya

Several

Mrs. Seema
Sharma

14

Mr. Anurag
Joshi



Dr. Sounak
Paul

Sangeeta

Dr. Soumya
Ray


(Dr. Sheel Shalini)


Dr. P.S. Bishnu


Dr. Umesh Prasad


Dr. Amrita Priyam

CD4	Mini Projects/Projects	CO5	CD1,CD2
CD5	LaboratoryExperiments/TeachingAids	CO1-CO4	CD1,CD2
CD6	Industrial/GuestLectures	CO5	
CD7	IndustrialVisits/In-plantTraining	CO5	
CD8	Self- learning such as use of NPTEL Materials and Internets	CO1-CO4	
CD9	Simulation	CO5	

CourseCode		: CA25423
CourseTitle		:FEATURE ENGINEERING
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Classscheduleperweek

03

Class

:BCA

Semester/Level

:VIII/4

Branch

:Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Extractusefulfeaturesfromdataandconvertthemtofeatures.
B.	Learnhowtodealwithinfrequent,rare,andunseencategories.
C.	Learn to transform categorical variables into numbers while capturing meaningfulinformation.
D.	Learntoconvertnumericalvariablesintodiscrete ones.
E.	Learntechniques topre-processdataandbuildmorepowerfulmachinelearning models.

CourseOutcomes

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

CO1	Create newfeaturesfromexistingones.
CO2	Imputemissingdataand encodecategorical variables.
CO3	Transformnumericalvariablesandchangetheir distribution.
CO4	Performdiscretization,removeoutliers,andextractfeatures fromdate&time.
CO5	ReducedimensionalityofdatausingPCA.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Introduction: Introduction to Feature Engineering, Importance of feature engineering, Evaluation of machine learning algorithm and Feature engineering procedures. Feature Understanding: Feature Improvement-cleaning datasets, Feature Selection-removing bad attributes, Feature construction, Feature Transformation, Feature learning.	8

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Paul

Dr. Soumya
Ray

(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Module2 Data Pre-processing and Missing Values: Handling missing values, identification, imputation techniques (mean, median, regression-based), and impact on models. Basics of Feature Representation: Scalars and Vectors, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling).	8
Module3 Encoding and Transformation Techniques Handling categorical variables: one-hot encoding, label encoding, and target encoding, Handling text data: bag-of-words representation, TF-IDF encoding, and word embeddings. Numerical transformations: handling skewed distributions, logarithmic transformations, and scaling techniques. Binning and discretization of continuous variables.	8
Module4 Feature Selection: Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies. Effect of Irrelevant Feature, Univariate feature selection: statistical tests and feature importance, Recursive Feature Elimination, Stepwise Selection.	8
Module5 Feature Transformations: Intuition, Derivation, Linear Projection, Variance and Empirical Variance - Vector Formulation, General Solution of the Principal Components, Transforming Features, Implementing PCA, PCA in Action, Considerations and Limitations of PCA, Use Cases	8

TEXT BOOKS:

1. Max Kuhn, Kjell Johnson, "Feature Engineering and Selection: A Practical Approach for Predictive Models" 1st Edition, Chapman & Hall/CRC Data Science Series, ISBN 13-978-1-138-07922-9.
2. Sinan Ozdemir, Divya Susarla, "Feature Engineering Made Easy", Packt Publishing, ISBN 978-1-78728-760-0

REFERENCE BOOKS:

1. Alice Zheng & Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for data scientist", O'Reilly Publications

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Use of techniques for Multivariate missing data imputation and engineering mixed variables.
2. Assembling a feature engineering pipeline.

POs met through Gaps in the Syllabus -1,3, 4,12

Topics beyond syllabus/ Advanced topics/ Design

3. Outlier handling
4. Use of Clustering algorithms for feature engineering
5. Image data feature engineering

POs met through Topics beyond syllabus/ Advanced topics/ Design -1,2,3,4,12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

A.	Know the data and its characteristics.
B.	Understand data relationship, advanced data analysis: classification clustering.
C.	Understand association rule extraction from the transaction datasets using various methods.
D.	Identify Time series data analysis for forecasting.
E.	Learn text data analysis.

Course Outcomes

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

CO1	Get the insight about the data.
CO2	Establish the Data relationship and able to analyze the data in more advance way.
CO3	Getting the analysis of transaction data to extract the associative patterns.
CO4	Forecasting about the future using the time series data analysis.
CO5	The documents classification and clustering based on the similarity's measures.

Syllabus

List of Programs as Assignments:

1. Program on data reading and writing using csv file.
2. Program on Data visualization: Various charts and Graphs.
3. Program on Data Normalization: Max-min normalization and Standard normalization.
4. Program on Dimensional reduction using principal component analysis.
5. Program on Correlation analysis to compute the Pearson coefficient of correlation.
6. Program on Correlation analysis to compute the Spearman coefficient of correlation.
7. Program on simple Regression and multiple Regression Analysis.
8. Program on data classification using Bayesian classifiers.
9. Program on data classification using logistic regression.
10. Program on data clustering using KMeans and KMedoids method.
11. Program on data clustering using Hierarchical method.
12. Program on Time series data analysis to know the characteristic of time series data.
13. Program on Time series data analysis for future forecasting.
14. Program on document Classification and Clustering.
15. Program on sentiment analysis of documents.

TEXT BOOKS:

1. Sayan Mukhopadhyay, "Advanced Data Analytics Using Python", Apress, 2018
2. Dipanjan Sarkar, "Text Analytics with Python", Apress, 2016

REFERENCE BOOKS:

1. Han J and Kamber M, "Data Mining: Concepts and techniques", Morgan Kaufmann Publishers. 2nd and 3rd Edition.
2. Gupta and Gupta, "Business Statistics", Sultan Chand and Sons, 2014.
3. Maheshwari Anil, "Data Analytics", McGrawhill publication, 2017.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

Working on real life data collected from the industries and institutions.

POs met through Gaps in the Syllabus -6, 9, 11 and 12



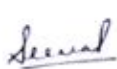
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



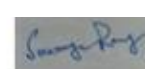
Mrs. Seema
Sharma



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Dr. Sounak
Paul



Dr. Soumya
Ray



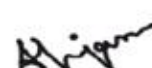
(Dr. Shree Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Topics beyond syllabus/ Advanced topics/ Design

1. Some other classification and clustering techniques
2. Web data scraping and its analysis

POs met through Topics beyond syllabus/ Advanced topics/ Design-5,8,11,and12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**Direct Assessment**

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	2	2	2	1	1	1	1	1	2	3
CO2	3	3	2	2	1	3	1	1	2	1	1	2	3	2	3
CO3	3	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	3	3	3	3	3	1	3	1	3	1	3	3	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD4 CD8 CD5, CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD4 CD8 CD5, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Dr. Archana
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Dr. Madhavi
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Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

CourseCode		:CA25422
CourseTitle		:REINFORCEMENT LEARNING LAB
Pre-requisite(s)		:
Co-requisite(s)		:ReinforcementLearning
Credits:2	L:0	T:0 P:4

Class schedule per week

:04 Class :BCA

Semester/Level

:VIII/4

Branch

:Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	UnderstandthefoundationsofReinforcement Learning.
B.	Learnreinforcementlearning algorithms.
C.	Gainhands-onexperiencewithRL frameworks.
D.	Evaluateand compareRLalgorithms.
E.	Experimentwithhyperparametertuning.

CourseOutcomes

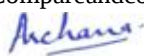
After the completion of this course, students will be able to:

CO1	Explain the fundamental concepts and principles of reinforcement learning, including Markov Decision Processes (MDPs), Bellman equations, and value/policy iteration.
CO2	Develop the ability to implement and apply a variety of RL algorithms, such as temporal difference learning (e.g., SARSA, Q-learning), policy gradient methods, and function approximation techniques (e.g., Deep Q-Networks).
CO3	Apply RL techniques to solve real-world problems and practical applications, such as control tasks
CO4	Acquire practical skills by working with popular RL frameworks and libraries, such as OpenAI Gym, TensorFlow, or PyTorch, to design, train, and evaluate RL agents.
CO5	Gain experience in tuning hyperparameters of RL algorithms to optimize their performance, including learning rates, discount factors, exploration rates.

Syllabus

List of Experiments

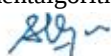
1. Implement basic MDP framework and solve a simple grid world problem
2. Implement Tic-tac-Toe using RL
3. Implement SARSA algorithm and evaluate their performance on a classic RL benchmark, such as the Frozen Lake environment
4. Implement Q-learning algorithm and evaluate their performance on a classic RL benchmark
5. Implement a DQN agent using a deep neural network to solve a continuous control task in the OpenAI Gym environment, such as CartPole or LunarLander
6. Implement the Actor-Critic Model
7. Implement the REINFORCE algorithm for training an RL agent on a continuous action space environment, such as the Pendulum or BipedalWalker
8. Implement the Proximal Policy Optimization (PPO) for training an RL agent on a continuous action space environment, such as the Pendulum or BipedalWalker
9. Compare and contrast the Reinforcement algorithm and PPO for training an RL agent



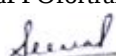
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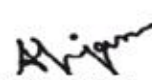
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Dr. Umesh Prasad



Dr. Amrita Priyam

10. Implement one policy gradient method.
11. Implement the Upper Confidence Bound (UCB) algorithm and compare its performance with other exploration strategies on a multi-armed bandit problem

TEXT BOOKS:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
2. Reinforcement Learning: With OpenAI, TensorFlow and Keras Using Python by Abhishek Nandy, Manisha Biswas, 1st Edition, Apress, 2017

REFERENCE BOOKS:

1. Applied Reinforcement Learning with Python: With OpenAI Gym, Tensorflow and Keras. by Taweh Beysolow II, Apress, 2019.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Day today performance	30
Exam Evaluation performance	30

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (Pos)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	1	1	1	2	1	1	2	3

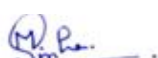
Correlation Levels 1, 2 or 3 as defined below:

1:Slight(Low) 2:Moderate (Medium) 3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods



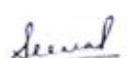
Dr. Archana
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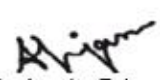
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1, CO2, CO3, CO4	CD1, CD8
CD2	Tutorials/Assignments	CO2-CO5	CD1, CD8, CD9
CD3	Seminars	CO5	CD1, CD2, CD3
CD4	Mini Projects/Projects	CO5	CD1, CD5, CD8, CD9
CD5	Laboratory Experiments/Teaching Aids	CO1-CO4	CD1, CD2, CD9
CD6	Industrial/Guest Lectures	CO5	
CD7	Industrial Visits/In-plant Training	CO5	
CD8	Self-learning such as use of NPTEL Materials and Internets	CO1-CO4	
CD9	Simulation	CO5	

Course Code		:CA25424
Course Title		:FEATURE ENGINEERING LAB
Pre-requisite(s)		:Python Programming Lab
Co-requisite(s)		:Feature Engineering
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

:BCA

Semester/Level

:VIII/4

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the different types of features.
B.	Select features that are relevant and informative for machine learning algorithms.
C.	Evaluate the effectiveness of feature engineering.
D.	Apply feature engineering techniques to real-world data.
E.	Do the feature engineering for numerical, text, image, audio and time series data.

Course Outcomes

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

CO1	Handle the missing values using different imputation techniques and indicator techniques.
CO2	Apply encoding techniques for categorical data and handle the text data.
CO3	Apply different feature selection methods.
CO4	Apply outlier engineering and feature transformations.
CO5	Apply feature engineering on time series data and domain specific data.

Syllabus

List of Programs as Assignments:

1. Missing Values:

Dr. Archana
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Dr. Madhavi
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Dr. Umesh Prasad

Dr. Amrita Priyam

- Imputation Techniques: Implement different methods such as mean, median, mode, or regression-based imputation to fill in missing values.
 - Indicator Variables: Create binary indicator variables to represent missingness in categorical or numerical features.
2. Encoding Categorical Variables:
 - One-Hot Encoding: Convert categorical variables into binary vectors.
 - Label Encoding: Assign a unique numerical label to each category.
 3. Numerical Transformations:
 - Logarithmic Transform: Apply logarithmic transformation to handle skewed distributions.
 - Scaling: Normalize numerical features using techniques like standardization (mean 0, standard deviation 1) or min-max scaling (range between 0 and 1).
 - Binning: Convert continuous variables into discrete bins to capture non-linear relationships.
 4. Date and Time Features:
 - Extract Components: Break down dates into day, month, year, or extract time-based features like hour of the day, day of the week, etc.
 - Time Since/Until: Calculate the time duration between two dates or events.
 5. Textual Data:
 - Bag-of-Words: Convert text into numerical vectors based on word frequency.
 - TF-IDF Encoding: Assign weights to words based on their importance in a document or corpus.
 6. Interaction Features:
 - Polynomial Features: Generate higher-order polynomial terms to capture non-linear relationships between features.
 - Interaction Terms: Create new features by multiplying or combining existing features.
 7. Feature Selection:
 - Univariate Selection: Use statistical tests like chi-square, ANOVA, or correlation coefficients to select relevant features.
 - Recursive Feature Elimination: Iteratively remove less important features based on model performance.
 - Dimensionality Reduction: Apply techniques like Principal Component Analysis (PCA) to reduce feature dimensionality.
 8. Time-based Features:
 - Rolling Statistics: Calculate statistical measures (mean, max, min, etc.) over a rolling window of time.
 - Lagged Variables: Include past values of a feature as additional input, capturing time-dependent patterns.
 9. Domain-Specific Feature Engineering:
 - Create domain-specific features based on prior knowledge of the problem domain on a suitable dataset.
 10. Feature Crosses:
 - Combine multiple features to create new composite features. For example, if you have features A and B, create a new feature by multiplying A and B or concatenating their values.
 11. Grouping and Aggregating:
 - Group data by a categorical feature and calculate aggregate statistics such as mean, sum, count, etc., on numerical features within each group. These aggregated features can capture group-level information.
 12. Target-Related Features:
 - Create features based on the relationship between a feature and the target variable. For example, compute the mean or standard deviation of a numeric feature for different values of the target variable.
 13. Time-Series Features:
 - Derive features specific to time-series data, such as moving averages, exponential smoothing, autocorrelation, or seasonality indicators.
 14. Outlier Engineering:
 - Identify and handle outliers by transforming or capping extreme values. For instance, replace outliers with the median or mean, or create binary indicator variables to capture the presence of outliers.
 15. Domain-Specific Transformations:

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- Apply domain-specific transformations to features. For example, on geographical data, you can calculate distances between points or create clusters based on spatial proximity.
16. TimeSinceLastEvent:
- Calculate the time durations since the occurrence of specific events or actions, which can capture recency information.
17. CompositeFeatures:
- Create composite features by combining multiple existing features using mathematical operations (e.g., addition, subtraction, multiplication, division).

REFERENCE BOOKS:

1. Max Kuhn , Kjell Johnson, "Feature Engineering and Selection: A Practical Approach for Predictive Models" 1st Edition, Chapman & Hall/CRC Data Science Series, ISBN 13-978-1-138-07922-9.
2. Sinan Ozdemir, Divya Susarla, "Feature Engineering Made Easy", Packt Publishing, ISBN 978-1-78728-760-0
3. Alice Zheng & Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for data scientist", O'Reilly Publications

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Feature Extraction from Images: Utilize techniques such as convolutional neural networks (CNNs) or pre-trained models (e.g., ResNet) to extract meaningful features from images.
2. Feature Extraction from Audio: Extract audio features like Mel-frequency cepstral coefficients (MFCC), spectral contrast, or pitch-related features to represent audio data.
3. Feature Importance: Use model-based feature importance techniques like permutation importance or feature importance from tree-based models (e.g., random forests, gradient boosting) to identify the most influential features.

POs met through Gaps in the Syllabus -1,3, 4,12

Topics beyond syllabus/ Advanced topics/ Design

1. Outlier handling
2. Use of Clustering algorithms for feature engineering
3. Image data feature engineering

POs met through Topics beyond syllabus/ Advanced topics/ Design -1,2,3,4,12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

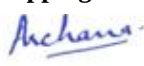
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

In Direct Assessment

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

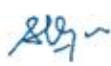
Mapping between COs and Program Outcomes



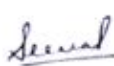
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Dr. Shripal
Vijayvargiya



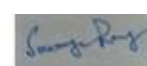
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Dr. Sounak
Paul



Dr. Soumya
Ray



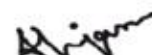
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Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	3
CO2	3	1	3	1	3	3	1	1				2	2	3	3
CO3	3	3	3	3	3	1	2	2		1	1	2	3	3	2
CO4	3	2	2	1	3		1	1		1	1	2	2	2	2
CO5	1	3	3	3	3	1	1	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 COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD4
CD2	Tutorials/Assignments	CO2	CD1, CD4
CD3	Seminars	CO3	CD1, CD8
CD4	Mini Projects/Projects	CO4	CD1, CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25417
Course Title		:COMPUTER VISION
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week

03

Class

:BCA

Semester/Level

:VIII/4

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

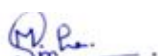
A.	Understand the concepts of computer vision.
B.	Understand the various image processing methods used in computer vision.
C.	Learn about basic concepts of model fitting and optimization.
D.	Learn about deep learning concepts.
E.	Understand the various feature detection and matching techniques used in computer vision.

Course Outcomes

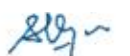
After the completion of this course, students will be able to:



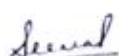
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Joshi



Dr. Sounak
Paul



Dr. Soumya
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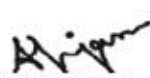
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CO1	Understand the various features of computer vision and basics of transformation techniques.
CO2	Apply different image processing techniques for solving real world computer vision problems and finding solutions.
CO3	Understand about the model fitting and optimization in computer vision world.
CO4	Explain the concepts of deep learning.
CO5	Implement the feature detection and matching techniques for various applications in computer vision.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Introduction: Overview of Computer Vision, Applications, Geometric Primitives and Transformations: 2D Transformations, 3D Transformations, 3D to 2D Projections, Photometric Image Formation: Digital Camera.	7
Module2 Image Processing: Point Operators: Pixel Transforms, Color Transforms, Histogram Equalization, Linear Filtering, 2D Fourier Transforms, Geometric Transformations.	8
Module3 Model Fitting and Optimization: Scattered Data Interpolation: Radial Basis Functions, Overfitting and Underfitting.	6
Module4 Deep Learning: Supervised Learning: Nearest Neighbors, Bayesian Classification, Logistic Regression, Unsupervised Learning: Clustering, K-Means, Deep Neural Networks: Weights and Layers, Backpropagation, Convolutional Neural Networks.	10
Module5 Feature Detection and Matching: Points and Patches: Feature Detectors, Feature Matching, Feature Tracking, Edges and Contours: Edge Detection, Contour Detection.	5

TEXT BOOKS:

1. Forsyth David A. and Ponce Jean, "Computer Vision. A Modern Approach", Pearson Education, 2015.
2. Szeliski R., "Computer Vision: Algorithms and Applications (Texts in Computer Science)", Springer.

REFERENCE BOOKS:

1. Hartley R. and Zisserman A., "Multiple View Geometry in Computer Vision", Cambridge University Press.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25



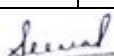
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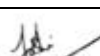
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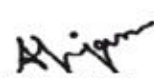
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Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (Pos)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	2	2	1	1	2	2	1	2	2	3	2	2
CO2	3	2	2	1	3	1	1	1	2	1	2	2	3	2	3
CO3	3	3	3	2	3	1	2	2	2	2	2	2	3	2	3
CO4	3	2	3	2	3	1	2	2	3	2	2	2	3	3	3
CO5	3	3	3	2	3	1	2	2	2	2	2	2	3	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD3, CD6
CD2	Tutorials/Assignments	CO2	CD1, CD3, CD6, CD8
CD3	Seminars	CO3	CD1, CD3, CD6, CD7
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD3, CD6
CD5	Laboratory Experiments/Teaching Aids	CO5	CD2, CD6, CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		:CA25419
Course Title		:IMAGE PROCESSING
Pre-requisite(s)		:Mathematics for Computing I
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week

03

Class

:BCA

Semester/Level

:VIII/4

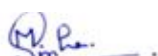
Branch

:Bachelor of Computer Applications

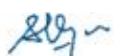
Course Objectives



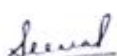
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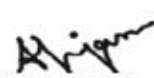
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This course enables the students to:

A.	Understand the fundamentals of digital image processing.
B.	Develop a broad knowledge of different transform methods for enhancing the image.
C.	Learn Image restoration techniques and noise models used for restoring an image.
D.	Understand about image compression and image segmentation.
E.	Know about Object Recognition & learn techniques to perform the same.

Course Outcomes

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

CO1	Understand the concept of image formation, digitization, and the role which human visual system plays in perception of image data.
CO2	Acquire an appreciation for transform techniques for enhancing the appearance of an image and will be able to apply them in different applications.
CO3	Discern the difference between noise models, gain an insight into assessing the degradation function and apply noise removal technique.
CO4	Synthesize a solution to image compression.
CO5	Design pattern/object recognition system, evaluate its performance and apply improvement techniques.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module 1 Introduction to Digital Image Processing: Fundamental Steps in Digital Image Processing, Components of an Image Processing System; Color Image: Fundamentals, Color Models & various image formats like bmp, jpeg, tiff, png, gif, etc.	8
Module 2 Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.	8
Module 3 Image Enhancement & Restoration: Image Enhancement: Basic intensity transformation function, Histogram Processing, Image degradation/Restoration Process, Noise Models, Restoration in the presence of noise only - Spatial Filtering	8
Module 4 Image Compression & Segmentation: Image Compression: Fundamentals, some basic compression methods; Image segmentation: Fundamentals, point, line & edge detection, thresholding, region based segmentation.	8
Module 5 Image Processing Applications: Object Recognition: Patterns & Patterns Classes, Recognition using Neural Network, matching shape numbers.	8

TEXT BOOKS:

1. Rafael.C. & Woods Richard E. "Digital Image Processing", 3rd Edition, Pearson Education, New Delhi, 2009.

REFERENCE BOOKS:

1. Pratt W.K. "Digital Image Processing", 4th Edition, John Wiley & sons Inc., 2006.



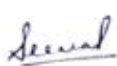
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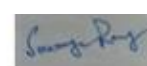
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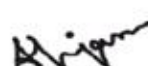
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2. Sonka M., Hlavac Vaclav, Boyle Roger "Image Processing, Analysis and Machine Vision", 2nd Edition, Thomson Learning, India Edition, 2007.
3. Jayaraman "Digital Image Processing", Tata McGraw Hill Education, 2011.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	2
CO2	3	3	3	1	3	1	1	1				2	2	2	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD9
CD3	Seminars	CO3	CD1, CD2, CD3
CD4	Mini Projects/Projects	CO4	CD1, CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2
CD6	Industrial/Guest Lectures		



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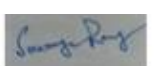
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CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learningsuchasuseofNPTELMaterials and Internets		
CD9	Simulation		



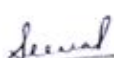
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ANNEXURE B DATA SCIENCE

SEMESTER VII/ VIII

CourseCode		: CA25425
CourseTitle		:NoSQL DATABASE
Pre-requisite(s)		:Database Management System
Co-requisite(s)		:NoSQL Database Lab
Credits:4	L:3	T:1 P:0

Class schedule per week

04

Class

:BCA

Semester/Level

:VII /4

Branch

:Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understand the basic concepts and the applications of database systems. To master the basics of SQL and construct queries using SQL.
B.	ExploredifferenttypesofNoSQLdatabasesandunderstandtheprinciplesofrelational database design.
C.	Understandthearchitectureofdifferenttypesof databases.
D.	Becomefamiliarwiththebasicissuesoftransactionprocessingandconcurrency control.
E.	Becomefamiliarwithdatabasestoragestructuresandaccesstechniques.

CourseOutcomes

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

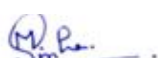
CO1	Explainandcomparedifferenttypesof NoSQL Databases.
CO2	CompareandcontrastNoSQLdatabaseswithRDBMS.
CO3	Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL Databases.
CO4	ApplyNoSQLdevelopmenttoolsondifferenttypesofNoSQL database.
CO5	Demonstratethearchitecture,defineobjects,loaddataandperformancetuneColumn oriented, Document-oriented, Graph NoSQL databases.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
ModuleI Introduction: Overview and History of NoSQL Databases. Definition of the Four TypesofNoSQLDatabase,TheValueofRelationalDatabases,GettingatPersistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Point.	8



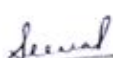
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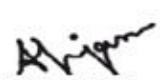
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Dr. Amrita Priyam

Module II Evaluating NoSQL: Introduction, The Technical Evaluation, Choosing NoSQL, Search Features, Scaling NoSQL, Keeping Data Safe, Visualizing NoSQL, Extending Data Layer, Business Evaluation, Deploying Skills, Deciding Open Source versus commercial software, Business critical features, Security.	8
Module III Key-Value & Document Based Databases: Introduction to Key-Value Databases, Key Value Store, Essential Features, Consistency, Transactions, Partitioning, Scaling, Replicating Data, Versioning Data, How to construct a Key, Using Keys to Locate Values, Hash Functions, Store data in Values, Use Cases, Introduction to Document Databases, Supporting Unstructured Documents, Document Databases Vs. Key-Value Stores, Basic Operation on Document database, Partition, Sharding, Features, Consistency, Transactions, Availability, Scaling, Use Cases.	8
Module IV Column-oriented & Graph based Databases: Introduction to Column Family Database, Features, Architectures, Differences and Similarities to Key Value and Document Database, Consistency, Transactions, Scaling, Use Cases, Introduction to Graph Databases, Advantages, Features, Consistency, Transactions, Availability, Scaling, Graph & Network Modelling, Properties of Graphs and Nodes, Types of Graphs, Undirected and directed Graph, Flow Network, Bipartite Graph, Multigraph, Weighted Graph, Conclusion of Unit.	8
Module V Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In MongoDB, Creating and Using Indexes In MongoDB, Indexing And Ordering In CouchDB, Indexing In Apache Cassandra.	8

TEXT BOOKS:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications.
2. NoSQL for Dummies, Adam Fowler, John Wiley & Sons.

REFERENCE BOOKS:

1. NoSQL for Mere Mortals, Dan Sullivan, Pearson Education.
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", Manning Publication/Dreamtech Press.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment



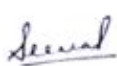
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



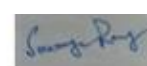
Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
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CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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 Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/Projects	CO4	CD1,CD5,CD8, CD9
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CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learningsuchasuseofNPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25431
CourseTitle		:CLOUD COMPUTING
Pre-requisite(s)		:ComputerNetworks,Operating System
Co-requisite(s)		:
Credits:4	L:3	T:1 P:0

Class schedule per week

04

Class

:BCA

Semester/Level

:VII /4

Branch

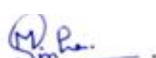
:Bachelor of Computer Applications

Course Objectives

This course enables the students to:



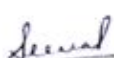
Dr. Archana
Bhatnagar



Dr. Madhavi
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Vijayvargiya



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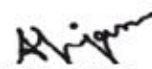
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

A.	Understand software, and other shared resources to be provisioned over the network as services in an on-demand manner.
B.	Comprehend the cloud computing models.
C.	Gain knowledge about the different types of cloud computing services namely, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS).
D.	Understand virtualization, security and privacy issues.
E.	Understand Cloud OS, federated clouds.

Course Outcomes

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

CO1	Describe the various aspects of cloud computing and distributed computing.
CO2	Understand the specifics of virtualization and cloud computing architecture.
CO3	Develop and deploy cloud application using services of different cloud computing technologies provider: Google app Engine, Amazon Web Services (AWS) and Microsoft Azure.
CO4	Provide recommendations on cloud computing solutions for a Green enterprise.
CO5	Identify and deploy appropriate design choices when solving real-world cloud computing problems.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module I Cloud Computing at a glance, Distributed Systems, Virtualization, Web 2.0, Service-oriented computing, Utility-oriented computing.	8
Module II Eras of Computing, Elements of Distributed Computing, Concepts of Virtualization and its characteristics, Virtualization and cloud computing, cloud reference model, types of clouds, economics of the cloud.	8
Module III Cloud Platforms in Industry: Amazon Web Services: Compute Services, Storage Services, Communication Services. Google App Engine: Architectural and Core Concepts, Application Life-Cycle, Cost Model. Microsoft Azure: Azure Core Concepts, SQL Azure.	8
Module IV Energy-Efficiency in clouds, Energy-Efficient and Green Cloud Computing Architecture, Market-Oriented Cloud Computing, Federated clouds: characterization and definition, cloud federation stack. Cloud Security and Trust Management: Cloud Security Defense Strategies.	8
Module V Application of clouds in: Health care, Biology, CRM, ERP, Social Networking, Productivity and Geoscience. Cloudlets for Mobile Cloud Computing.	8

TEXT BOOKS:

1. Buyya Rajkumar, Charles, Vecchiola Christian and Selvi S. Thamarai "Mastering Cloud Computing", McGraw Hill Education (India) Private Limited.

REFERENCE BOOKS:



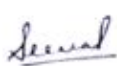
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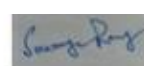
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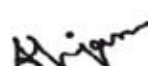
(Dr. Sheel Shalini)



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1. Hwang Kai, Fox Geoffrey C., Dongarra Jack J., “Distributed and Cloud Computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann.

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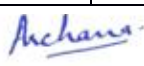
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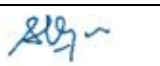
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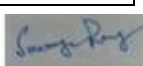
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Joshi



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Dr. Soumya
Ray



(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25426
CourseTitle		:NoSQL LAB
Pre-requisite(s)		:
Co-requisite(s)		:NoSQL Database
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

:BCA

Semester/Level

:VII/4

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Setup and configure the lab environment.
B.	Make use of different commands in the lab environment.
C.	To create and implement shards.
D.	Understand the model of system existing in various IT companies.
E.	Using and learning the MongoDB environment.

Course Outcomes

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

CO1	Design a database for a given set of requirements.
CO2	Use NoSQL and its various commands.
CO3	Apply commands on a given database.
CO4	Have knowledge of creating, adding shards to the structure.
CO5	Understand the importance of migration to NoSQL.

SYLLABUS

List of Programs as Assignments:

Below experiments can be performed on MongoDB Lab by creating a single node cluster.

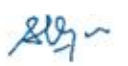
1. Prepare and install infrastructure for setting up MongoDB lab.
2. Execute set of basic commands on MongoDB lab environment
 - a. Login
 - b. Display all databases.
 - c. Authenticate and logout from databases.
 - d. List down collections, users, roles
3. Execute set of basic commands on MongoDB lab environment
 - a. Insert document.
 - b. Update document
 - c. Save document.
 - d. Display collection records



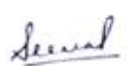
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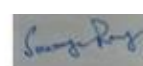
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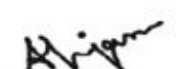
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

- e. Drop function.
4. XYZ Pvt Ltd. is a famous telecom company. They have customers in all locations. Customers use the company's network to make calls. Government has brought in a regulation that all telecom companies should store call details of their customers. This is very important from a security point of view and all telecom companies have to retain this data for 15 years. The company already stores all customer details data, for their analytics team. But due to as urgeinmobileusersinrecentyears,theircurrentdatabasecannot handle huge amounts of data. Currentdatabasestoresonlysixmonthsofdata.XYZPvtLtdnowwantstoscaletheir database and wants to store 15 years of data.
Datacontainsfollowing columns:
Source: Phone number of caller Destination:Phonenumberofcallreceiver Source_location: Caller's city
Destination_location: Call receiver's city Call_duration: phone call duration
Roaming:Flagtocheckifcallerisinroaming Call_charge: Money charged for call
5. After discussing the requirements with database and architecture team, it has been decided that they should useMongoDb. You havebeen given thetask to Setup adistributed system (database)suchthatdatafromdifferentlocationsgotodifferentnodes(todistributetheload)
- Importdatatoshardedcollection.
 - Checkdataoneachshardfordistribution.
6. Executebelowsetofproblembytakingreferenceofpreviousexperiment andfindout:
- Addadditional nodeto existing system.
 - Checkthebehaviorofclusteron addingashard.
 - Checkthebehaviorofqueryfor findingadocumentwithsourcelocation Delhi.
7. Casestudyon5differentITCompanieswhoareworkingonMongoDB.Explainonthe below parameters:
- Whymovedto NoSQL
 - AdvantagesoverNOSQL
BusinessBenefitsTechnology Adaptation

TEXTBOOKS

- "GettingStartedwithNoSQL:YourguidetotheworldandtechnologyofNoSQL",by Gaurav Vaish, Packt Publishing.

REFERENCEBOOKS

- ShashankTiwari,ProfessionalNoSQL,WroxPress, Wiley.

Gaps in the Syllabus (to meet Industry/ Profession requirements) POs met through Gaps in the Syllabus Topics beyond syllabus/ Advanced topics/ Design

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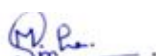
Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30



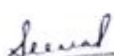
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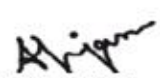
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
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CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1:Slight(Low) 2:Moderate (Medium) 3:Substantial(High)

CD Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1	CD1,CD8
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CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learningssuchasuseofNPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25432
CourseTitle		:CLOUDCOMPUTINGLAB
Pre-requisite(s)		:ComputerNetworks,Operating System
Co-requisite(s)		:Cloud Computing
Credits:2 L:0	T:0	P:4

Class/schedule/per week	04
Class	:BCA
Semester/Level	:VII/4
Branch	:Bachelor of Computer Applications

This course enables the students to:

A.	Understand software, and other shared resources to be provisioned over the network as services in an on-demand manner.
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Anchana

Dr. Archana
Bhatnagar

Simha

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2023 ~

Dr. Shripal
Vijayvargiya

Serial

Mrs. Seema
Sharma

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Joshi



Dr. Sounak
Paul

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Ray

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Dr. P.S. Bishnu

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Dr.Umesh Prasad

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B.	Comprehend the cloud computing models.
C.	Gain knowledge about the different types of cloud computing services namely, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS).
D.	Understand virtualization, security and privacy issues.
E.	Identify and deploy appropriate design choices when solving real-world cloud computing problems.

Course Outcomes

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

CO1	Configure various virtualization tools such as VirtualBox, VMware workstation.
CO2	Use Infrastructure and Platform services provided by AWS.
CO3	Learn serverless computing using AWS Lambda function.
CO4	Understand concepts of Identity management using AWS IAM.
CO5	Create a virtual private cloud.

Syllabus

List of Programs as Assignments:

1. Install VirtualBox/VMware Workstation with different flavors of Linux or Windows OS
2. Create Amazon AWS EC2 Linux instance with conceptual understanding of SSH
3. software protocol and keys.
4. Configure Web Server on Amazon Linux Instance.
5. Create cloud storage bucket using Amazon Simple Storage Service (S3).
6. Launch and connect to Amazon Relational Database Service (RDS).
7. Host your application in the cloud using AWS Elastic Beanstalk.
8. Create an AWS Lambda Function and an event to trigger it.
9. Explore AWS Identity and Access Management Users, Groups and Policies.
10. Create VPC using Amazon Virtual Private Cloud.
11. Assign Elastic IP Address to an EC2 instance.

TEXT BOOKS:

1. Buyya Rajkumar, Charles, Vecchiola Christian and Selvi S. Thamarai "Mastering Cloud Computing", McGraw Hill Education (India) Private Limited.

REFERENCE BOOKS:

1. Hwang Kai, Fox Geoffrey C., Dongarra Jack J., "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufmann - India Edition.

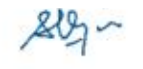
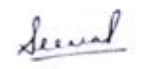
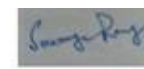
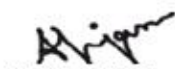
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Topics beyond syllabus/ Advanced topics/ Design

POs met through Topics beyond syllabus /Advanced topics/ Design

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Assessment Tool		% Contribution during CO Assessment				
						
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(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

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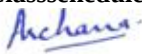
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CD3	Seminars	CO3	CD1,CD5,CD8
CD4	Mini Projects/Projects	CO4	CD1,CD5,CD8
CD5	LaboratoryExperiments/Teaching Aids	CO5	CD1,CD2,CD5, CD8
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learningssuchasuseofNPTEL Materials and Internets		
CD9	Simulation		

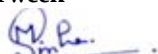
CourseCode		:CA25433
CourseTitle		:DATA PREPROCESSING AND REPORTING
Pre-requisite(s)		:Introduction to Data Science
Co-requisite(s)		:Data Preprocessing and Reporting Lab
Credits:4	L:3	T:1 P:0

Classscheduleperweek

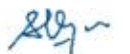
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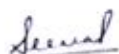
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



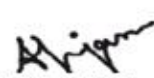
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Class :BCA
Semester/Level :VII/4
Branch :Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Know the basics of data Pre-processing and Reporting.
B.	Know the basics for data cleaning and Integration.
C.	Translate and present data in standard form and selecting the features.
D.	Have an understanding of handling the categorical and imbalanced data.
E.	Learn to wisely use various data visualization techniques such as plots, chart graphs and reporting of data analysis results.

Course Outcomes

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

CO1	Demonstrate understanding of Data Pre-processing and Reporting basics.
CO2	Demonstrate skill on Data Cleaning and Integration process.
CO3	Apply pre-processing techniques for various data analysis tasks.
CO4	Demonstrate understanding of handling of categorical and imbalanced techniques.
CO5	Demonstrate skill in using different types of visualization and reporting tools and techniques.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module I Introduction to Data Preprocessing Overview of the data analysis process, Importance of data pre-processing and reporting, Ethical considerations in data handling and reporting.	8
Module II Data Cleaning and Integration Handling missing data: techniques and imputation methods, Dealing with outliers: detection and treatment strategies, Data integration: merging datasets, resolving inconsistencies.	8
Module III Data Transformation and Feature Selection Data normalization and standardization, Log transformations and power transformations, Feature selection: identifying relevant variables.	8
Module IV Handling Categorical Data and Data Splitting Encoding categorical variables: one-hot encoding, label encoding, Train-test split: dividing data for model development and evaluation, Handling imbalanced datasets: techniques for addressing class imbalance.	8
Module V Data Visualization, Reporting, and Interpretation Introduction to data visualization techniques: plots, charts, and graphs, Descriptive statistics: calculating and interpreting summary statistics, Exploratory data analysis	8

Dr. Archana
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Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

(EDA): identifying patterns and relationships, Reporting and communication of data analysis results.	
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TEXT BOOKS:

1. Data Science for Business, Authors: Foster Provost and Tom Fawcett, Publisher: O'Reilly Media, Year: 2013
2. PracticalDataCleaning, Author:LeeBaker,Publisher:Kindle Edition
3. DataPreparationforDataMining,Author:DorianPyle,Publisher:MorganKaufmann, Year: 1999 (Revised edition in 2011)
4. PythonDataScienceHandbook,Author:JakeVanderPlas,Publisher:O'Reilly,Year:2016
5. StorytellingwithData,Author:ColeNussbaumerKnafl,Publisher:Wiley,Year:2015

REFERENCE BOOKS:

1. FeatureEngineeringforMachineLearning,Author:AliceZhengandAmandaCasari, Publisher: O'Reilly, Year: 2018
2. DataWrangling with Python, Author: Sarkar Dr. Tirthajyoti, Publisher: Packt Publisher,Year: 2019

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	ProgramOutcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	2	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

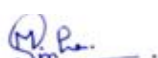
Correlation Levels 1, 2 or 3 as defined below:

1:Slight(Low)

2:Moderate (Medium)3:Substantial(High)



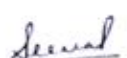
Dr. Archana
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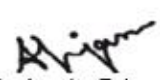
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD8,
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Mini Projects/Projects	CO4	CD1,CD4,CD5, CD9
CD5	LaboratoryExperiments/TeachingAids	CO5	CD1,CD8
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		:CA25434
CourseTitle		:DATA PREPROCESSING AND REPORTING LAB
Pre-requisite(s)		:
Co-requisite(s)		:DataPreprocessingandReporting
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

:BCA

Semester/Level

:VII/4

Branch

:Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Knowaboutthedatapreprocessingandreportingprocess.
B.	Differentcategoriesofdatssets,datatypes, andattribute-types.
C.	Understandthedifferenttechniquesofdata preprocssing.
D.	Reallifeapplicationsofdatapreprocessingfunctionalities.
E.	Decidewhatdatareportingtechniquesarerequiredtoobtainthedesiredobjectives.

CourseOutcomes

Afterthe completionofthiscourse,students will be able to:

CO1	Basicsofsuitabletooltoimplementthedatapreprocessingandreportingprocess.
CO2	Methodsandmetricsofdescriptiveandvisualdata analysis.
CO3	Implementthe techniquesof differentdata preprocessingfunctionalitiesusing suitable packages/ libraries/ tools.
CO4	Conductprojectstosolveareallifeproblemsusingthedatapreprocessingmethods and tools.
CO5	Demonstratetheuseofvariousdatavisualization andreportingtools.

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Dr. Soumya
Ray

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Syllabus

List of Programs as Assignments:

Exercise 1: You have a dataset that contains information about customers, including their age, income, and purchase history. However, the dataset contains missing values in some of the columns. Your task is to handle the missing values appropriately.

- Load the dataset into a pandas DataFrame.
- Check for missing values in each column.
- Decide on a strategy to handle the missing values. You can either remove the rows with missing values or impute the missing values with appropriate values.
- Implement your chosen strategy and update the dataset accordingly.

Exercise 2: You have a dataset that contains text data, and you want to pre-process it for natural language processing tasks.

- Load the dataset into a pandas DataFrame.
- Remove any special characters, numbers, and punctuation marks from the text.
- Convert the text to lowercase.
- Tokenize the text into individual words.
- Remove stop words from the text.
- Apply stemming or lemmatization to reduce words to their base form.
- Update the dataset with the preprocessed text.

Exercise 3: You have a dataset that contains categorical variables encoded as strings. However, for some categorical variables, there are typos and inconsistent capitalization.

- Load the dataset into a pandas DataFrame.
- Examine the unique values in each categorical column to identify any inconsistencies.
- Clean the categorical variables by correcting the typos and ensuring consistent capitalization.
- Encode the categorical variables using one-hot encoding or label encoding.
- Update the dataset with the cleaned and encoded categorical variables.

Exercise 4: You have a dataset that contains numerical features, but some of the features are skewed and have a wide range of values.

- Load the dataset into a pandas DataFrame.
- Examine the distribution of each numerical feature using histograms or density plots.
- Apply a transformation technique (such as logarithmic transformation or Box-Cox transformation) to reduce skewness and make the distribution more symmetric.
- Scale the numerical features to a similar range using techniques like min-max scaling or standardization.
- Update the dataset with the transformed and scaled numerical features.

Exercise 5: Data Visualization and Reporting

- Select a dataset of interest for analysis and reporting.
- Identify the main message or insights you want to communicate.
- Choose appropriate visualization techniques to support your message (e.g., bar charts, line graphs, scatter plots).
- Create visually appealing and informative charts using data visualization tools (e.g., matplotlib, Tableau, Power BI).
- Organize your findings into a cohesive report, incorporating visualizations, text explanations, and key takeaways.

****Import the necessary libraries (such as pandas, numpy, and sklearn) to perform these exercises.**

TEXT BOOKS:



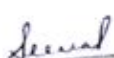
Dr. Archana
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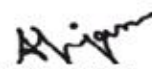
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Dr. Amrita Priyam

CD4	Mini Projects/Projects	CO4	CD1,CD2,CD5
CD5	LaboratoryExperiments/TeachingAids	CO5	CD1,CD4,CD5
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25427
CourseTitle		:DATA ETHICS AND PRIVACY
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:4	L:3	T:1 P:0

Classscheduleperweek 04
Class :BCA
Semester/Level :VII /4
Branch :Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Exploretheethicaldimensionsandprivacyimplicationsofdata-driventechologies.
B.	Focusontheresponsiblecollection,analysis,storage,anduseof data.
C.	Explorestrategiesforpromotingresponsibledata practices.
D.	Understandsocietalimplicationsofdata ethics.
E.	Understandtheethicalframeworksandprivacy concerns.

CourseOutcomes

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

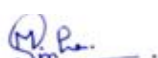
CO1	Understandthe fundamentalconceptsandprinciplesofdataethicsandprivacy.
CO2	Identifyethicalissuesandchallengesassociatedwithdata-driven technologies.
CO3	Applyethicalframeworksandguidelinestoaddressdataethicsandprivacyconcerns.
CO4	Developstrategiesforpromotingresponsibledatapacticesandprotecting privacy.
CO5	Analyzetheimpactofbiasesandfairnessindata-drivendecision-making.

Syllabus

MODULES	(NO. OF LECTURE HOURS)
ModuleI IntroductiontoDataEthics,Overviewofdataethicsanditsimportance,Keyethical principles and frameworks, Privacy rights and legal considerations, Ethical Issues in Data Collection, Informed consent and data transparency, Data anonymization and de-identification, Ethical considerations in data sharing and aggregation.	8



Dr. Archana
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Sinha



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Vijayvargiya



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Sharma



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Dr. Soumya
Ray



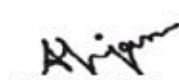
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Dr. Umesh Prasad



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Module II Ethical Data Analysis and Use Responsible data analysis practices, Ethical considerations in AI and machine learning Data-driven decision-making and accountability, Bias and Fairness in Data, Types of bias in data and algorithms, Implications of biased data and algorithmic decision-making.	8
Module III Ethical Guidelines and Frameworks, International and industry-specific data ethics guidelines, Ethical considerations for data scientists and practitioners, Corporate social responsibility and ethical data governance.	6
Module IV Privacy and Data Protection, Data breaches and security risks, Privacy-enhancing technologies and techniques, Privacy regulations and compliance (e.g., GDPR, CCPA).	6
Module V Social Impact of Data Ethics and Privacy, Surveillance society and implications for civil liberties, Ethical considerations in data-driven research and public policy, Ethical implications of data-driven business models.	6

TEXT BOOKS:

1. "Ethics of Big Data" by Kord Davis and Doug Patterson
2. "Privacy in Context: Technology, Policy, and the Integrity of Social Life" by Helen Nissenbaum
3. "Data Ethics: The New Competitive Advantage" by DJ Patil

REFERENCE BOOKS:

1. "Responsible Data Science" by Foster Provost and Panos Ipeirotis
2. "Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor" by Virginia Eubanks

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

1. Student Feedback on Faculty
2. Student Feed back on Course Outcome

Mapping between COs and Program Outcomes

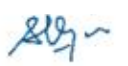
Course outcome	Program Outcomes (POs)	Program Specific Outcomes
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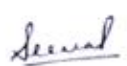
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



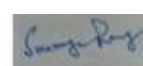
Mrs. Seema
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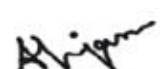
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Dr. P.S. Bishnu



Dr. Umesh Prasad



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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1	2	3	2	2	2	3	2
CO2	3	3	3	1	3	1	1	1	2	2	4	2	2	2	2
CO3	3	3	3	3	3	1	2	2	3	1	1	2	2	3	2
CO4	3	3	3	1	3	2	1	1	1	1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

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 Code	CourseDeliveryMethods	Course Outcome	CourseDelivery Method Used
CD1	LecturebyuseofBoards/LCDProjectors	CO1	CD1,CD5,CD7, CD8
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD5, CD8
CD3	Seminars	CO3	CD1,CD2,CD3, CD5, CD8
CD4	Mini Projects/Projects	CO4	CD1,CD2,CD5, CD8
CD5	LaboratoryExperiments/TeachingAids	CO5	CD1,CD2,CD6, CD7, CD9
CD6	Industrial/GuestLectures		
CD7	IndustrialVisits/In-plantTraining		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25429
CourseTitle		:CRYPTOGRAPHY&NETWORK SECURITY
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:4	L:3T:1	P:0

Class schedule per week

4

Class

:BCA

Semester/Level

:VII//4

Branch

:Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understandthefunctionsofcryptographic attacks.
B.	Gainknowledgeofsymmetriccryptographic techniques.
C.	Enhanceknowledgeof asymmetriccryptographic techniques.
D.	Differentiatebetweenthecryptographictechniquesandknowtheirsuitabilitytoan application.
E.	Preparestudentsforresearchintheareaofcryptography&networksecurityand enhance problem solving skills.

CourseOutcomes

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

Dr. Archana
Bhatnagar

Dr. Madhavi
Sinha

Dr. Shripal
Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

CO1	Understand the various types of cryptographic attacks and the mathematics behind cryptography.
CO2	Apply the symmetric cryptographic techniques to solve real life problems.
CO3	Apply the asymmetric cryptographic techniques to solve real life problems.
CO4	Describe digital certificates and PKIX model.
CO5	Analyze all relevant aspects of security in networks like E-mail security, PEM & S/MIME, PGP, Firewalls.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module I Introduction: Security goals, Principles of Security, Cryptographic attacks, Mathematics of cryptography. Cryptography: Concepts and Techniques: Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key range and Key Size, Possible Types of Attacks.	8
Module II Symmetric Key Algorithms and AES: Introduction, Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard (AES).	8
Module III Asymmetric Key Algorithms, Digital Signatures and RSA: Introduction, Brief History of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm.	8
Module IV Digital Certificates and Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML, PKI and Security.	8
Module V Network Security: System Security-Users, Trusts and Trusted systems. Malicious Software. Intrusion Detection system (IDS). Firewalls. Security at the Network layer: IPSec Security at the Transport layer: SSL and TLS Security at the Application layer: PGP and S/MIME	8

TEXT BOOKS:

1. Atul Kahate, Cryptography and Network Security, Tata McGraw Hill Publication.

REFERENCE BOOKS:

1. Behrouz A. Forouzan and D. Mukhopadhyay, Cryptography & Network Security, TMH.
2. William Stallings, Cryptography and Network Security – Principle & Practice, Pearson.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Real-time use cases and applications of cryptography.

POs met through Gaps in the Syllabus – PO2, PO3 and PO5

Topics beyond syllabus/ Advanced topics/ Design

1. Industry based use-case.



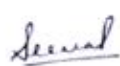
Dr. Archana
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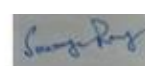
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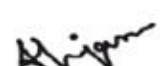
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

POs met through Topics beyond syllabus/ Advanced topics/ Design–PO5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
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In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
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CO1	3	1	1	1	2	2	1	1	1	2	1	2	3	1	1
CO2	3	3	3	3	2	2	2	2	2	2	2	3	3	3	2
CO3	3	3	3	3	2	2	2	2	2	2	2	3	3	3	2
CO4	3	2	2	2	2	2	1	1	1	2	1	2	3	1	1
CO5	3	2	2	3	2	2	1	1	2	2	1	3	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

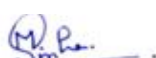
1:Slight(Low) 2:Moderate (Medium)3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

CD Code	CourseDeliveryMethods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD5, CD6, CD9
CD3	Seminars	CO3	CD1,CD2,CD5, CD6, CD9
CD4	Mini Projects/Projects	CO4	CD1,CD3,CD7, CD8
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,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		



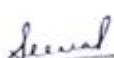
Dr. Archana
Bhatnagar



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Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



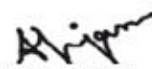
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CourseCode		: CA25437
CourseTitle		: DATA SECURITY
Pre-requisite(s)		:
Co-requisite(s)		: DataSecurityLab
Credits:3	L:3	T:0 P:0

Class schedule per week

03

Class

: BCA

Semester/Level

: VIII/4

Branch

: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Able to understand fundamentals of cryptography and its application to network security.
B.	Able to understand email security, PEM&S/MIME, PGP, and Firewalls.
C.	Understand network security threats, security services, and countermeasures.
D.	Acquire background on hash functions, authentication, firewalls, and intrusion detection techniques.
E.	Understand vulnerability analysis of network security and able to be introduced to new developing security features.

Course Outcomes

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

CO1	Identify state-of-the-art and open problems in network security.
CO2	Analyze all relevant aspects of security in networks like email security, PEM& S/MIME, PGP, and Firewalls.
CO3	Assess the impact of modes of operation and problems in the network.
CO4	Summarize developing security features in networking systems and Realtime communication security.
CO5	Design of secure system and applications.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module- I Introduction , Security Concepts, Challenges, Security Architecture, Security attacks, security.	8
Module- II Error detecting/correction: Block Codes, Generator Matrix, Parity Check Matrix, Minimum distance of a Code, Error detection and correction, Standard Array and syndrome decoding, Hamming Codes.	8
Module- III Cryptography: Encryption, Decryption, Substitution and Transposition, Confusion and diffusion, Symmetric and Asymmetric encryption, Stream and Block ciphers, DES, cryptanalysis. Public-key cryptography, Diffie-Hellman key exchange, man-in-the-middle attack, Digital signature, Steganography, Watermarking.	8
Module- IV	8

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Ray

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Malicious software: Types of malware (viruses, worms, Trojan horses, rootkits, bots), Memory exploits - Buffer overflow, Integer overflow.	
Module– V Security in Internet-of-Things: Security implications, Mobile device security - threats and strategies, Email mailsecurity, PEM&S/MIME, PGP, Firewalls– Design and Types of Firewalls, Personal Firewalls.	8

TEXT BOOKS:

1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
2. Cryptography and Network Security Principles and Practice, Fourth or Fifth Edition, William Stallings, Pearson.
3. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.

REFERENCE BOOKS:

1. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

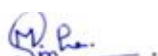
Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

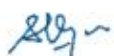
2: Moderate (Medium) 3: Substantial (High)



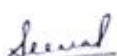
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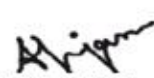
(Dr. Shree Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

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	CO1	CD1,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD8,CD9
CD3	Seminars	CO3	CD1,CD2,CD5
CD4	Miniprojects/Projects	CO4	CD1,CD5,CD8, CD9
CD5	Laboratory experiments/teaching aids	CO5	CD1,CD2,CD9
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self-learning, such as the use of NPTEL materials and internet		
CD9	Simulation		

CourseCode		: CA25438
CourseTitle		: DATASECURITYLAB
Pre-requisite(s)		:
Co-requisite(s)		: DataSecurity
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

: BCA

Semester/Level

: VIII/4

Branch

: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Understand the principles of web security and guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.
B.	Exhibit knowledge to secure corrupted systems, protect data and secure computer networks in an organization.
C.	Understand network security threats, security services, and counter measures.
D.	Acquire background on hash functions, authentication, firewalls, intrusion detection techniques.
E.	Have the ability to compare merits and demerits of techniques and take decisions while securing a network.

Course Outcomes

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

CO1	Analyse and evaluate the Cybersecurity needs of an organization.
CO2	Analyse all relevant aspects of security in networks like email security, PEM& S/MIME, PGP, and Firewalls.
CO3	Measure the performance and troubleshoot cybersecurity systems.
CO4	Summarised developing security features in networking systems.
CO5	Implementation of Secure system applications.

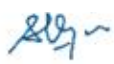
Syllabus



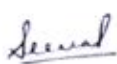
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Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



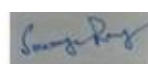
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Dr. Soumya
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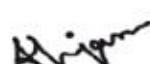
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

List of Programs as Assignments:

1. Implement the error-correcting code.
2. Implement the error detecting code.
3. Implement Caesar cipher substitution operation.
4. Implement monoalphabetic and polyalphabetic cipher substitution operation.
5. Implement Playfair cipher substitution operation.
6. Implement hill cipher substitution operation.
7. Implement the rail fence cipher transposition operation.
8. Implement row transposition cipher transposition operation.
9. Implement the product cipher transposition operation.
10. Illustrate the ciphertext-only and known-plaintext attacks.
11. Implement a stream cipher technique.

TEXT BOOKS

1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
2. Cryptography and Network Security Principles and Practice, Fourth or Fifth Edition, William Stallings, Pearson.

REFERENCE BOOK

1. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.
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Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day-to-day performance	30
Exam Evaluation performance	30

In Direct Assessment

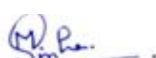
1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between COs and Program Outcomes

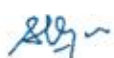
Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2



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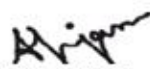
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Dr. Umesh Prasad



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

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, CD8
CD2	Tutorials /Assignments	CO2	CD1, CD8, CD9
CD3	Seminars	CO3	CD1, CD2, CD5
CD4	Mini projects/ Projects	CO4	CD1, CD5, CD8, CD9
CD5	Laboratory experiments/teaching aids	CO5	CD1, CD2, CD9
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self-learning, such as the use of NPTEL materials and internet		
CD9	Simulation		

Course Code		: CA25435
Course Title		BIG DATA ANALYTICS
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week: 03

Class: BCA

Semester/Level: VIII/4

Branch: Bachelor of Computer Applications

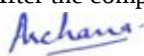
Course Objectives

This course enables the students to:

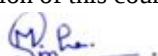
A.	Understand the concepts related to Big Data and Artificial Intelligence for data-driven decision making.
B.	Understand the explosion of big data in organizations and cultural transformation.
C.	Understand Big Data & AI tools & technologies available in market.
D.	Explain the merits and limitations of different Big Data architectures.
E.	Apply these concepts to solve real-world problems.

Course Outcomes

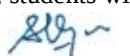
After the completion of this course, students will be able to:



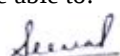
Dr. Archana
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Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
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Dr. Soumya
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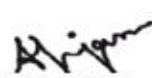
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CO1	Ability to recognize related technologies like AI, IoT, and Digital Reality.
CO2	Ability to define big data & explain the various Vs of Big Data.
CO3	Understand the application of AI for Executives.
CO4	Understand the people component of AI & Big Data.
CO5	Understand the analytical aspects of Big Data.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
ModuleI Big Data and its Explosion in Organizations: Challenges of Data Explosion, CEO's Perspective, Cultural Changes and Strategies for Cultural Transformation, Practising Managers, Practitioner's Perspectives, Formulating the Data Management Strategy Basics of Big Data: History of Big Data, Types of Big Data: Structured, Unstructured and Semi-structured Data, Vs of Big Data, Why Big Data Needs Analysis, Creating Values for Businesses using big data, Types of Big Data Analytics, Steps for Big Data Analytics (BDA), Role of Statistics in BDA, Types of Statistical Analysis, Role of Computer Science in BDA.	6
ModuleII Converging Technologies: Growth and Evolution of Disruptive Technologies, Internet of Things (IoT), Digital Reality Technologies: AR, VR and MR, Cloud, Big Data Storage Platforms (Apache Hadoop-HDFS), CEPH, Big Data on Cloud, Big Data Analytical Tools, Big Data Visualization Tools, Characteristics of Big Data Tools.	6
ModuleIII Basics of Big Data Architecture (BDA): Basic Components of a Big Data Architecture (BDA), Types of Big Data Architecture (BDA): Lambda Architecture, Kappa Architecture, Microservices Architecture, Zeta Architecture, IoT Architecture, Challenges of BDA, Benefits of BDA, Successful BDA Implementations.	6
ModuleIV Big Data Privacy, Security and Ethical Concerns: Privacy Issues, Ensuring Big Data Privacy at Various Stages, Privacy-Preserving Data Publishing (PPDP), Data Anonymization, Data Protection: Roles and Responsibilities, Challenges to Securing Big Data, Ethical Issues and Principles of Big Data Ethics.	6
ModuleV People Component of BDA: People as a Prime Component of BDA, Role of a Data Analyst, Business Analyst, DataEngineer/DataArchitect, Big Data Engineer, DataScientist, DataScientist vs DataManager, Machine Learning(ML) Engineer, Quality Traits: Personality, Professional Quality Traits Applications of Big Data Analytics: Finance Domain, Insurance Sector, HR Domain, Supply Chain Domain, Healthcare Sector, Services Industry.	6

TEXT BOOKS:

1. Big Data Analytics Using Artificial Intelligence Technologies: Transforming Organizations, by Rinku Dixit and Shailee Choudhary, Wiley Publishers.

REFERENCE BOOKS:

1. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses by Michele Chambers, Ambiga Dhiraj, and Michael Minelli



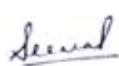
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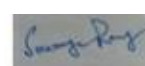
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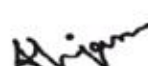
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Dr. Umesh Prasad



Dr. Amrita Priyam

2. Big Data, Black Book, Dream tech Press

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1	2	3	1	2	2	3	2
CO2	3	3	3	1	3	1	1	1	1	2	2	2	2	2	2
CO3	3	3	3	3	3	1	2	2	2	1	1	2	2	3	2
CO4	3	3	3	1	3	1	1	1	1	1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

Correlation Levels 1, 2, or 3 as defined below:

1:Slight(Low)

2:Moderate (Medium)

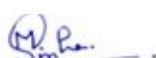
3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1, CO2, CO3, CO4	CD1, CD7, CD8
CD2	Tutorials/Assignments	CO2-CO5	CD1, CD9
CD3	Seminars	CO5	CD1, CD2, CD3
CD4	Mini Projects/Projects	CO5	CD1, CD2
CD5	Laboratory Experiments/Teaching Aids	CO1-CO4	CD1, CD2
CD6	Industrial/Guest Lectures	CO5	
CD7	Industrial Visits/In-plant Training	CO5	



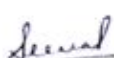
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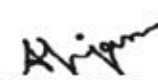
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Dr. Umesh Prasad



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CD8	Self-learning, such as the use of NPTEL Materials and Internets	CO1-CO4	
CD9	Simulation	CO5	

ANNEXURE C HIGH PERFORMANCE COMPUTING SEMESTER VII/VIII

CourseCode		: CA25441
CourseTitle		: MASSIVELY PARALLEL MODELS OF COMPUTATION
Pre-requisite(s)		:
Co-requisite(s)		Massively Parallel Models of Computation Lab
Credits:4	L:3	T:1 P:0

Class schedule per week :04
Class : BCA
Semester/Level : VII/4
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Introduce programming paradigms for parallel computers and the hardware and software used in it.
B.	Explain several programming platforms.
C.	Learn basic techniques of parallel algorithm development and different parallel communication operations.
D.	Address the modeling, analysis, and measurement of program performance.
E.	Describe, implement, and use parallel programming.

Course Outcomes

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

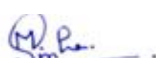
CO1	Understanding of parallel hardware constructs, including instruction-level parallelism.
CO2	Understand the implicit and explicit parallel platform.
CO3	Decompose a given problem into many sub-problems using different decomposition techniques.
CO4	Used different performance metrics for analysis of parallel algorithms.
CO5	Use message passing library for communication among processes running on a parallel platform.

Syllabus

MODULE	(No. of Lecture Hours)
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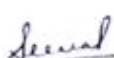
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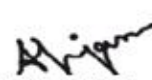
(Dr. Sheel Shalini)



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Dr. Umesh Prasad



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Module1 Introduction: Why parallel computing? Motivating and Scope of Parallel Computing ParallelHardwareandParallelSoftware: Von Neumann architecture, Processes, multitasking, and threads, Modifications to the von Neumann Model, Parallel Hardware, Parallel Software, Input and Output, Performance, Parallel Program Design.	10
Module2 Parallel Programming Platforms: Implicit Parallelism, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.	10
Module3 Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models. Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.	10
Module4 Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs.	10
Module5 Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations. MPI: Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators.	10

TEXT BOOKS:

1. A. Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, 2nd Ed., Pearson, 2011.
2. Peter SPacheco, An Introduction to Parallel Programming, MorganKauFmann, 2011.
3. JosephJa'Ja', An Introduction to Parallel Algorithms, 1st Edition, Addison-Wesley, 1992.

REFERENCE BOOKS:

1. V.RajaramanandC.SivaRamMurthy, Parallel Computers Architecture and Programming, PHI Learning Pvt. Ltd., 2012.
2. J. L. Hennessy and DA Patterson, Computer Architecture: A Quantitative Approach, 4th Ed., Morgan Kaufmann/Els India, 2006.
3. M.J.Quinn, Parallel Computing: Theory and Practice, Tata McGraw-Hill,2002.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
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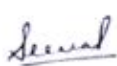
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



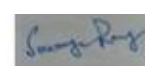
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Sharma



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Dr. Sounak
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Dr. Soumya
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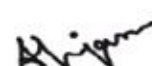
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

First Quiz	10
Mid-Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	1	1	1	2	2	2	3	2	3
CO2	3	3	3	3	3	2	1	1	1	2	3	3	3	2	3
CO3	3	3	3	3	3	2	1	1	1	2	3	3	3	2	3
CO4	3	3	2	3	3	1	1	1	1	2	3	3	3	2	3
CO5	3	3	3	3	3	2	1	1	1	2	3	3	3	2	3

Correlation Levels 1, 2, or 3 as defined below:

1:Slight(Low)

2:Moderate (Medium)

3:Substantial(High)

Mapping between COs and Course Delivery (CD) methods

CD Code	CourseDeliveryMethods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD2,CD5, CD8
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD5, CD8
CD3	Seminars	CO3	CD1,CD2,CD5, CD8
CD4	Mini Projects/Projects	CO4	CD1,CD2,CD5, CD8
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD5, CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25442
CourseTitle		: MASSIVELY PARALLEL MODEL OF COMPUTATION LAB
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:2	L:0	T:0 P:4

Class schedule per week

Class

: 04

Semester/Level

: BCA

Branch

: VII/ 4

: Bachelor of Computer Applications



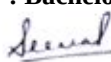
Dr. Archana
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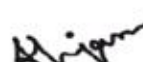
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Course Objectives

This course enables the students to:

A.	Describe the benefits and applications of parallel computing.
B.	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.
C.	Understand principles for parallel and concurrent program design, decomposition of work, task and data parallelism, processor mapping, mutual exclusion, and locks.
D.	Write programs that effectively use parallel collections to achieve performance.
E.	Use large-scale parallel machines to solve problems as well as discuss the issues related to their construction and use.

Course Outcomes

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

CO1	Understand tasks and data-parallel programs.
CO2	Express common algorithms in a functional style and solve them in parallel.
CO3	Analyze a problem, identify, formulate, and use the appropriate computing and engineering requirements to obtain its solution.
CO4	Write a parallel program using OpenMP, CUDA, and MPI programming models.
CO5	Perform analysis and optimization of parallel program.

Syllabus

List of Programs as Assignments:

1. Write a program that uses MPI and has each MPI process print 'Hello world from process iofn' using the rank in MPI_COMM_WORLD for i and the sizeof MPI_COMM_WORLD for n.
2. Write a parallel program to print any input message supplied by user.
3. Write a parallel program to add two one dimensional arrays of size 'n'.
4. Write a parallel program to add two matrices of order n*n.
5. Write a parallel program to multiply two matrices.
6. Write a parallel program to multiply a matrix of order nxn by a vector of size n.
7. Write a parallel program to count the no. of vowels in a text.
8. Write a parallel program to find the largest element of n elements.
9. Write a parallel program to count no. characters, words and lines in a file.
10. Write a parallel program to find factorial value of an integer.
11. Write a parallel program to find the transpose of a given matrix.
12. Write a parallel program to implement ring topology.
13. Write a parallel program to find the largest and these cond largest from a list of elements, considering minimum no. of comparisons.
14. Write a parallel program to sort elements, using any sorting technique.
15. Write a parallel program to solve a set of linear equations using gauss elimination method.
16. Write a parallel program to find the inverse of a given matrix of n*n order.
17. Write a parallel program to find minimal path (minimal cost) in an undirected graph.
18. Write a parallel program to find roots of an equation using N-R method.

TEXT BOOKS:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Introduction to Parallel Computing (2nd Edition).

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Paul

Dr. Soumya
Ray

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Dr. Umesh Prasad

Dr. Amrita Priyam

2. John Cheng, Max Grossman, and TyMc Kercher, Professional CUDAC PrProgramming, 1st Edition 2014.

REFERENCE BOOKS:

1. Barbara Chapman, Gabriele Jost, and RuudvanderPas, Using OpenMP: Portable Shared Memory Parallel Programming, 2007.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

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



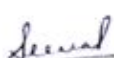
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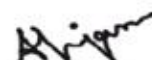
(Dr. Shree Shalini)



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Dr. Umesh Prasad



Dr. Amrita Priyam

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (Pos)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	1	1	1	1	1	1	1	2	1	2	2	1	1	1
CO2	2	3	3	2	2	1	2	1	1	1	2	2	3	1	2
CO3	2	3	3	2	2	1	2	1	1	1	2	2	3	1	2
CO4	2	3	3	2	2	1	2	1	1	1	2	2	3	1	2
CO5	3	3	3	3	3	2	1	1	2	2	2	2	3	1	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 Code	CourseDeliveryMethods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD6
CD2	Tutorials/Assignments	CO2	CD1,CD6,CD7
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CD1,CD3,CD6, CD7
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2,CD7
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25439
CourseTitle		ADVANCED COMPUTER ARCHITECTURE
Pre-requisite(s)		Computer Fundamentals & Digital Logic Design
Co-requisite(s)		:
Credits:4	L:3	T:1 P:0

Class schedule per week

:04 Class :BCA

Semester/Level

: VII/4

Branch

: Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Provide knowledge of Computer Architecture.
B.	Employ knowledge of various Digital Logic Circuits, Data Representation, Register and Processor level Design, and Instruction Set architecture.

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C.	Develop the logical ability to determine which hardware blocks and control lines are used for specific instructions.
D.	Understand memory organization, I/O organization, and its impact on computer cost/performance.
E.	Know merits and pitfalls in computer performance measurements.

Course Outcomes

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

CO1	The impact of instruction set architecture on the cost-performance of computer design.
CO2	Explain Digital Logic Circuits, Data Representation, Register and Processor level Design, and Instruction Set architecture.
CO3	Solve problems related to computer arithmetic and determine which hardware blocks and control lines are used for specific instructions.
CO4	Design a pipeline for consistent execution of instructions with minimum hazards.
CO5	Explain memory organization, I/O organization, and their impact on computer cost/performance.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module1 Introduction Digital Logic Design: Axioms and Laws of Boolean algebra, Reduction of Boolean expressions, conversion between canonical forms, Karnaugh map (4 variable), Half Adder, Full Adder, Parallel Parity Bit Generator, Checker Circuit, Decoder, Encoder, Multiplexer, RAM, ROM, Memory Organization, Sequential Circuits, State transistors, Flip-flop, RS, JK, D-Latch, Masterslave.	10
Module2 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.	10
Module3 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.	10
Module4: 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.	10
Module5: Input Output: 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 Modelling.	10

TEXT BOOKS:



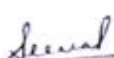
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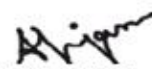
(Dr. Sheel Shalini)



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1. Hamacher Carl, et.al, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, New Delhi.
2. Mano M. Morris, "Computer System Architecture", Revised 3rd Edition, Pearson Education.

REFERENCE BOOKS:

1. Patterson David A., "Computer Organization and Design: The Hardware/Software Interface", 5th Edition.

**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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	2	3	2	1	1	2	1	2	3	3	2
CO2	3	3	2	3	3	3	2	1	1	1	1	2	3	2	2
CO3	3	3	3	3	3	2	1	1	1	2	1	2	3	3	2
CO4	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3
CO5	3	3	3	3	3	3	3	1	1	2	1	2	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low)

2: Moderate (Medium)

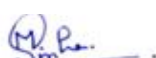
3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

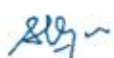
CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD6
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD6
CD3	Seminars	CO3	CD1, CD2, CD3,
CD4	Mini Projects/Projects	CO4	CD1, CD3,
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD3, CD4, CD5



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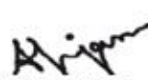
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CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25443
CourseTitle		: HIGH PERFORMANCE CLUSTER COMPUTING
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week

03

Class

: BCA

Semester/Level

: VII/ VIII/ 4

Branch

: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Gain a solid understanding of the principles and concepts underlying high-performance cluster computing, including parallel processing, fault tolerance, and scalability.
B.	Explore the architecture and components of high-performance clusters, including hardware, network topologies, and cluster management software.
C.	Learn parallel and distributed programming models, such as MPI and frameworks like Hadoop and Spark, to effectively harness the computing power of clusters.
D.	Develop practical skills in deploying and managing high-performance clusters, including configuration, installation, resource allocation, and job scheduling.
E.	Discover performance optimization techniques specific to cluster computing, such as profiling, load balancing, and parallel algorithm optimization, to maximize the efficiency and speed of cluster-based computations.

Course Outcomes

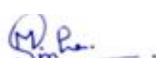
After the completion of this course, students will be able to:

CO1	Demonstrate a comprehensive understanding of the principles and concepts underlying high-performance cluster computing.
CO2	Design and implement parallel and distributed algorithms to leverage the computing power of clusters effectively.
CO3	Configure, deploy, and manage high-performance clusters, including hardware, software, and networking components.
CO4	Utilize parallel programming models and frameworks to develop efficient cluster-based applications.
CO5	Analyze and optimize the performance of cluster-based computations through techniques such as load balancing, task scheduling, and resource allocation.

Syllabus



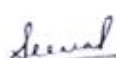
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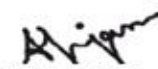
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MODULE	(No. of Lecture Hours)
Module1 What is cluster computing? Approach to parallel computing, how to achieve low-cost parallel computing through clusters, definition, and architecture of a cluster, and what functionality a cluster can offer? Categories of clusters.	8
Module2 Clustermiddleware: an introduction, levels and layers of single system image (SSI), cluster middleware design objectives, resource management and scheduling.	8
Module3 Cluster programming environment and tools, threads, message passing system, PVM, distributed shared memory, parallel debugger, performance analysis tools, Cluster Administrative tools.	8
Module4 Networking, p, and I/O for clusters, networks, and interconnection/ switching devices, design issues in interconnection networking/ switching, HiPPI, ATM, Myrinet, memory channel, and Gigabit Ethernet.	8
Module5 Cluster technology for high availability: Highly available clusters, highly available parallel computing, types of failure and errors, cluster architecture and configurations for high availability, faults, and error detection.	8

TEXT BOOKS:

1. C.S.R.Prabhu, Grid and Cluster Computing, PHI Learning, New Delhi.

REFERENCE BOOKS:

1. Rajkumar Buyya, High-Performance Cluster Computing: Architectures and Systems, Volume 1, Prentice Hall PTR, 2007
2. Richard S. Morrison, Cluster Computing Architectures, Operating Systems, Parallel Processing & Programming Languages.

Gaps in the Syllabus (to meet Industry/ Profession requirements)

1. Limited coverage of containerization and orchestration technologies for cluster deployment and management.
2. Inadequate exposure to distributed storage systems and data processing frameworks for handling large-scale data workloads in industry.

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

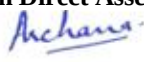
POs met through Topics beyond syllabus /Advanced topics/ Design

Course Outcome(CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment



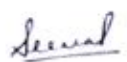
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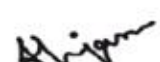
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1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	1	2	2	3	1	2	2	3	1	2	2	3	1
CO2	2	3	2	3	2	3	1	3	1	3	2	3	1	3	2
CO3	1	3	3	4	2	3	3	4	2	2	3	4	2	3	2
CO4	4	4	3	3	3	4	3	3	3	4	3	3	3	4	3
CO5	3	3	2	2	4	3	2	2	4	3	2	1	4	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 Code	CourseDeliveryMethods	Course Outcome	Course Delivery Method Used
CD1	Lecture using Boards/LCD Projectors	CO1	CD1,CD2
CD2	Tutorials/Assignments	CO2	CD1,CD2
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CD1,CD4
CD5	Laboratory Experiments/TeachingAids	CO5	CD1,CD3
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25445
CourseTitle		: GRID COMPUTING
Pre-requisite(s)		:
Co-requisite(s)		Grid Computing Lab
Credits:3	L:3	T:0 P:0

Class schedule per week

03

Class: BCA

Semester/Level: VIII/4

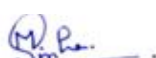
Branch: Bachelor of Computer Applications

CourseObjectives

This course enables the students to:



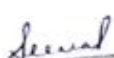
Dr. Archana
Bhatnagar



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Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
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Dr. Soumya
Ray



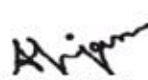
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

A.	Understand the elements of distributed computing and core aspects of Grid computing.
B.	Understand the concepts and aspects of virtualization and the application of virtualization technologies in a Grid computing environment.
C.	Understand the architecture and concept of the Grid.
D.	Understand the key security, compliance, and confidentiality challenges in Grid computing.
E.	Understand the commonly used Grid programming platforms, tools, and simulators.

Course Outcomes

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

CO1	Recall the various aspects of Grid computing and distributed computing
CO2	Understand the specifics of virtualization and Grid computing architectures.
CO3	Develop and deploy a Grid application.
CO4	Evaluate the security and operational aspects in Grid system design, identify and deploy appropriate design choices when solving real-world Grid computing problems.
CO5	Identify and deploy appropriate design choices when solving real-world Grid computing problems.

SYLLABUS

MODULE	(No. of Lecture Hours)
Module1 Introduction: Motivation; Definitions of Grid Computing; Evolution of the Grid; Differences with similar efforts (Meta, cluster, heterogeneous, Internet); Examples of usage; Research possibilities/scope in Grid Computing; Thrust areas. High Performance computing: PACX-MPI, MPI-Connect, P-MPI; I-WAY experiment.	10
Module2 Earliest Grid Tools/Projects: Condor Part1, Part2; Globus Part1, Part2; Nimrod.	8
Module3 Grid Basics-Technologies/Challenges: Security-Different models: SSL, Kerberos, SASL, GSI, Others; Information Services: NWS.	7
Module4 HPC and Grids: Scheduling HPC applications in Grids: AppLeS, Scheduling Parameter sweep applications, Metascheduling Part1, Part2; Grid RPC mechanisms - Part1, Part2; Rescheduling; Computational Steering, Scientific visualization of Grid applications; Grid Applications - Everywhere and Cactus experiments; Data management: Data distribution, Redistribution, Data cache maintenance.	10
Module5 Recent Efforts: Grid economy; Grid simulation-SimGrid, GridSim, MicroGrid; Grid standards and forums - OGSA, GGF.	5

TEXT BOOKS:

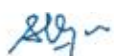
1. **Ian Foster, Carl Kesselman;** The Grid: Blueprint for a New Computing Infrastructure; Morgan Kaufmann Publishers; 2nd edition, 2003.
2. **Francine Berman, Geoffrey Fox, Tony Hey;** Grid Computing: Making the Global Infrastructure a Reality; John Wiley & Sons, 2003.



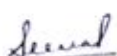
Dr. Archana
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Sinha



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Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
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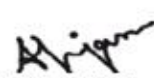
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

REFERENCE BOOKS:

1. Jarek Nabrzyski, Jennifer M. Schopf, Jon Weglarz; Grid Resource Management: State of the Art and Future Trends; Kluwer Academic Publishers, 2003.

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 & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COS and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	2
CO2	3	3	3	1	3	1	1	1				2	2	3	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	3	2	3
CO5	3	3	3	3	3	1	1	1	1	1	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 COS and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD9
CD3	Seminars	CO3	CD1, CD2, CD3
CD4	Mini Projects/Projects	CO4	CD1, CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2
CD6	Industrial/Guest Lectures		

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Dr. Umesh Prasad

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CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25447
CourseTitle		: INTRODUCTION TO QUANTUM COMPUTING
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week

03

Class

: BCA

Semester/Level

: VIII/4

Branch

: Bachelor of Computer Applications

CourseObjectives

This course enables the students to:

A.	Understand the classical computer.
B.	Understand the concepts and aspects of quantum entanglement.
C.	Understand the concept of Quantum Teleportation.
D.	Understand the concept of quantum cryptography.
E.	Understand the commonly used Quantum programming platforms, tools, and simulators.

CourseOutcomes

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

CO1	Understand the supremacy of Quantum computer.
CO2	Recall the various aspects of Quantum computing Platform.
CO3	Understand the specifics of Quantum Computing Parallelism.
CO4	Develop and deploy a Quantum Computing application.
CO5	Evaluate the concept of Quantum cryptography.

SYLLABUS

MODULE	(No. of Lecture Hours)
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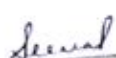
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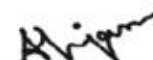
(Dr. Shree Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Module1 QuantumMechanicalPreliminaries: Origin of Quantum Mechanisms and Its Scope. Two Fundamental Ideas of Quantum Mechanics: Idea of Discreteness, Idea of Wave-Particle Duality. Uncertainty Relations and Results ensuing Therefrom Mathematical Preliminaries: Introduction, Operator Concept: Linear operators, Hermitian operator, and Eigenvalue of problem, Important Theorems on Operators, Basic Postulates of Quantum mechanics. Bra-ket notations: Eigen states and eigenvalues of operators. Principle of Superposition of States and Interference of Transmission Amplitudes Measurement in Quantum Mechanics. Matrix representation of operators and eigenstates.	8
Module2 QuantumModelofComputation: Classical Bit, Quantum Bits, Mathematical Foundation of Quantum Bit, Dirac Notation for Quantum Bit, Matrix Representation of Superposition States of Qubit, The Bloch Sphere, Myth About a Single Qubit, Quantum Measurement Postulate, Bipartite System and Multipartite System.	8
Module-3 QuantumCircuitModel: Turing Machine, Quantum Turing Machine, Quantum Circuit, Introduction of QuantumGates: SingleQubitQuantumGates, QuantumNOTGate, QuantumZGate, QuantumY Gate, Quantum Hadamard Gate, Phase Gate. T Gate, Relationship of Single Qubit Quantum Gates and Pauli Matrices, Representation of Single Qubit Quantum Gates on Bloch Sphere, Implementation of Single Quantum Gate Using Python Programming Language, Overview of Qiskit.	8
Module4 Quantum Supremacy Mathematical Background, Visual Representation of Multipartite State, Multiple Qubit, QuantumGates-ControlledNotGate: SWAPGate, ControlledZGate, Toffoli Gate. Matrix Representation of Quantum Circuit, Half Adder, ORACLE, No Cloning Theorem, Quantum Parallelism.	8
Module5 ApplicationofQuantumComputing SimpleQuantumAlgorithms-Shor's Algorithm, QuantumFourierTransformation, Quantum Search Algorithms. Physical Realization of Quantum Computers, Bell State, Quantum Teleportation.	8

TEXT BOOKS:

1. **Michael A.Nielsen, Isaac L. Chuang;** Quantum Computation and Quantum Information; Cambridge University Press; 10th edition, 2010.

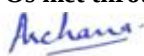
REFERENCE BOOKS:

1. **Nikhil Ranjan Roy;** Introduction to Quantum Mechanics; Vikash Publishing House Pvt Ltd, 1st Edition, 2015.

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

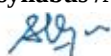
POs met through Topics beyond syllabus /Advanced topics/ Design



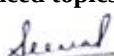
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Bhatnagar



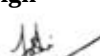
Dr. Madhavi
Sinha



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Vijayvargiya



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Sharma



Mr. Anurag
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Dr. Sounak
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Dr. Soumya
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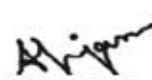
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Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Course Outcome(CO)AttainmentAssessment Tools&EvaluationProcedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	2
CO2	3	3	3	1	3	1	1	1				2	2	3	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	3	2	3
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	2	3

Correlation Levels 1,2 or 3 as defined below:

1: Slight (Low)

2: Moderate (Medium)

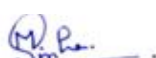
3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD7,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD9
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internet		
CD9	Simulation		



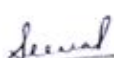
Dr. Archana
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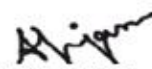
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Dr. Umesh Prasad



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CourseCode		: CA25444
CourseTitle		CLUSTER COMPUTING LAB
Pre-requisite(s):		
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

: BCA

Semester/Level

: VIII/ 4

Branch

: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Develop practical skills in setting up and configuring a high-performance cluster environment for distributed computing tasks.
B.	Gain hands-on experience in utilizing cluster computing frameworks like Apache Spark for distributed data processing and analytics.
C.	Learn to design and implement parallel algorithms using cluster computing techniques to solve computationally intensive problems efficiently.
D.	Understand load balancing and task scheduling strategies to optimize resource utilization and improve overall cluster performance.
E.	Enhance proficiency in performance analysis, profiling, and optimization techniques for cluster-based applications.

Course Outcomes

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

CO1	Demonstrate proficiency in setting up and configuring a high-performance cluster environment for efficient distributed computing tasks.
CO2	Apply cluster computing frameworks like Apache Spark to perform distributed data processing and analytics tasks effectively.
CO3	Design and implement parallel algorithms using cluster computing techniques to solve complex computational problems with improved performance.
CO4	Evaluate and optimize the performance of cluster-based applications through performance analysis, profiling, and tuning techniques.
CO5	Develop practical skills in load balancing, task scheduling, and resource management for optimal utilization of cluster resources.

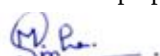
Syllabus

List of Programs as Assignments:

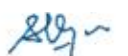
1. Installing and Configuring PySpark, Apply any standalone program.
2. Use the Python library Charm4py for cluster computing
3. Use Dask (a library for parallel computing in Python)
Create a Random array
Create Random Data
Create Random Dataframe
Create simple functions
Parallelize Normal Python code
4. Study and use function dispy (Distributed and Parallel Computing)
5. Parallel Python and for parallel execution of Python code on SMP (systems with multiple processors) and clusters (computers connected via a network).
6. Use of function mpi4py



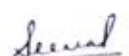
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
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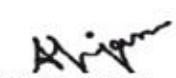
(Dr. Shree Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Createenv andinstall scipy
Installandtest mpi4py
Parallelizing the map method

TEXT BOOKS:

1. Bill Chambers and Matei Zaharia, Spark: The Definitive Guide, Big Data Processing Made Simple, O'Reilly Media, Inc.
2. Francesco Pierfederici, Distributed Computing with Python, PACKT Publishing.
3. C.S.R.Prabhu, Grid and Cluster Computing, PHI Learning, New Delhi.

REFERENCE BOOKS:

1. Rajkumar Buyya, High-Performance Cluster Computing: Architectures and Systems, Volume 1, Prentice Hall PTR, 2007
2. RichardS.Morrison, Cluster Computing Architectures, Operating Systems, Parallel Processing & Programming Languages.
3. <https://wiki.python.org/moin/ParallelProcessing>

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Cloud Computing Integration
2. BigDataProcessing: Incorporating a component on big data processing frameworks like Apache Hadoop or Apache Flink

POs met through Gaps in the Syllabus:1,3,4,12

Topics beyond syllabus/Advanced topics/ Design

1. Containerization and Orchestration: Introducing containerization technologies like Docker and container orchestration platforms like Kubernetes to enable students to deploy and manage cluster computing applications in a containerized environment.
2. DistributedMachineLearning: Exploring distributed machine learning frameworks such as TensorFlow or PyTorch in the context of cluster computing.

POs met through Topics beyond syllabus/ Advanced topics/ Design-1, 2, 4, 7

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

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Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	2	3	1	2	3	1	2	3	1	2	3	1	3	3	1
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	2	2	1	2	2	1	3	2	1	2	2	1
CO4	1	2	3	3	2	3	1	2	3	1	2	3	1	2	3
CO5	2	1	3	2	1	3	2	1	3	2	1	3	2	1	3

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 Code	CourseDeliveryMethods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD3,CD4,CD5
CD2	Tutorials/Assignments	CO2	CD2,CD5
CD3	Seminars	CO3	CD3,CD4,CD5
CD4	Mini Projects/Projects	CO4	CD3,CD4,CD8
CD5	Laboratory Experiments/Teaching Aids	CO5	CD3,CD4
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning, such as the use of NPTEL Materials and Internet		
CD9	Simulation		

CourseCode		: CA25446
CourseTitle		GRID COMPUTING LAB
Pre-requisite(s)		:
Co-requisite(s)		: Grid Computing
Credits:2	L:0	T:0 P:4

Class schedule per week

04

Class

: BCA

Semester/Level

: VIII/4

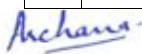
Branch

: Bachelor of Computer Applications

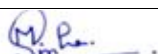
Course Objectives

This course enables the students to:

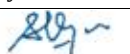
A.	UnderstandtheelementsofGridcomputingToolkit.
B.	Understand the concepts of virtualization in a grid environment.
C.	Understand the architecture Grid Computing Toolkit.
D.	Understand the key security challenges in the Grid Toolkit.
E.	Understand the commonly used Gridsimulator.



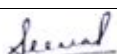
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Bhatnagar



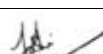
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Dr. Soumya
Ray



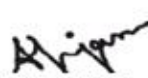
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Course Outcomes

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

CO1	Recall the various aspects of Grid computing.
CO2	Understand the concepts of virtualization in a grid environment.
CO3	Understand the specifics of Grid computing architectures.
CO4	Develop and deploy the Grid Toolkit.
CO5	Deploy appropriate design choices when solving real-world Grid computing problems.

SYLLABUS

List of Programs as Assignments:

Use Globus Toolkit to do the following:

1. Develop a new Web Service for Calculator.
2. Develop a new OGSA-compliant Web Service.
3. Using Apache Axis develop a Grid Service.
4. Develop applications using Java or C++ Grid APIs.
5. Develop secure applications using basic security mechanisms available in Globus Toolkit.
6. Develop a Grid portal, where users can submit a job and get the result.
7. Find procedure to run the virtual machine of different configuration.
8. Check how many virtual machines can be utilized at a particular time.
9. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
10. Install a C++ compiler in the virtual machine and execute a sample program.
11. Show the virtual machine migration based on the certain condition from one node to the other.
12. Find procedure to install storage controller and interact with it.
13. Find procedure to set up the one node Hadoop cluster.
14. Mount the one-node Hadoop cluster using FUSE.
15. Write a program to use the APIs of Hadoop to interact with it.
16. Write a word count program to demonstrate the use of Map and Reduce tasks.

TEXT BOOKS:

1. **Ian Foster, Carl Kesselman**; The Grid: Blueprint for a New Computing Infrastructure (2nd edition); Morgan Kaufmann Publishers; 2nd edition, 2003.
2. **Francine Berman, Geoffrey Fox, Tony Hey**; Grid Computing: Making the Global Infrastructure a Reality; John Wiley & Sons, 2003.

REFERENCE BOOKS:

1. Jarek Nabrzyski, Jennifer M. Schopf, Jon Weglarz; Grid Resource Management: State of Art and Future Trends; Kluwer Academic Publishers, 2003.

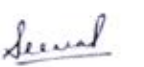
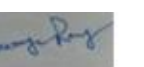
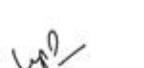
Gaps in the Syllabus (to meet Industry/ Profession requirements) POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

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

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

						
Dr. Archana Bhatnagar	Dr. Madhavi Sinha	Dr. Shripal Vijayvargiya	Mrs. Seema Sharma	Mr. Anurag Joshi	Dr. Sounak Paul	Dr. Soumya Ray
						
(Dr. Sheel Shalini)	Dr. P.S. Bishnu	Dr. Umesh Prasad	Dr. Amrita Priyam			

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
ExamEvaluationperformance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	2
CO2	3	3	3	1	3	1	1	1				2	2	3	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	3	2	3
CO5	3	3	3	3	3	1	1	1	1	1	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 COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD9
CD3	Seminars	CO3	CD1, CD2, CD3
CD4	Mini Projects/Projects	CO4	CD1, CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code		: CA25448
Course Title		QUANTUM COMPUTING LAB
Pre-requisite(s)		:
Co-requisite(s)		Introduction to Quantum Computing
Credits: 2	L: 0	T: 0 P: 4

Class schedule per week

Class

04

: BCA

Dr. Archana Bhatnagar

Dr. Madhavi Sinha

Dr. Shripal Vijayvargiya

Mrs. Seema Sharma

Mr. Anurag Joshi

Dr. Sounak Paul

Dr. Soumya Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Semester/Level
Branch

: VIII/4
: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the elements of Quantum Computing Toolkit.
B.	Understand the concepts of Quantum Supremacy.
C.	Understand the architecture of Quantum Computing Toolkit.
D.	Understand the application of Quantum Computing.
E.	Understand the commonly used Quantum Computing simulator.

Course Outcomes

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

CO1	Understand the concepts of Quantum Supremacy.
CO2	Recall the various aspects of quantum computing.
CO3	Understand the concept of Quantum Computing Algorithms.
CO4	Develop and deploy a Quantum Computing Application on Qiskit.
CO5	Deploy appropriate design choices when solving real-world quantum computing problems.

SYLLABUS

List of Programs as Assignments:

Use IBMQiskit or equivalent and do the following using the Python Programming Language:

1. Write a program to display a "Welcome" Message.
2. Write a program to obtain maximum between two numbers.
3. Write a program to obtain minimum between two numbers.
4. Write a program to obtain factorial of a positive number.
5. Write a program to generate the first n natural numbers.
6. Write a program to check whether a number is even or not.
7. Write a program to generate multiplication table of a user-defined number.
8. Write a program to check whether an input number is positive or not.
9. Write a program to obtain area of a rectangle. Take length and breadth of rectangle from user.
10. Write a program to obtain area of a circle. Take the radius of the circle from the user.

TEXT BOOKS:

1. Michael A. Nielsen, Isaac L. Chuang; Quantum Computation and Quantum Information; Cambridge University Press; 10th edition, 2010.

REFERENCE BOOKS:

1. James L. Weaver, Frank J. Harkins; Qiskit Pocket Guide: Quantum Development with Qiskit; O'Reilly, 1st Edition, 2022.

Gaps in the Syllabus (to meet Industry/Profession requirements) POs met through Gaps in the Syllabus

Topics beyond the syllabus/Advanced topics/Design

POs met through Topics beyond syllabus /Advanced topics/ Design

Dr. Archana
Bhatnagar

Dr. Madhavi
Sinha

Dr. Shripal
Vijayvargiya

Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Shree Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Vivavoce	20
Daytodayperformance	30
Exam Evaluation performance	30

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	2
CO2	3	3	3	1	3	1	1	1				2	2	3	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	3	2	3

Course Delivery 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 Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1,CD7,CD8
CD2	Tutorials/Assignments	CO2	CD1,CD9
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini Projects/Projects	CO4	CD1,CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1,CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internet		
CD9	Simulation		

Course Code		: CA25449
Course Title		PARALLEL ALGORITHM AND COMPUTATION
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3 L:3	T:0	P:0

Class schedule per week

03

Class

: BCA

Semester/Level

: VIII/4

Branch

: Bachelor of Computer Applications

Achana

Dr. Archana
Bhatnagar

Simha.

Dr. Madhavi
Sinha

2021 ~

Dr. Shripal
Vijayvargiya

Several

Mrs. Seema
Sharma

12

Mr. Anurag
Joshi



Dr. Sounak
Paul

Sangeeta Ray

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr.Umesh Prasad

Dr. Amrita Priyam

Course Objectives

This course enables the students to:

A.	Learn of basics of parallel computing.
B.	Learn about the application of the parallel computing in today's world.
C.	Learn basic techniques of parallel algorithms.
D.	Learn SIMD and MIMD algorithms.
E.	Learn about parallel algorithms for multiprocessors.

Course Outcomes

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

CO1	Understand the concept of Parallel Computing.
CO2	Know Application of Parallel processing and Data Parallelism.
CO3	Understand the Performance Evaluation of Parallel Computers.
CO4	Learn sorting and searching using parallel algorithm.
CO5	Test different parallel algorithms.

Syllabus

MODULE	(No. of Lecture Hours)
Module 1 Definition Introduction to Parallel Computing, Basic Concepts about Programs / Process / Thread Concurrent Function, Parallel Execution. Parallel Processing Terminology- Contrasting Pipelining and Data Parallelism, Control Parallelism, Scalability, Control-Parallel Approach, Data-Parallel Approach with I/O.	8
Module 2 Granularity Potential of Parallelism, Level of Parallel Processing, Applications of Parallel Processing, Scientific Applications, Database Query, conserving applications, AI applications.	8
Module 3 PRAM Algorithm, Message Passing Programming, Shared memory, Message Passing Libraries, Data Parallel Programming, Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging two sorted lists.	8
Module 4 2D Mesh SIMD Model- Parallel Algorithms for Reduction- Prefix Computation - Selection- Odd-Even Merge Sorting- Matrix Multiplication, Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort.	8
Module 5 Elementary Parallel Algorithm: Classifying MIMD Algorithm, Reduction. Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors.	8

TEXT BOOKS:

1. Michael J. Quinn, "Parallel Computing: Theory & Practice", Tata McGraw-Hill Edition, Second edition, 2017.
2. V Rajaraman, C Siva Ram Murthy, "Parallel computers- Architecture and Programming ", PHI learning, 2016.

Dr. Archana
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Mrs. Seema
Sharma

Mr. Anurag
Joshi

Dr. Sounak
Paul

Dr. Soumya
Ray

(Dr. Sheel Shalini)

Dr. P.S. Bishnu

Dr. Umesh Prasad

Dr. Amrita Priyam

REFERENCE BOOKS:

1. M Sasikumar, Dinesh Shikhare and P Ravi Prakash, " Introduction to Parallel Processing", PHI learning, 2013.
2. H.Attiya & J. Welch- Distributed Computing- Fundamentals, Simulations and Advanced Topics, 2nd Edn., Wiley India Publication, New Delhi, 2006.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI,1989.

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

1. Classificationbasedgrainsizeandinstructionlevelparallelism
2. Networkdesignissuesofinterconnected network

POs met through Gaps in the Syllabus**Topics beyond the syllabus/Advanced topics/Design****POs met through Topics beyond syllabus /Advanced topics/ Design****Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure****Direct Assessment**

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

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

Mapping between COs and Program Outcomes

Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	2	3	1	1	2	2	3	3	2	3	1	1	2
CO2	3	2	2	3	2	2	2	2	3	2	3	3	2	3	3
CO3	3	3	2	2	1	1	2	2	2	2	2	3	2	3	3
CO4	3	3	2	2	2	2	3	3	2	2	3	3	1	3	3
CO5	3	3	3	2	2	2	2	3	3	3	3	3	2	3	3

Correlation Levels 1, 2 or 3 as defined below:

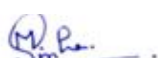
1:Slight(Low) 2:Moderate (Medium) 3:Substantial(High)

Mapping Between COS and Course Delivery (CD) Methods

CD Code	Course Delivery Methods	Course Outcome	Course DelEvery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD3
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD5



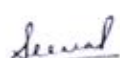
Dr. Archana
Bhatnagar



Dr. Madhavi
Sinha



Dr. Shripal
Vijayvargiya



Mrs. Seema
Sharma



Mr. Anurag
Joshi



Dr. Sounak
Paul



Dr. Soumya
Ray



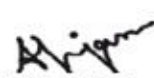
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CD3	Seminars	CO3	CD1, CD2, CD3, CD5
CD4	Mini Projects/Projects	CO4	CD1, CD2, CD3, CD5
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD3, CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self-learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

CourseCode		: CA25451
CourseTitle		: HIGH-PERFORMANCE BIG DATA COMPUTING
Pre-requisite(s)		:
Co-requisite(s)		:
Credits:3	L:3	T:0 P:0

Class schedule per week 03
Class : BCA
Semester/Level : VIII/4
Branch : Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand the principles of High-performance Computing.
B.	Understand the principles of parallel computing.
C.	Apply parallel programming models to real-world problems.
D.	Evaluate the performance of parallel programs.
E.	Select and use appropriate HPC systems and Software.

Course Outcomes

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

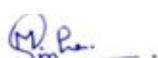
CO1	Understand the principles, challenges, and applications of HPC.
CO2	Apply the different parallel programming models.
CO3	Design algorithms for parallel computation.
CO4	Evaluate the performance of parallel programs.
CO5	Use the different types of HPC software.

Syllabus

MODULE	(No. of Lecture Hours)
Module1 Introduction to HPC: history, applications, and Challenges Parallel architectures: super scalar architectures, multi-core, multi-threaded, server, and cloud.	8
Module2 Parallel Programming Models: MPI, OpenMP, and CUDA Algorithms for parallel computation: load balancing, data partitioning, and communication.	8



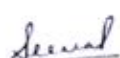
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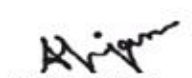
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

Module3 Fundamental design issues in HPC: Load balancing, scheduling, synchronization, and resource management; Operating systems for scalable HPC Performance analysis of parallel algorithms: different metrics, such as execution time, speedup, and efficiency.	8
Module4 HPC systems and architectures: supercomputers, clusters, and cloud computing platforms.	8
Module5 HPC software: different types of HPC software, such as compilers, libraries, and tools	8

TEXT BOOKS:

1. Georg Hager Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, CRC Press.
2. R. Buyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education, 2008.
3. D.Janakiram, Grid Computing, Tata McGraw-Hill,2005.
4. Vipin Kumar, Ananth Grama, Anshul Gupta, George Karypis. Introduction to Parallel Computing (2nd ed.). Pearson India. 2003.

REFERENCE BOOKS:

1. B.Sosinsky, Cloud Computing Bible, Wiley, 2011.
2. B.Wilkinson, Grid Computing: Techniques and Applications, CRC Press,2009.
3. R.Buyya, C.Vecchiola, and S.T.Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Morgan Kaufmann, Elsevier, 2013.

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) AttainmentAssessment Tools&EvaluationProcedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

In Direct Assessment

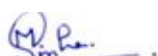
1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between COS and Program Outcomes

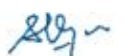
Course outcome	Program Outcomes (POs)												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2	2	1	1	1	2	2	2	3	2	3
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CO3	3	3	3	3	3	2	1	1	1	2	3	3	3	2	3



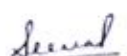
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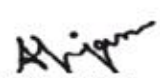
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam

CO4	3	3	2	3	3	1	1	1	1	2	3	3	3	2	3
CO5	3	3	3	3	3	2	1	1	1	2	3	3	3	2	3

Correlation Levels 1, 2 or 3 as defined below:

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Mapping between Cos and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
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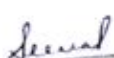
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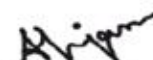
(Dr. Sheel Shalini)



Dr. P.S. Bishnu



Dr. Umesh Prasad



Dr. Amrita Priyam