

St. Xavier's Catholic College of Engineering, Chunkankadai.

AUTONOMOUS COLLEGE AFFILIATED TO ANNA UNIVERSITY

MASTER OF COMPUTER APPLICATIONS CURRICULUM

REGULATIONS – 2022

CHOICE BASED CREDIT SYSTEM

In consonance to the vision of our College,

A Master of Computer Application graduate we form would be a person with optimal human development, i.e. physical, mental, emotional, social and spiritual spheres of personality.

He/she would be also a person mature in relationships, especially knowing how to treat everyone with respect, including persons of complementary gender with equality and gender sensitivity guided by clear and pro-social values.

He would be patriotic and would hold the Indian Constitution and all the precepts it outlays close to his heart and would have a secular spirit committed to safeguard and cherish the multi-cultural, multi-religious and multi-linguistic ethos of Indian Society.

Academically, he/she would be a graduate with a strong Computational knowledge with proficient technical knowledge and skills. He would have enough exposure and experience into the ethos of relevant industry and be industry ready to construct a successful career for himself and for the benefit of the society.

He would have been well trained in research methodology and would have established himself as a researcher having taken up many research projects, with sound ethical standards and social relevance. He would be a person with a passion for technical innovations committed to lifelong learning and research.

He would be well prepared and confident to develop ingenious solutions to the problems people face as an individual and as a team and work for the emancipation of our society with leadership and courage.

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates will be able to:

I.	Apply their computing skills to analyze, design and develop innovative software products to meet the industry needs and excel as software professionals.
II.	To pursue a lifelong development as top class professionals, willing to serve for the diverse work places of local and Global Environment with ethical integrity and moral values.
III.	To be committed in pioneering research for developing a technically-empowered humane society.
IV.	Communicate and function effectively as a leader in teams in multidisciplinary fields involving technical, managerial, economical and social constraints.

PROGRAMME OUTCOMES (POs)

1.	Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
2.	Problem Analysis: Identify, formulate, research literature, and solve <i>complex</i> computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
3.	Design /Development of Solutions: Design and evaluate solutions for <i>complex</i> computing problems, design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4.	Conduct Investigations of Complex Computing 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, adapt and apply appropriate techniques, resources, and modern computing tools to <i>complex</i> computing activities, with an understanding of the limitations.
6.	Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
7.	Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
8.	Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
9.	Communication Efficacy: Communicate effectively with the computing community, and with society at large, about <i>complex</i> computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
10.	Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.
11.	Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
12.	Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

2. PROGRAMME SPECIFIC OUTCOMES (PSOs)

1.	Able to analyze and select appropriate architecture and techniques to implement interdisciplinary application software.
2.	Able to provide effective solutions for problems and challenges in real time environments.
3.	Able to design and develop innovative products for societal needs using existing and upcoming

	technologies.
4.	Able to inculcate the knowledge of computing and management principles to manage software projects effectively and create innovative career path.

PEO's – PO's & PSO's MAPPING:

PEO	PO											PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
I.	3	3	3	3	3	3	2	1	1	1	1	3	3	3	3	3
II.	2	2	3	2	2	3	3	1	3	3	2	1	3	3	3	3
III.	3	3	3	3	3	2	3	1	2	3	3	1	3	3	3	2
IV.	1	2	3	2	1	3	3	1	3	3	3	3	2	3	3	3

PROGRAM ARTICULATION MATRIX

Year	Semester	Course code	PO												PSO			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
I	I	MA22109	3	2	-	1	-	-	1	-	-	-	-	-	-	1	-	-
		MC22101	3	3	3	3	2.4	-	2.6	-	-	-	-	-	3	2.6	-	-
		MC22102	2.2	2.8	2.8	1.8	2.4	-	-	-	2.8	-	1.8	-	3	2.8	1.6	-
		MC22103	1.8	2.4	2.2	1.8	2	-	-	-	-	-	-	-	1.2	0.6	0.6	2.6
		MC22104	1.4	2	1	0.6	1.4	1.2	1.4	0.8	0.6	0.6	1	1	1.8	1.8	0.6	0.6
		MC22105	2.2	1.8	1.8	1.2	2.4	2.8	1.6	2.4	3	1.0	2.0	1.0	2.0	2.0	1.6	0.8
		MC22106	2	2	2.6	2	1.2	-	1	0.4	0.2	1	1.6	1	2	2	2	1
		MC22107	3	3	3	3	3	-	0.6	-	-	2.4	1.8	-	-	3	-	-
I	II	MC22201	2	0.6	1.4	1.4	1.6	0.2	0.4	0.6	1.4	1.6	1	1.6	2.2	2.2	2.2	0.8
		MC22202	1.6	1.6	1.4	1.2	2	1.2	1.2	-	0.8	1.2	1.6	1.2	2	1	2	2
		MC22203	3	3	3	3	3	-	-	-	2		2	-	3	3	2	-
		MC22204	1.8	2.4	1.6	1.2	1.2	1.2	0.6	0.6	1.6	0.6	2.2	1.2	2.2	1.4	0.8	1.8
		MC22205	0.4	0.8	1.4	1.6	1.4	-	-	0.2	-	0.4	0.2	-	-	3	0.4	-
		MC22206	2.2	0.6	2.4	2	2.6	0	0.4	0.4	0.4	0.8	2	1.2	2.2	2.2	2.2	1.2
		MC22207	3	3	3	3	3	-	-	-	2		2	-	3	3	2	0.6
II	III	MC22301	2.2	1.2	0.6	0.2	0.6	2.6	1	0.2	0.6	1.2	2	1	1.2	1.2	1.2	1.2

		MC22302	2.2	2.6	2.8	2.4	3	-	1	0.6	0.8	0.2	0.4	0.6	2	1.8	1	0.6
		MC22303	3	3	2.0	2.6	2.4	0.6	1.2	0.6	2.2	0.6	1.4	1.0	2.4	1.4	1.2	1.6

Curriculum

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MA22109	Mathematical Statistics for Computer Applications	FC	3	1	0	4	4
2.	MC22101	Advanced Data Structures and Algorithms	PCC	3	0	0	3	3
3.	MC22102	Advanced Database Technology	PCC	3	0	0	3	3
4.	MC22103	Object Oriented Software Engineering	PCC	3	0	0	3	3
5.	MC22105	Cloud Computing Technologies	PCC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
6.	MC22104	Python Programming	PCC	3	0	2	5	4
PRACTICAL COURSES								
7.	MC22106	Advanced Database Technology Laboratory	PCC	0	0	4	4	2
8.	MC22107	Advanced Data Structures and Algorithms Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
9.	SD22101	Coding Skills and Soft skills Training -Phase I	EEC	0	0	4	4	2
MANDATORY COURSES								
10.		Audit Course – I*	AC	2	0	0	2	0
TOTAL				20	1	14	35	26

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MC22201	Full Stack Web Development	PCC	3	0	0	3	3
2.	MC22202	Research Methodology and IPR	RMC	2	0	0	2	2
3.	MC22203	Data Science	PCC	3	0	0	3	3
4.	MC22205	Advances in Operating System	PCC	3	0	0	3	3
5.		Professional Elective I	PEC	3	0	0	3	3

THEORY COURSES WITH PRACTICAL COMPONENT								
6.	MC22204	Mobile Application Development	PCC	3	0	2	5	4
PRACTICAL COURSES								
7.	MC22206	Full Stack Web Development Laboratory	PCC	0	0	4	4	2
8.	MC22207	Data Science Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
9.	SD22201	Coding Skills and Quantitative Aptitude –Phase I	EEC	0	0	4	4	2
MANDATORY COURSES								
10.		Audit Course – II*	AC	2	0	0	2	0
TOTAL				19	0	14	33	24

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MC22302	Advanced Java Programming	PCC	3	0	0	3	3
2.	-	Professional Elective II	PEC	3	0	0	3	3
3.	-	Professional Elective III	PEC	3	0	0	3	3
4.	-	Open Elective	OEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
5.	MC22301	Internet of Things	PCC	3	0	2	5	4
6.	-	Professional Elective IV	PEC	3	0	2	5	4
PRACTICAL COURSES								
7.	MC22303	Advanced Java Programming Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8.	MC22304	Mini Project	EEC	0	0	4	4	2
9.	SD22304	Coding Skills and Quantitative Aptitude Training – Phase II	EEC	0	0	4	4	2
TOTAL				18	0	16	34	26

PROFESSIONAL ELECTIVES

SEMESTER II, ELECTIVE I

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		

1.	MC22211	Software Project Management	PEC	3	0	0	3	3
2.	MC22212	Professional Ethics in IT	PEC	3	0	0	3	3
3.	MC22213	E – Learning	PEC	3	0	0	3	3
4.	MC22214	Fundamentals of Accounting	PEC	3	0	0	3	3
5.	MC22215	Information Retrieval Techniques	PEC	3	0	0	3	3
6.	MC22216	Soft Computing Techniques	PEC	3	0	0	3	3
7.	MC22217	Operations Research	PEC	3	0	0	3	3
8.	MC22218	Business Data Analytics	PEC	3	0	0	3	3
9.	MC22219	Cyber Security	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE II

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MC22311	DevOps and Microservices	PEC	3	0	0	3	3
2.	MC22312	Advances in Networking	PEC	3	0	0	3	3
3.	MC22313	Digital Image Processing	PEC	3	0	0	3	3
4.	MC22314	Social Network Analytics	PEC	3	0	0	3	3
5.	MC22315	Blockchain for Business	PEC	3	0	0	3	3
6.	MC22316	Bio Inspired Computing	PEC	3	0	0	3	3
7.	MC22317	Digital Marketing	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE III

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MC22321	Software Architecture	PEC	3	0	0	3	3
2.	MC22322	Digital Forensics	PEC	3	0	0	3	3
3.	MC22323	Wireless Networking	PEC	3	0	0	3	3
4.	MC22324	Deep Learning	PEC	3	0	0	3	3
5.	MC22325	Data Mining in Healthcare	PEC	3	0	0	3	3
6.	MC22326	Agile Methodologies	PEC	3	0	0	3	3
7.	MC22337	Organizational Behavior	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MC22331	Web Design	PEC	3	0	2	5	4
2.	MC22332	C# and .NET	PEC	3	0	2	5	4
3.	MC22333	Big Data Analytics	PEC	3	0	2	5	4
4.	MC22334	Software Quality and Testing	PEC	3	0	2	5	4
5.	MC22335	Machine Learning	PEC	3	0	2	5	4
6.	MC22336	Network Programming and Security	PEC	3	0	2	5	4

SEMESTER III, OPEN ELECTIVE

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MC22681	Block chain Technology	OEC	3	0	0	3	3
2.	MC22781	Python for Data Science	OEC	3	0	0	3	3
3.	MC22782	Web Designing	OEC	3	0	0	3	3

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
EMPLOYABILITY ENHANCEMENT COURSES								
1.	MC22401	Project Work	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

Total no. of credits: 88

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AC22101	English for Research Paper Writing	AC	2	0	0	2	0

2.	AC22102	Constitution of India	AC	2	0	0	2	0
3.	AC22201	Disaster Management	AC	2	0	0	2	0
4.	AC22202	நற்றமிழ் இலக்கியம்	AC	2	0	0	2	0

BRIDGE COURSES

(For the M.C.A students admitted under non-computer science background category)

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
Classes are to be conducted and completed before the start of the class of first semester, Examinations will be conducted along with first semester								
THEORY COURSES WITH PRACTICAL COMPONENT								
1.	BX22101	Data Structures and Algorithms	PCC	3	0	2	5	4
2.	BX22102	Problem Solving and Programming in C	PCC	3	0	2	5	4
Classes are to be conducted and completed before the start of the class of second semester, Examinations will be conducted along with second semester								
THEORY COURSES								
3.	BX22201	Introduction to Computer Organization and Operating Systems	PCC	3	0	0	3	3
4.	BX22202	Basics of Computer Networks	PCC	3	0	0	3	3
To be completed before the End of Third Semester								
5.	noc23-cs66	Software Conceptual Design (NPTEL domain)	PCC	4 weeks	-	-	-	1

FOUNDATION COURSES (FC)

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	MA22109	Mathematical Statistics for Computer Applications	3	1	0	4	I

PROFESSIONAL CORE COURSES (PCC)

SL NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	MC22101	Advanced Data Structures and Algorithms	3	0	0	3	I
2.	MC22102	Advanced Database	3	0	0	3	I

		Technology					
3.	MC22103	Object Oriented Software Engineering	3	0	0	3	I
4.	MC22104	Python Programming	3	0	2	4	I
5.	MC22105	Cloud Computing Technologies	3	0	0	3	I
6.	MC22106	Advanced Data Structures and Algorithms Laboratory	0	0	4	2	I
7	MC22107	Advanced Database Technology Laboratory	0	0	4	2	I
8.	MC22201	Full Stack Web Development	3	0	0	3	II
.9	MC22203	Data Science	3	0	0	3	II
10.	MC22204	Mobile Application Development	3	0	2	4	II
11.	MC22205	Advances in Operating System	3	0	0	3	II
12.	MC22206	Full Stack Web Development Laboratory	0	0	4	2	II
13.	MC22207	Data Science Laboratory	0	0	4	2	II
14.	MC22301	Internet of Things	3	0	2	4	III
15.	MC22302	Advanced Java Programming	3	0	0	3	III
16.	MC22303	Advanced Java Programming Laboratory	0	0	4	2	III

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	MC22102	Research Methodology and IPR	2	0	0	2	1

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		

1.	SD22101	Coding Skills and Soft skills Training - Phase I	0	0	4	2	I
2.	SD22201	Coding Skills and Quantitative Aptitude – Phase I	0	0	4	2	II
3.	SD22304	Coding Skills and Quantitative Aptitude Training – Phase II	0	0	4	2	III
4.	MC22304	Mini Project	0	0	4	2	III
5.	MC22401	Project Work	0	0	24	12	IV

SYLLABUS
SEMESTER I

MA22109	MATHEMATICAL STATISTICS FOR COMPUTER APPLICATIONS	L	T	P	C
		3	1	0	4
COURSE OBJECTIVES					
<ul style="list-style-type: none"> • To enable students to understand the concepts of Probability and Random Variables. 					
<ul style="list-style-type: none"> • To understand the basic probability concepts with respect to two dimensional random variables along with the significance of the central limit theorem. 					
<ul style="list-style-type: none"> • To apply the small / large sample tests through Tests of hypothesis. 					
<ul style="list-style-type: none"> • To encourage students to develop a working knowledge of Analysis of Variance. 					
<ul style="list-style-type: none"> • To enable the students to use the concepts of logical and mathematical maturity and ability to deal with abstractions. 					
Unit I	PROBABILITY AND RANDOM VARIABLES	12			
Probability - Axioms of probability - Conditional probability - Discrete random variable – Probability mass function– Continuous random variable – Probability density function – Properties - mean, variance – Special distributions: Binomial, Poisson and Normal distributions (Derivations not included).					
Unit II	TWO DIMENSIONAL RANDOM VARIABLES	12			
Two dimensional Random variables-Discrete and continuous Joint distributions –Discrete and continuous Marginal distributions - conditional distributions -Central limit theorem(excluding proof) – Covariance– Correlation –Karl Pearson correlation coefficient-Regression- Regression lines- Regression coefficient.					
Unit III	TESTING OF HYPOTHESIS	12			
Statistical hypothesis - Type I and Type II errors - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t distribution for single mean and equality of means - Test based on F distribution for equality of variances - Chi square test for single variance and goodness of fit - Independence of attributes - Contingency table : Analysis of $r \times c$ tables.					
Unit IV	DESIGN OF EXPERIMENTS	12			

General principles – Analysis of variance(ANOVA) - One way classification - Completely randomized design (CRD) – Two way classification - Randomized block design (RBD) – Three way classification -Latin square design(LSD) – Two factor experiments: 2^2 factorial design.

Unit V	LOGIC AND PROOFS	12
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Mathematical Logic: Statement and Notation – Connectives – Statement Formulas and Truth Tables – Tautologies – Equivalence of Formulas – Duality Law. Tautological implications – Theory of inference – Validity using truth tables– Rules of inference.

TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Define the basic concepts of random variables, statistical hypothesis and logical techniques.
CO 2	Demonstrate the concepts of probability distributions, correlation and regression in engineering field.
CO 3	Explain statistical and logical techniques.
CO 4	Apply the concept of probability and correlation in engineering discipline.
CO 5	Apply the concept of testing of hypothesis, analysis of variance in real life problems and logics in network related problems.

REFERENCES

1. Gupta S.C., and Kapoor V.K., “Fundamentals of Mathematical Statistics”, 12th Edition, Sultan Chand and Sons, 2020.
2. Johnson R.A., Miller I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers & Pearson Education, Asia, 9th Edition, 2017.
3. S.P.Gupta, “Statistical Methods”, Sultan Chand & Sons, 48th edition, New Delhi, 2022.
4. Koshy. T. “Discrete Mathematics with Application”, Elsevier Publications, 2006.
5. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2015.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	1	-	-	1	-	-	-	-	-	-	1	-	-
CO2	3	2	-	1	-	-	1	-	-	-	-	-	-	1	-	-

CO3	3	2	-	1	-	-	1	-	-	-	-	-	-	1	-	-
CO4	3	2	-	1	-	-	1	-	-	-	-	-	-	1	-	-
CO5	3	2	-	1	-	-	1	-	-	-	-	-	-	1	-	-
Avg.	3	2	-	1	-	-	1	-	-	-	-	-	-	1	-	-

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: PROBABILITY AND RANDOM VARIABLES	2	1 either or	1(2)-CO1	1(2)-CO2	1 either or (16) – CO4	-
Unit-II: TWO DIMENSIONAL RANDOM VARIABLES	2	1 either or	1(2)-CO1	1(2)-CO2	1 either or (16)-CO4	-
Unit-III: TESTING OF HYPOTHESIS	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16) –CO5	
Unit-IV: DESIGN OF EXPERIMENTS	2	1 either or	2(2)-CO4	-	1 either or (16) –CO5	-
Unit-V: LOGIC AND PROOFS	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16) –CO5-	
Total Qns. Title	10	5 either or	6(2)	4(2)	5 either or (16)	-
Total Marks	20	80	12	8	80	-
Weightage	20%	80%	12%	8%	80%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	12	4	4	32	48	
Weightage	12%	4%	4%	32%	48%	

MC22101	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the usage of algorithms in computing
- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs and its applications
- To select and design data structures and algorithms that is appropriate for problems
- To study about NP Completeness of problems.

Unit I	ROLE OF ALGORITHMS IN COMPUTING COMPLEXITY ANALYSIS	9
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Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms- Asymptotic Analysis- Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms- Program Performance Measurement -Recurrences: The Substitution Method –The Recursion-Tree Method- Data Structures And Algorithms.		
Unit II	HIERARCHICAL DATA STRUCTURES	9
Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B - trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Heap – Heap Implementation – Disjoint Sets - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node- Bounding the maximum degree.		
Unit III	GRAPHS	9
Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra,s Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm		
Unit IV	ALGORITHM DESIGN TECHNIQUES	9
Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.		
Unit V	NP COMPLETE AND NP HARD	9
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility– NP-Completeness Proofs – NP-Complete Problems.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Write an algorithm for Towers of Hanoi problem using recursion and analyze the complexity (No. of Disc-4)		
2. Write any one real time application of hierarchical data structure		

3. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with simple implementation of Union operation
4. Find Minimum cost to reach last cell of the matrix from its first cell
5. Discuss about any NP completeness problem

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1	Analyze the complexity of algorithms to solve computing problems.
CO2	Analyze and use appropriate hierarchical data structures to solve problems.
CO3	Apply algorithms using graph data structure to solve real-life problems.
CO4	Apply suitable design strategy for problem solving.
CO5	Design one's own algorithm for an unknown problem.

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1. S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
2. Adam Drozdex, "Data Structures and Algorithms in C++", Cengage Learning, 4th Edition, 2013.
3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall ofIndia, 3rd Edition, 2012.
4. E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms", UniversityPress,2nd Edition, 2008.
5. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", PearsonEducation, Reprint 2006.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	-	2	-	-	-	-	-	3	3	-	-
CO2	3	3	3	3	3	-	3	-	-	-	-	-	3	3	-	-
CO3	3	3	3	3	2	-	3	-	-	-	-	-	3	3	-	-
CO4	3	3	3	3	3	-	3	-	-	-	-	-	3	3	-	-
CO5	3	3	3	3	2	-	2	-	-	-	-	-	3	1	-	-
Avg.	3	3	3	3	2.4	-	2.6	-	-	-	-	-	3	2.6	-	-

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluvate (Ev)

			No. of Qns. (marks) and CO			
Unit-I: ROLE OF ALGORITHMS IN COMPUTING COMPLEXITY ANALYSIS	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16) - CO1	-	-
Unit-II: HIERARCHICAL DATA STRUCTURES	2	1 either or	1(2)-CO2	1(2)-CO2	1 either or (16)-CO2	-
Unit-III: GRAPHS	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) -CO3	-
Unit-IV: ALGORITHM DESIGN TECHNIQUES	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) -CO4	-
Unit-V: NP COMPLETE AND NP HARD	2	1 either or	2(2)-CO5	1 either or (16) -CO5	-	-
Total Qns. Title	10	5 either or	6(2)	4(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	12	40	48	-
Weightage	20%	80%	12%	40%	48%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22102	ADVANCED DATABASE TECHNOLOGY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the working principles and query processing of distributed databases. To understand the basics of spatial, temporal and mobile databases and their applications. To distinguish the different types of NoSQL databases. To understand the basics of XML and create well-formed and valid XML documents. To gain knowledge about information retrieval and web search. 					
Unit I	INTRODUCTION TO DBMS	9			
File systems versus Database systems – Data Models – DBMS Architecture – Data Independence –Data Modeling using Entity – Relationship Model - Relational Model Concepts – Relational Algebra – SQL – Basic Queries – Complex SQL Queries – Views – Constraints					
Unit II	DISTRIBUTED DATABASES	9			

Distributed Systems – Introduction – Architecture – Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing		
Unit III	SPATIAL AND TEMPORAL DATABASES	9
Active Databases Model – Design and Implementation Issues - Temporal Databases - Temporal Querying - Spatial Databases: Spatial Data Types, Spatial Operators and Queries – Spatial Indexing and Mining – Applications -- Mobile Databases: Location and Handoff Management, Mobile Transaction Models – Deductive Databases - Multimedia Databases		
Unit IV	NOSQL DATABASES	9
NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding–Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – Orient DB Graph database – Orient DB Features.		
Unit V	XML DATABASES	9
Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases XML Querying – XPath – XQuery		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Create a distributed database for any application (ex. book store) and access it using PHP and Python.		
2. Create spatial database of any place and perform query operations.		
3. Creating Databases and writing simple queries using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.		
4. Creating XML Documents, Document Type Definition and XML Schema for any ecommerce website and perform XML Querying.		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Describe the basic concepts of the database and data models and design a database using ER diagrams and map ER into Relations and normalize the relations	
CO 2	Design a distributed database system and execute distributed queries.	
CO 3	Manage Spatial and Temporal Database systems and implement it in corresponding applications.	
CO 4	Use NoSQL database systems and manipulate the data associated with it.	

CO 5	Design XML database systems and validate with XML schema.
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REFERENCES

1. Abraham Silberschatz, Henry F Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2019.
2. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education/Addison Wesley, 2017.
3. Guy Harrison, “Next Generation Databases, NoSQL, NewSQL and Big Data”, First Edition, Apress publishers, 2015.
4. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining: Concepts and Techniques”, Third Edition, Morgan Kaufmann, 2012.
5. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	1	-	-	-	-	2	-	1	-	3	2	1	-
CO2	2	3	3	2	3	-	-	-	3	-	2	-	3	3	2	-
CO3	3	3	3	2	3	-	-	-	3	-	2	-	3	3	2	-
CO4	3	3	3	2	3	-	-	-	3	-	2	-	3	3	2	-
CO5	2	3	3	2	3	-	-	-	3	-	2	-	3	3	1	-
Avg.	2.2	2.8	2.8	1.8	2.4	-	-	-	2.8	-	1.8	-	3	2.8	1.6	-

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO DBMS	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16) - CO1	-	-
Unit-II: DISTRIBUTED DATABASES	2	1 either or	1(2)-CO2	1(2)-CO2 1 either or (16)-CO2	-	-
Unit-III: SPATIAL AND TEMPORAL DATABASES	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: NOSQL DATABASES	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: XML DATABASES	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-

Total Qns.Title	10	5 either or	5(2)	5(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	10	42	48	-
Weightage	20%	80%	10%	42%	48%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22103	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> • To understand the phases in object oriented software development • To gain fundamental concepts of requirements engineering and analysis. • To know about the different approach for object oriented design and its methods • To learn about how to perform object oriented testing and how to maintain software • To provide various quality metrics and to ensure risk management. 					
Unit I	SOFTWARE DEVELOPMENT AND PROCESS MODELS				9
Introduction to Software Development – Challenges – An Engineering Perspective – Object Orientation – Software Development Process – Iterative Development Process – Process Models – Life Cycle Models – Unified Process – Iterative and Incremental – Agile Processes					
Unit II	MODELING OO SYSTEMS				9
Object Oriented Analysis (OOA / Coad-Yourdon), Object Oriented Design (OOD/Booch), Hierarchical Object Oriented Design (HOOD), Object Modeling Technique (OMT) – Requirement Elicitation – Use Cases – SRS Document – OOA - Identification of Classes and Relationships, Identifying State and Behavior– OOD - Interaction Diagrams – Sequence Diagram – Collaboration Diagrams - Unified Modeling Language and Tools					
Unit III	DESIGN PATTERNS				9
Design Principles – Design Patterns – GRASP – GoF – Dynamic Object Modeling – Static Object Modeling.					
Unit IV	SYSTEM TESTING				9

Software testing: Software Verification Techniques – Object Oriented Checklist :- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Levels of Testing – Static and Dynamic Testing Tools – Software Maintenance – Categories – Challenges of Software Maintenance – Maintenance of Object Oriented Software – Regression Testing.		
Unit V	SOFTWARE QUALITY AND METRICS	9
Need of Object Oriented Software Estimation – Lorenz and Kidd Estimation – Use Case Points Method – Class Point Method – Object Oriented Function Point – Risk Management – Software Quality Models – Analyzing the Metric Data – Metrics for Measuring Size and Structure – Measuring Software Quality – Object Oriented Metric - Logical implications – Theory of inference – Validity using truth tables–Rules of inference.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Discuss the different phases in any domain like Health Monitoring System using extreme programming		
2. Describe Business Requirement Specification (BRS) and SRS (Software Requirement Specification) for any Project like Automatic Intelligent Plant Watering System .using any one of requirement analysis tool		
3. Identify the classes , relationship between classes and draw standard UML diagrams using any one UML modeling tool (eg: Argo UML that supports UML 1.4 and higher) for a system (eg: Conference Management System, student management system).		
4. Test the above UML for all the scenarios identified using Selenium /JUnit / Apache JMeter		
5. Perform COCOMO estimation for Book Management System to find effort and development time considering all necessary cost estimation factors. (Use GanttPRO Software for estimation)		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Design object oriented software using appropriate process models.	
CO 2	Differentiate software processes under waterfall and agile methodology.	
CO 3	Design and Develop UML diagrams for software projects.	
CO 4	Apply Design Patterns for a software process.	
CO 5	Categorize testing methods and compare different testing tools for software processes.	
CO 6	Analyze object oriented metrics and quality for software engineering processes	
REFERENCES		
1. Yogesh Singh, Ruchika Malhotra, “ Object – Oriented Software Engineering”, PHI Learning Private Limited ,First edition,2012.		

2. Ivar Jacobson, Magnus Christerson, PatrikJonsson, Gunnar Overgaard, “Object Oriented SoftwareEngineering, A Use Case Driven Approach”, Pearson Education, Seventh Impression, 2009.
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4. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston, “Object Oriented Analysis & Design with Applications, Third Edition, Pearson Education,2010.
5. Roger S. Pressman, “Software Engineering: A Practitioner’s Approach, Tata McGraw-Hill Education,8th Edition, 2015.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	1	2	-	-	-	-	-	-	-	2	1	1	3
CO2	1	3	1	3	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	2	3	1	3	-	-	-	-	-	-	-	2	1	1	3
CO4	3	2	3	1	2	-	-	-	-	-	-	-	2	1	1	3
CO5	1	3	1	3	3	-	-	-	-	-	-	-	-	-	-	2
CO6	1	3	1	2	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	1.8	2.4	2.2	1.8	2	-	-	-	-	-	-	-	1.2	0.6	0.6	2.6

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: SOFTWARE DEVELOPMENT AND PROCESS MODELS	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: MODELING OO SYSTEMS	2	1 either or	1(2)-CO2	1(2)-CO2 1 either or (16)-CO2	-	-
Unit-III: DESIGN PATTERNS	2	1 either or	1(2)-CO3	1(2)-CO3 1 either or (16) –CO3	-	-
Unit-IV: SYSTEM TESTING	2	1 either or	1(2)-CO4	1(2)-CO4 1 either or (16) –CO4	-	-
Unit-V: SOFTWARE QUALITY AND	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-

METRICS						
Total Qns.Title	10	5 either or	6(2)	4(2) 4 either or (16)	1 either or (16)	-
Total Marks	20	80	12	72	16	-
Weightage	20%	80%	12%	72%	16%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22104	PYTHON PROGRAMMING	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To develop Python programs with conditionals, loops and functions. To use Python data structures – lists, tuples, dictionaries. To do input/output with files in Python To use modules, packages and frameworks in python To define the concepts of OOPS concepts in python programming 					
Unit I	BASICS OF PYTHON	9+6			
<p>Introduction to Python Programming – Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements. Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement-Continue statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions</p> <p>Lab experiments:</p> <ol style="list-style-type: none"> Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points). Scientific problems using Conditionals and Iterative loops. 					
Unit II	DATA TYPES AND PACKAGES IN PYTHON	9+6			
<p>Lists, Tuples, Sets, Strings, Dictionary, Modules: Module Loading and Execution – Packages – Making Your Own Module – The Python Standard Libraries.</p> <p>Lab experiments:</p> <ol style="list-style-type: none"> Implementing applications using Lists, Tuples. Implementing applications using Sets, Dictionaries. Implementing programs using Functions. Implementing programs using Strings. 					
Unit III	FILE HANDLING AND EXCEPTION HANDLING	9+6			

Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files –FilePosition – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

Lab experiments:

1. Implementing real-time/technical applications using File handling.
2. Implementing real-time/technical applications using Exception handling..

Unit IV	PYTHON LIBRARIES AND FRAMEWORKS	9+6
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The Python Libraries for data processing, data mining and visualization- NUMPY, Pandas, Matplotlib,Plotly-Frameworks- -Django, Flask, Web2Py

Lab experiment:

- 1.Implementing programs using written modules and Python Standard Libraries (pandas, numpy,Matplotlib, scipy)

Unit V	OBJECT ORIENTED PROGRAMMING IN PYTHON	9+6
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Creating a Class, Class methods, Class Inheritance, Encapsulation, Polymorphism, class method vs. staticmethods, Python object persistence.

Lab experiment:

- 1.Creating and Instantiating classes

SUGGESTED ACTIVITIES

- 1 .Display a multiplication Table Both players are given the same string, S ; Both players have to make substrings using the letters of the string S.
3. Player A has to make words starting with consonants. Player B has to make words starting with vowels. The game ends when both players have made all possible substrings. Do Scoring
4. Write a function definition for JTOI() in Python that would display the corrected version of entire content of the file .TXT (has wrongly alphabet J in place of alphabet I) with all the alphabets "J" to be displayed as an alphabet "I" on screen.
5. Consider a CSV file of profit of 10 items in monthly sales of a year . Read this file usingPandas or NumPyor using the in-built matplotlib function. Perform the following task.
6. Read Total profit of all months and show it using a line plot Read all product sales data and show it using a multi-line plot Read each item sales data of each month and show it using a scatter plot Read each item product sales data and show it using the bar chart Read sales data of bathing soap of all months and show it using a bar chart. Calculate total sale data an year for each product and show it using a Pie chart
7. Create a Python class called Bank Account which represents a bank account, having as attributes: account Number (numeric type), name (name of the account owner as string type), balance. Create a constructor with parameters: account Number, name, balance. Create a Deposit() method which manages the deposit actions. Create a Withdrawal()Create a Deposit() method which manages the deposit actions. Create a Withdrawal()method which manages withdrawals actions

TOTAL : 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Illustrate algorithmic solutions to simple computational problems.
CO 2	Apply Python lists, tuples and dictionaries on compound data
CO 3	Develop Python programs to read and write data from/to files.
CO 4	Design simple Python programs using libraries, modules etc.
CO 5	Construct a program by bundling related properties and behaviors into individual objects.

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3. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", Network Theory Ltd., First edition, 2011
4. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press,
5. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, First Edition, 2016

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	3	2	3	2	2	1	-	1	3	3	1	-
CO2	-	2	-	2	3	-	1	1	-	-	1	-	-	2	-	1
CO3	2	2	3	1	1	-	1	-	-	-	1	-	2	-	-	-
CO4	2	3	1	-	-	3	2	1	-	-	1	3	1	3	2	2
CO5	2	3	1	-	-	1	-	-	1	2	2	1	3	1	-	-
Avg.	1.4	2	1	0.6	1.4	1.2	1.4	0.8	0.6	0.6	1	1	1.8	1.8	0.6	0.6

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: BASICS OF PYTHON	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16) - CO1	-	-
Unit-II: DATA TYPES AND PACKAGES IN	2	1 either or	1(2)-CO2	1(2)-CO2	1 either or (16)-CO2	-

PYTHON						
Unit-III: FILE HANDLING AND EXCEPTION HANDLING	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: PYTHON LIBRARIES AND FRAMEWORKS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: OBJECT ORIENTED PROGRAMMING IN PYTHON	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	5(2)	5(2) 1 either or (16)	4 either or (16)	-
Total Marks	20	80	10	26	64	-
Weightage	20%	80%	10%	26%	64%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22105	CLOUD COMPUTING TECHNOLOGIES				L	T	P	C	
					3	0	0	3	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To understand the basic concepts of Distributed systems. To learn about the current trend and basics of Cloud computing. To be familiar with various Cloud concepts. To expose with the Server, Network and storage virtualization. To be aware of Microservices and DevOps. 									
Unit I	DISTRIBUTED SYSTEMS							9	
Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models – Remote Invocation – Request-Reply Protocols – Remote Procedure Call – Remote Method Invocation – Group Communication – Coordination in Group Communication – Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks.									
Unit II	BASICS OF CLOUD COMPUTING							9	

Cloud Computing Basics – Desired features of Cloud Computing – Elasticity in Cloud – On demand provisioning - Applications – Benefits – Cloud Components: Clients, Datacenters & Distributed Servers – Characterization of Distributed Systems – Distributed Architectural Models - Principles of Parallel and Distributed computing - Applications of Cloud computing – Benefits – Cloud services – Open source Cloud Software: Eucalyptus, Open Nebula, Open stack, Aneka, Cloud sim.		
Unit III	CLOUD INFRASTRUCTURE	9
Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system - NIST Cloud computing Reference Architecture – Public, Private and Hybrid clouds – Cloud Models : IaaS, PaaS and SaaS – Cloud storage providers - Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things.		
Unit IV	CLOUD ENABLING TECHNOLOGIES	9
Service Oriented Architecture – Web Services – Basics of Virtualization – Emulation – Types of Virtualization – Implementation levels of Virtualization – Virtualization structures – Tools & Mechanisms – Virtualization of CPU, Memory & I/O Devices – Desktop Virtualization – Server Virtualization – Google App Engine – Amazon AWS - Federation in the Cloud.		
Unit V	MICROSERVICES AND DEVOPS	9
Defining Microservices - Emergence of Microservice Architecture – Design patterns of Microservices – The Mini web service architecture – Microservice dependency tree – Challenges with Microservices - SOA vs Microservice – Microservice and API – Deploying and maintaining Microservices – Reason for having DevOps – Overview of DevOps – Core elements of DevOps – Life cycle of DevOps –Adoption of DevOps -DevOps Tools – Build, Promotion and Deployment in DevOps.		
SUGGESTED ACTIVITIES		
1. Write a client and server program to calculate the value of PI, in which server calls the remote procedure of the client side (C programming)		
2.Create an word document of your class time table and store locally and also on cloud and share it (usewww.zoho.com , docs.google.com)		
3. Create your resume in a neat format using google and zoho cloud Programs on PaaS		
4. Discuss processor virtualization, memory virtualization, I/O virtualization in VMWare		
5. Set up Azure DevOps, Import Code and Create the Azure DevOps Build Pipeline		
TOTAL : 45 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Use Distributed systems in Cloud Environment.	
CO 2	Articulate the main concepts, key technologies, strengths and limitations of Cloud computing.	

CO 3	Identify the Architecture, Infrastructure and delivery models of Cloud computing.
CO 4	Install, choose and use the appropriate current technology for the implementation of Cloud.
CO 5	Adopt Microservices and DevOps in Cloud environments

REFERENCES

1. Kai Hwang, Geoffrey C. Fox & Jack J.Dongarra, "Distributed and Cloud Computing, From Para Processing to the Internet of Things", Morgan Kaufmann Publishers, First Edition, 2012
2. Andrew S. Tanenbaum & Maarten Van Steen, "Distributed Systems - Principles and Paradigms", Third Edition, Pearson, 2017.
3. Thomas Erl, Zaigham Mahood & Ricardo Puttini, "Cloud Computing, Concept, Technology & Architecture", Prentice Hall, Second Edition, 2013.
4. Richard Rodger, "The Tao of Microservices", ISBN 9781617293146, Manning Publications, First Edition, December 2017.
5. Kamal Kant Hiran, Ruchi Doshi, Dr. Fagbola Temitayo, and Mehul Mahrishi, Cloud Computing: Master the concepts, Architecture, and Applications with Real-World Examples and Case Studies, BPB publishers, First Edition, 2019.

Mapping of COs with POs and PSOs

CO	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	2	1	3	3	1	2	1	2	2	2	-
CO2	1	3	3	3	3	3	3	-	3	1	2	1	2	2	-	-
CO3	1	-	3	-	3	3	1	3	3	1	2	1	2	2	2	-
CO4	3	-	-	3	3	3	3	3	3	1	2	1	2	2	2	2
CO5	3	3	-	-	3	3	1	3	3	1	2	1	2	2	2	2
Avg.	2.2	1.8	1.8	1.2-	2.4	2.8	1.6	2.4	3	1.0	2.0	1.0	2.0	2.0	1.6	0.8

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: DISTRIBUTED SYSTEMS	2	1 either or	1(2)-CO1	1(2)-CO1	1 either or (16) - CO1	-
Unit-II: BASICS OF CLOUD COMPUTING	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: CLOUD INFRASTRUCTURE	2	1 either or	1(2)-CO3	1(2)-CO3 1 either or	-	-

				(16) –CO3		
Unit-IV: CLOUD ENABLING TECHNOLOGIES	2	1 either or	1(2)-CO4	1(2)-CO4 1 either or (16) –CO4	-	-
Unit-V: MICROSERVICES AND DEVOPS	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns. Title	10	5 either or	6(2)	4(2) 3 either or (16)	2 either or (16)	-
Total Marks	20	80	12	56	32	-
Weightage	20%	80%	12%	56%	32%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22106	ADVANCED DATABASE TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To understand the process of distributing tables across multiple systems
- To understand the process of storing, retrieving spatial and temporal data
- To understand the process of storing, retrieving objects in a database
- To understand the process of storing and retrieving data from a XML Database
- To use the open source database for building a mobile application

List of Experiments

1. Data Manipulation Commands for inserting, deleting, updating and retrieving in Tables
2. Transaction Control Language Commands like Commit, Rollback and Save Point
3. Illustrate the statements to create index and drop index
4. Perform database querying using simple query, nested query, subquery and join operations
5. Create a PL/SQL block to implement procedures and functions
6. Create a PL/SQL block to execute triggers
7. NOSQL Exercises
 - a. MongoDB – CRUD operations, Indexing, Sharding
 - b. Cassandra: Table Operations, CRUD Operations, CQL Types
 - c. OrientDB Graph database – OrientDB Features
8. MySQL Database Creation, Table Creation, Query
9. Spatial data storage and retrieval in MySQL
10. Temporal data storage and retrieval in MySQL

11. Object storage and retrieval in MySQL
12. XML Databases, XML table creation, XQuery FLWOR expression
TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1	Explain the knowledge of query evaluation to monitor the performance of the DBMS
CO2	Design advanced databases.
CO3	Apply big data frameworks and tools on databases.
CO4	Formulate complex queries using SQL.
CO5	Create an XML document and perform Xquery.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	1	-	1	2	1	1	2	1	2	2	2	1
CO2	2	2	3	2	1	-	1	-	-	1	1	1	2	2	2	1
CO3	2	2	2	2	2	-	1	-	-	1	2	1	2	2	2	1
CO4	2	2	3	2	1	-	1	-	-	1	1	1	2	2	2	1
CO5	2	2	3	2	1	-	1	-	-	1	2	1	2	2	2	1
Avg.	2	2	2.6	2	1.2	-	1	0.4	0.2	1	1.6	1	2	2	2	1

MC22107	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To acquire knowledge of using advanced tree structures
- To learn the usage of heap structures
- To understand the usage of graph structures and spanning trees
- To understand the problems such as matrix chain multiplication, activity selection and Huffman coding
- To understand the necessary mathematical abstraction to solve problems.

List of Experiments

1. Implementation of recursive function for tree traversal and Fibonacci
2. Implementation of iteration function for tree traversal and Fibonacci
3. Implementation of Merge Sort and Quick Sort

4. Implementation of a Binary Search Tree
5. Red-Black Tree Implementation
6. Heap Implementation
7. Fibonacci Heap Implementation
8. Graph Traversals
9. Spanning Tree Implementation
10. Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)
11. Implementation of Matrix Chain Multiplication
12. Activity Selection and Huffman Coding Implementation
TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1	Design and implement basic and advanced data structures extensively.
CO2	Design algorithms using graph structures.
CO3	Design and develop efficient algorithms with minimum complexity using design techniques.
CO4	Develop programs using heap and tree data structures.
CO5	Choose appropriate data structures and algorithms of ADT/libraries, and use it to design algorithms for a specific problem

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	-	-	3	3	-	-	3	-	-
CO2	3	3	3	3	3	-	-	-	-	1	3	-	-	3	-	-
CO3	3	3	3	3	3	-	-	-	-	3	-	-	-	3	-	-
CO4	3	3	3	3	3	-	-	-	-	2	-	-	-	3	-	-
CO5	3	3	3	3	3	-	3	-	-	3	3	-	-	3	-	-
Avg.	3	3	3	3	3	-	0.6			2.4	1.8			3		

SD22101	CODING SKILLS AND SOFT SKILLS TRAINING – PHASE I	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES					
• To make the students to solve basic programming logics.					
• To help the students develop logics using decision control statements.					
• To make them develop logics using looping statements and arrays.					
• To train the students for effective communication and identify the common errors in formal writings.					
• To guide and motivate the students for setting their goals with positive thinking.					
Unit I	FUNDAMENTALS IN PROGRAMMING	8			

Output of Programs: I/O Functions, Data types, Constants, Operators – Mathematical Problems – Debugging – Puzzles - Company Specific Programming Examples.		
Unit II	DECISION CONTROL STATEMENTS	8
Logic Building Using Conditional Control Statements – Output of Programs –Mathematical Problems - Puzzles –Company Specific Programming Examples		
Unit III	LOOPING STATEMENTS AND ARRAYS	14
Logic Building Using Looping Statements –Number Programs – Programs on Patterns – Array Programs – Programs on Sorting and Searching - Matrix Programs –Puzzles - Output of Programs - Company Specific Programming Examples		
Unit IV	COMMUNICATION IN GENERAL	15
Introduction to communication-Types of communication – Effective Communication-Barriers to communication. Language Study: Vocabulary-Formation of sentences-Sentence and sentence structures-Common errors – Writing paragraphs & essays. Professional writing: Job application & Resume writing		
Unit V	PERSONALITY DEVELOPMENT	15
Study of personality & ways to improve. Soft Skills: Self-evaluation / self-awareness – Goal setting and positive thinking – Self-esteem and confidence – Public speaking – Extempore – Body language and Observation skills		
SUGGESTIVE ASSESSMENT METHODS		
1) Pre Assessment Test – To check the student’s previous knowledge in Programming skills.		
2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20.		
3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20.		
4) Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20.		
5) A test for Communication skills will be conducted for 100 marks which will be then calculated to 40.		
6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.		
7) The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Solve problems on basic I/O constructs.	
CO 2	Develop problem solving skills using decision control statements.	
CO 3	Develop logics using looping statements and arrays.	
CO 4	Avoid / fix the common errors they commit in academic and professional writings and prepare standard resumes and update the same for future career.	
CO 5	Recognize the value of self-evaluation and grow with self-confidence.	
TEXT BOOKS		
1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.		
2. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.		
REFERENCE BOOKS		
1. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson		

Education, 2013.

- Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
- E Balagurusamy, “Programming in ANSI C”, Eighth edition, Mc GrawHill Publications, 2019.
- S.Sobana, R.Manivannan, G.Immanuel, ‘Communication and Soft Skills’ VK Publications’, 2016.
- Zed Shaw, “ Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding”, Zed Shaw’s Hardway Series, 2015.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	1	1	1	-	-	-	1	2	1	2	3	2
CO2	3	2	2	-	1	1	1	-	-	-	1	2	1	2	3	2
CO3	3	2	2	-	1	1	1	-	-	-	1	2	1	2	3	2
CO4	-	-	-	-	-	-	-	1	2	3	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	1	2	3	-	2	-	-	-	-
CO	1.8	1.2	1.2	-	0.6	0.6	0.6	0.4	0.8	1.2	0.6	2	0.6	1.2	1.8	1.2

SEMESTER II

MC22201	FULL STACK WEB DEVELOPMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the fundamentals of web programming and client-side scripting. To learn server-side development using NodeJS. To understand API development with Express Framework. To understand and architect databases using NoSQL and SQL databases. To learn the advanced client-side scripting and ReactJS framework. 					
Unit I	INTRODUCTION TO CSS and JAVASCRIPT	9			
Introduction to Web: Server - Client - Communication Protocol (HTTP) – Structure of HTML Documents – Basic Markup tags – Working with Text and Images with CSS– CSS Selectors – CSS Flexbox - JavaScript: Data Types and Variables - Functions - Events – AJAX: GET and POST.					
Unit II	SERVER-SIDE PROGRAMMING WITH NODE JS	9			

Introduction to Web Servers – JavaScript in the Desktop with NodeJS – NPM – Serving files with the http module – Introduction to the Express framework – Server-side rendering with Templating Engines – Static Files - async/await - Fetching JSON from Express.		
Unit III	ADVANCED NODE JS AND DATABASE	9
Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS –HandlingUser Authentication with NodeJS.		
Unit IV	ADVANCED CLIENT-SIDE PROGRAMMING	9
React JS: ReactDOM - JSX - Components - Properties – Fetch API - State and Lifecycle - JS Local Storage - Events - Lifting State Up - Composition and Inheritance.		
Unit V	APP IMPLEMENTATION IN CLOUD	9
Cloud providers Overview – Virtual Private Cloud – Scaling (Horizontal and Vertical) – Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
<ol style="list-style-type: none"> 1. Build an online MCQ quiz app. The questions and options should be fetched based on the chosen topic from a NodeJS server. The questions can be stored in a JSON file in the backend. Once the user has answered the questions, the frontend must send the chosen options to the backend and the backend must identify the right answers and send the score back to the front end. The frontend must display the score in a separate neatly designed page. 2. Build a blog website where you can add blog posts through a simple admin panel and the users can view the blog posts. The contents of the blog posts can be stored in either MongoDB or MySQL database. The home page should contain the titles of the blog post and the full post can be viewed by clicking the title. Frontend can be built either using React or through template engines served by the NodeJS server. 3. Take any ecommerce or social media website/app. Analyze what the API endpoints would have been used for and how the frontend interacts with the backend. The networks tab in the browser’s developer tools can be used if required. 4. Architect an entire database structure for an E-Commerce application for MongoDB. Discuss how the database would have been structured if you were using a SQL database. 5. Build a simple calculator app with React. The user should be able to add numbers and operations to the app by clicking on buttons, just like you would do in a mobile phone. The moment the operation and the two operations are defined, the answer should be displayed. 		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		

CO1	Develop client-side applications using HTML, CSS and JavaScript.
CO2	Develop server-side applications using NodeJS.
CO3	Make use of express framework in web development.
CO4	Build database systems in both NoSQL and SQL environments.
CO5	Make use of ReactJS library in front end web development.
CO6	Develop a full-stack Single Page Application using React, NodeJS and MongoDB and deploy on Cloud.

REFERENCES

1. David Flanagan, "Java Script: The Definitive Guide", O'Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019
3. Alex Banks, Eve Porcello, "Learning React", O'Reilly Media, Inc, 2nd Edition, 2020
4. Marc Wandschneider, "Learning Node", Addison-Wesley Professional, 2nd Edition, 2016
5. Joe Beda, Kelsey Hightower, Brendan Burns, "Kubernetes: Up and Running", O'Reilly Media, 1st edition, 2017

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	-	2	-	-	-	-	-	-	3	1	1	1	-
CO2	2	1	2	1	-	-	-	-	-	-	-	3	2	2	2	-
CO3	3	1	2	1	3	1	3	-	2	1	1	3	2	2	2	-
CO4	3	1	2	1	-	-	3	1	2	1	1	3	3	3	3	1
CO5	3	1	2	1	3	1	3	-	2	-	-	3	2	2	2	-
CO6	3	1	2	1	3	1	3	-	-	-	-	3	3	3	3	1
Avg.	2.7	1	2	0.8	1.8	0.5	2	0.27	1	0.3	0.3	3	2.2	2.2	2.2	0.3

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO CSS and JAVASCRIPT	2	1 either or	1(2)-CO1	1(2)-CO1	1 either or (16) - CO1	-

Unit-II: SERVER-SIDE PROGRAMMING WITH NODE JS	2	1 either or	1(2)-CO2	1(2)-CO2	1 either or (16)-CO2	-
Unit-III: ADVANCED NODE JS AND DATABASE	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: ADVANCED CLIENT-SIDE PROGRAMMING	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: APP IMPLEMENTATION IN CLOUD	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO6	-
Total Qns.Title	10	5 either or	5(2)	5(2)	5 either or (16)	-
Total Marks	20	80	10	10	80	-
Weightage	20%	80%	10%	10%	80%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	CO6
Total marks	20	20	20	20	4	10
Weightage	20%	20%	20%	20%	4%	16%

MC22202	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2
COURSE OBJECTIVES					
<ul style="list-style-type: none"> Identify an appropriate research problem in their interesting domain. Understand research related information and research ethics. Understand the preparation of a research project thesis report. Understand the adequate knowledge on intellectual property, its relevance and business impact in the changing global business environment. Understand the law of patent and copyrights. 					
Unit I	RESEARCH DESIGN	6			
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.					
Unit II	DATA COLLECTION AND SOURCES	6			
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.					

Unit III	DATA ANALYSIS AND REPORTING	6
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.		
Unit IV	INTELLECTUAL PROPERTY RIGHTS	6
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Biodiversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.		
Unit V	PATENTS	6
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.		
TOTAL : 30 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO1	Identify the criteria and characteristics of a good research problem.	
CO2	Develop research ethics in Professional life.	
CO3	Develop technical report writers, research paper writers and presentation skills.	
CO4	Identify various IPR components, copy rights and process of filing.	
CO5	Develop awareness on the patent law and procedural mechanism in obtaining a patent.	
REFERENCES		
1.Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).		
2.Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.		
3.David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.		
4.The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.		
5. C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques, New Age International Publishers, Fourth Edition, September 2019.		
Mapping of COs with POs and PSOs		

MC22203	DATA SCIENCE	3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To know the fundamental concepts of data science and analytics. To learn fundamental data analysis using R. To understand various data modeling techniques. To learn the basic and advanced features of open source big data tools and frameworks. To study various analytics on stream data. 					
Unit I	INTRODUCTION TO DATA SCIENCE AND BIG DATA	9			
Introduction to Data Science – Data Science Process – Exploratory Data analysis – Big data: Definition, Risks of Big Data, Structure of Big Data – Web Data: The Original Big Data – Evolution of Analytic Scalability – Analytic Processes and Tools – Analysis versus Reporting Core Analytics versus Advanced Analytics– Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Introduction to Data Visualization					
Unit II	DATA ANALYSIS USING R	9			
Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis – Bivariate Analysis: Correlation – Regression Modeling: Linear and Logistic Regression – Multivariate Analysis – Graphical representation of Univariate, Bivariate and Multivariate Analysis in R: Bar Plot, Histogram, Box Plot, Line Plot, Scatter Plot, Lattice Plot, Regression Line, Two-Way cross Tabulation.					
Unit III	DATA MODELING	9			
Bayesian Modeling – Support Vector and Kernel Methods – Neuro – Fuzzy Modeling – Principal Component Analysis – Introduction to NoSQL: CAP Theorem, Mongo DB: RDBMS Vs MongoDB, Mongo DB Database Model, Data Types and Sharding – Data Modeling in HBase: Defining Schema – CRUD Operations.					
Unit IV	DATA ANALYTICAL FRAMEWORKS	9			
Introduction to Hadoop: Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Introduction to MapReduce - Running Algorithms Using MapReduce – Introduction to HBase: HBase Architecture, HLog and HFile, Data Replication – Introduction to Hive, Spark and Apache Sqoop.					
Unit V	STREAM ANALYTICS	9			
Introduction To Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window.					
TOTAL : 45 PERIODS					

COURSE OUTCOMES	
Upon completion of the course, the students will be able to:	
CO1	Apply statistical testing to real-world problems that are converted into hypotheses.
CO2	Apply data analysis using R.
CO3	Develop efficient modeling of very large data and work with big data platforms.
CO4	Make use of suitable data analysis for stream data.
CO5	Develop efficient Map Reduce programmes for small problem solving methods.

REFERENCES

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge DataStreams with Advanced Analytics", John Wiley & sons, First Edition, 2013.
2. Umesh R Hodeghatta, Umesh Nayak, "Business Analytics Using R – A Practical Approach", Apress, First Edition, 2017.
3. J. Leskowec, Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.
4. Nishant Garg, "HBase Essentials", Packt, First Edition, 2014.
5. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly, First Edition, 2013

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO2	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO3	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO4	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO5	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
Avg.	3	3	3	3	3	-	-	-	2		2	-	3	3	2	-

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO DATA SCIENCE AND BIG DATA	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: DATA ANALYSIS USING	2	1 either or	1(2)-CO1	1(2)-CO1	1 either or (16)-CO2	-

R						
Unit-III: DATA MODELING	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) – CO3-	-
Unit-IV: DATA ANALYTICAL FRAMEWORKS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) – CO1-	-
Unit-V: STREAM ANALYTICS	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	6(2)	4(2) 1 either or (16)	4 either or (16)	-
Total Marks	20	80	12	24	64	-
Weightage	20%	80%	12%	24%	64%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22204	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the need and characteristics of mobile applications. To design the right user interface for mobile applications. To understand the design issues in the development of mobile applications. To understand the development procedure for mobile applications. To develop mobile applications using various tools and platforms. 					
Unit I	INTRODUCTION	15			
Mobile Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools					
Lab Component					
i. Installation of necessary components and software					
Unit II	USER INTERFACE	15			
Generic UI Development - Multimodal and Multichannel UI –Gesture Based UI – Screen Elements and Layouts – Voice XML.					
Lab Component					
i. Implement mobile application using UI toolkits and frameworks.					
ii. Design an application that uses Layout Managers and event listener					
Unit III	APPLICATION DESIGN	15			

Memory Management – Design Patterns for Limited Memory – Workflow for application - development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs – Multithreading in Java - Concurrency and Resource Management		
Lab Component		
i. Design a mobile application that is aware of the resource constraints of mobile devices. ii. Design an application that uses Dynamic Linking		
Unit IV	MOBILE OS	15
Mobile OS: Android, iOS – Android Application Architecture – Understanding the anatomy of a mobile application - Android basic components –Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.		
Lab Component		
i. Develop an application that makes use of Mobile database. ii. Implement an android application that writes data into the SD card.		
Unit V	APPLICATION DEVELOPMENT	15
Communication via the Web – Notification and Alarms – Graphics and Multimedia: Layer Animation, Event handling and Graphics services – Telephony – Location based services		
Lab Component		
i. Develop a web based mobile application that accesses internet and location data. ii. Develop an android application using telephony to send SMS.		
TOTAL : 75 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Make use of mobile application frameworks and tools.	
CO 2	Develop a UI for mobile applications.	
CO 3	Design mobile applications that manage memory dynamically.	
CO 4	Design an application based on mobile OS like Android, iOS.	
CO 5	Build web based mobile application using event handling and location based services.	
SOFTWARE REQUIREMENTS		
1. JDK, ECLIPSE IDE / equivalent, ANDROID STUDIO		
REFERENCES		
1. Reto Meier, Ian Lake, “Professional Android”, 4 th Edition, Wrox, 2018.		
2. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, “Programming Android”, O’Reilly, 2 nd Edition, 2012.		

3. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, 4th edition, 2019
4. Christian Keur, Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 6th Edition, O'Reilly, 2016.
5. Barry Burd, Android Application Development, All-In-One for Dummies, 3rd Edition, 2021.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	3	-	-	3	3	-	-	3	-	3	-	3	2	-	3
CO2	3	3	3	-	3	-	-	-	3	3	3	3	3	3	3	2
CO3	3	2	-	3	-	-	-	-	-	-	2	2	2	2	1	2
CO4	3	2	3	2	-	-	-	-	-	-	2	-	2	-	-	2
CO5	-	2	2	1	-	3	3	3	2	-	1	1	1	-	-	-
Avg.	-	3	-	-	3	3	-	-	3	-	3	-	3	2	-	3

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16) - CO1	-	-
Unit-II: USER INTERFACE	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16)-CO2	-	-
Unit-III: APPLICATION DESIGN	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) – CO3-	-
Unit-IV: MOBILE OS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) – CO1-	-
Unit-V: APPLICATION DEVELOPMENT	2	1 either or	-	2(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	4(2)	6(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	8	44	48	-
Weightage	20%	80%	8%	44%	48%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22205	ADVANCES IN OPERATING SYSTEM	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To review the fundamentals of Operating Systems To gain knowledge on Distributed Operating System concepts that includes issues, Mutual exclusion algorithms, Deadlock detection algorithms To gain insight on the distributed resource management components viz. the algorithms for implementation of distributed shared memory, and distributed scheduling. To know the components and management aspects of Real time, Mobile operating Systems. To acquire knowledge on the basics of Linux and Mobile OS like iOS, Android 					
Unit I	FUNDAMENTALS OF OPERATING SYSTEMS	9			
Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling –Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.					
Unit II	DISTRIBUTED OPERATING SYSTEMS	9			
Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport’s Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.					
Unit III	DISTRIBUTED RESOURCE MANAGEMENT	9			
Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.					
Unit IV	REAL TIME AND MOBILE OPERATING SYSTEMS	9			
Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems –Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads – Memory Management - File system.					
Unit V	CASE STUDIES	9			
Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System – Inter process Communication. iOS and Android: Architecture and SDK Framework - Media Layer -Services Layer - Core OS Layer - File System.					
TOTAL : 45 PERIODS					
SUGGESTED ACTIVITIES					

<p>1. Consider the following preemption method to prevent deadlocks: All processes are assigned unique priorities that can be totally ordered. A requesting process is allowed to preempt another process that holds the needed the requesting process has higher priority, otherwise, it is blocked. Demonstrate that this method prevents deadlock.</p>	
<p>2. Consider a distributed system where each node has its own clock. Assume that all the clocks in the system are perfectly synchronized. Also, assume that the communication network is reliable. Give an algorithm for recording the global state. Note that your algorithm should be simpler than the Chandy-Lamport algorithm.</p>	
<p>3. Predict the performance of the receiver-initiated load sharing algorithm when the entire system workload is generated at only a few nodes in the system instead of equally at all the nodes in the system. (Hint : performance depends on how successful receivers will be in locating senders)</p>	
<p>4. Consider two processes, P1 and P2, where $p1 = 50$, $t1 = 25$, $p2 = 75$, and $t2 = 30$.</p> <p>a. Can these two processes be scheduled using Rate-Monotonic Scheduling? Illustrate your answer by displaying a Gantt chart</p> <p>b. Implement the scheduling of these two processes using Earliest Deadline-First (EDF) scheduling.</p>	
<p>5. Developers David and Peter of R & D belong to group A. Administrative staff Jack and Mike belong to group B.</p> <p>a. Create a shared directory <code>"/ project_a"</code>. The files in this directory can only be read, added, deleted, modified, and executed by developers in the R & D department. Other users cannot perform any access operation in this directory.</p> <p>b. Create a directory <code>"/ project_b"</code>. The files in this directory can only be read, added, deleted, modified and executed by the staff of the Administration Department, other users cannot do anything to this directory Access operation.</p> <p>c. Create a directory <code>"/ project"</code>. The files in this directory can be read, added, deleted, modified, and executed by personnel in the R & D department and administrative department. Users in other departments can only use this directory and perform read-only access operations.</p>	
<p>COURSE OUTCOMES</p>	
<p>Upon completion of the course, the students will be able to:</p>	
CO 1	Discuss various synchronization, scheduling and deadlock issues
CO 2	Demonstrate mutual exclusion and deadlock detection of Distributed Operating system
CO 3	Discuss various resource management techniques for distributed systems
CO 4	Identify the different features of real time and mobile operating systems
CO 5	Perform administrative tasks on Linux Servers, iOS and Android
<p>REFERENCES</p>	
<p>1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts- Essentials”, ninth Edition, John Wiley & Sons, 2013.</p>	

2. Mukesh Singhal, Niranjana G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw Hill, First Edition, 1994.
3. Love Robert,” Linux Kernel Development”, Pearson Education India, Third Edition, 2018.
4. Neil Smyth, “iPhone/iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.
5. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, First Edition 2006.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	-	2	-	-	-	-	-	2	-	-	-	3	-	-
CO2	-	-	-	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	2	2	2	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	3		2	-	-	-	-	-	-	-	-	3	-	-
CO5	2	2	2	2	3	-	-	1	-	-	1	-	-	3	2	-
Avg.	0.4	0.8	1.4	1.6	1.4			0.2		0.4	0.2			3	0.4	-

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: FUNDAMENTALS OF OPERATING SYSTEMS	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16) - CO1	-	-
Unit-II: DISTRIBUTED OPERATING SYSTEMS	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16)-CO2	-	-
Unit-III: DISTRIBUTED RESOURCE MANAGEMENT	2	1 either or	1(2)-CO3	1(2)-CO3 1 either or (16) –CO3-		-
Unit-IV: REAL TIME AND MOBILE OPERATING SYSTEMS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: CASE STUDIES	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-

Total Qns.Title	10	5 either or	5(2)	5(2) 3 either or (16)	2 either or (16)	-
Total Marks	20	80	10	58	32	-
Weightage	20%	80%	10%	58%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22206	FULL STACK WEB DEVELOPMENT LABORATORY				L	T	P	C
					0	0	4	2

COURSE OBJECTIVES

- To implement the client side of the web application using Java Script.
- To understand JavaScript on the desktop using NodeJS.
- To develop a web application using NodeJS and Express.
- To implement a SPA using React.
- To develop a full stack single page application using React, NodeJS, and a Database (MongoDB or SQL).

List of Experiments

1. Create a form and validate the contents of the form using JavaScript.
2. Get data using Fetch API from an open-source endpoint and display the contents in the form of a card.
3. Create a NodeJS server that serves static HTML and CSS files to the user without using Express.
4. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.
5. Create a NodeJS server using Express that creates, reads, updates and deletes students' details and store them in MongoDB database. The information about the user should be obtained from a HTML form.
6. Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form.
7. Create a counter using ReactJS
8. Create a To do application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.
9. Create a simple Sign up and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using NodeJS and Express Framework.
10. Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH.
11. Create a docker container that will deploy a NodeJS ping server using the NodeJS image.

TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Design client-side web applications using HTML, CSS and JavaScript
CO 2	Develop server-side applications using NodeJS
CO 3	Create web applications using Express framework.
CO 4	Design database systems in both NoSQL and SQL environments.
CO 5	Develop a full stack single page application using React, NodeJS, and a Database and deploy using containers.

SOFTWARE REQUIREMENTS

1. NodeJS/Express JS, ReactJS, Docker, any IDE like NOTEPAD++/visual studio code/sublime text etc.
2. MySQL, MongoDB4.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	2	2	2	-	-	-	-	2	2	2	2	2	2	2
CO2	2	2	2	2	3	-	-	-	-	2	2	2	2	2	2	2
CO3	3	-	3	2	3	-	-	-	-	-	2	-	2	2	2	-
CO4	2	-	2	2	2	-	-	-	-	-	2	-	3	3	3	-
CO5	3	1	3	2	3	-	2	2	2	-	2	2	2	2	2	2
Avg.	2.2	0.6	2.4	2	2.6	0	0.4	0.4	0.4	0.8	2	1.2	2.2	2.2	2.2	1.2

MC22207	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To provide hands-on cloud and data analytics frameworks and tools.
- To use the Python/R packages for performing analytics.
- To learn using analytical tools for real world problems.
- To familiarize the usage of distributed frameworks for handling voluminous data.
- To write and deploy analytical algorithms as Map Reduce tasks.

List of Experiments

Experiments using R/Python

1. Download, install and explore the features of R/Python for data analytics.

<p>2. Use the Diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:</p> <ol style="list-style-type: none"> Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis. Bivariate Analysis: Linear and logistic regression modeling. Multiple Regression Analysis Also compare the results of the above analysis for the two data sets. 	
3. Apply Bayesian and SVM techniques on Iris and Diabetes data set.	
4. Apply and explore various plotting functions on UCI data sets.	
Implement the following using Hadoop, Map Reduce, HDFS, Hive	
1. Perform setting up and Installing Hadoop in its two operating modes: pseudo distributed and fully distributed.	
2. Implement the following file management tasks in Hadoop: adding files and directories, Retrieving files and Deleting files	
3. <ol style="list-style-type: none"> Performing a MapReduce Job for word search count (look for specific keywords in a file) Implement stop word elimination problem: Input a large textual file containing one sentence per line and a small file containing a set of stop words (one stop word per line) and save the results in an output textual file containing the same sentences of the large input file without the words appearing in the small file. 	
4. Implement a Map Reduce program that processes a weather data set to: <ol style="list-style-type: none"> Find average, max and min temperature for each year in National Climate Data Centre data set. Filter the readings of a set based on value of the measurement. The program must save the line of input files associated with a temperature value greater than 30.0 and store it in a separate file. 	
5. Install, deploy & configure Apache Spark cluster. Run Apache Spark applications using Scala.	
6. Install and run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.	
7. Mini projects on the following: <ol style="list-style-type: none"> Simulate a simple recommender system with Amazon product dataset, Social tweet data set etc. on Hadoop Perform a very large text classification run on Hadoop. 	
TOTAL : 60 PERIODS	
COURSE OUTCOMES	
Upon completion of the course, the students will be able to:	
CO 1	Experiment with installing analytical tools and configuring a distributed file system.
CO 2	Develop and execute analytical procedures in various distributed frameworks and databases.
CO 3	Develop, implement and deploy simple applications on very large datasets.
CO 4	Develop simple-to-complex data modelling in NoSQL databases.
CO 5	Develop and deploy simple applications in cloud.
SOFTWARE REQUIREMENTS	
<ul style="list-style-type: none"> Python or any ML tools like R 	

Mapping of COs with POs and PSOs																
CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO2	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO3	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO4	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO5	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	3
Avg.	3	3	3	3	3	-	-	-	2		2	-	3	3	2	0.6

SD22201	CODING SKILLS AND QUANTITATIVE APTITUDE TRAINING– PHASE I											L	T	P	C
												0	0	4	2

COURSE OBJECTIVES

- To help students on developing modular applications using functions.
- To train them on building logics using strings and pointers.
- To make them develop applications using user defined datatypes.
- To improve aptitude, problem solving skills and reasoning ability of the students
- Demonstrate the use of mathematical reasoning by justifying through numerical skills.

Unit I	FUNCTIONS & QUANTS –NUMBERS	15
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Logic Building Using Functions– Programs on Recursion – Puzzles - Output of Programs - Company Specific Programming Examples

Quants: Numbers– Number Systems, Types of Numbers, Series (Arithmetic Progression, Geometric Progression), HCF & LCM, Decimal Fractions, Simplification (Including Expression & Evaluation) Average- Problem on Ages

Unit II	STRINGS & QUANTS–TIME & WORK	10
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Logic Building Using Strings – Programs on Strings– Puzzles - Output of Programs - Company Specific Examples

Quants: Time & Work -Chain Rule-Work and Wages-Pipes and Cisterns

Unit III	POINTERS & QUANTS –RATIO AND PROPORTIONS	10
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Logic Building Using Pointers – Programs on Pointers – Puzzles - Output of Programs - Company Specific Examples

Quants: Ratio & Proportions-Partnership-Mixtures and Alligations

Unit IV	UNIONS AND ENUMERATED DATATYPES & LOGICAL REASONING	10
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Working with Unions- Working with Enumerated Datatypes – Puzzles - Output of Programs - Company Specific Examples

Logical Reasoning- Analogy-Blood Relations/Family Tree –Calendar –Clocks-Images(Mirror & Water

Unit V	STRUCTURES & LOGICAL REASONING	15
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Working with Structures – Puzzles - Output of Programs - Company Specific Examples

Logical Reasoning: Coding-Decoding-Cubes and Dices-Data Sufficiency

SUGGESTIVE ASSESSMENT METHODS

- 1) Pre Assessment Test – To check the student’s previous knowledge in Programming skills and quantitative aptitude and logical reasoning
- 2) Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 20.
- 3) Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 20.
- 4) Model Exam for coding skills and quantitative aptitude will be conducted for 100 marks which are then reduced to 20
- 5) For assignments, students should attend all the practice tests conducted online on HackerRank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
- 6) The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Develop and implement modular applications using functions.
CO 2	Develop logics using strings and pointers.
CO 3	Develop applications in C using user defined datatypes.
CO 4	Apply quantitative techniques to solve variety of problems and can enhance their employability quotient and to establish a stronger connect with the technical environment in which they operate
CO5	Find solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems

TEXT BOOKS

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.
3. Agarwal R.S, “Quantitative Aptitude,” S.Chand and Company Pvt.Ltd., New Delhi, First Edition 1989, Reprint, 2016.
4. Agarwal R.S, “A Modern Approach to Verbal and Non-Verbal Reasoning,” S.Chand and Company Pvt.Ltd., New Delhi, First Edition 1994, Reprint, 2016.

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1. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.
2. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
3. E Balagurusamy, “Programming in ANSI C”, Eighth edition, Mc GrawHill Publications, 2019.
4. Anand PA, “Quantitative Aptitude,” Wiley India Pvt.Ltd., New Delhi, Edition, 2016
5. Arun Sharma, “How to Prepare for Logical Reasoning,” Tata-McGrawHill Education Series. New Delhi, First Edition 2016
6. Sharon Weiner Green, Ira K Wolf, “Barron’s GRE,” Barron Publishers. First Edition 1995, Reprint, 2016
7. The Princeton Review, “Cracking the GRE”, Random House Publisher, Premium Edition 2016.
8. Mark Alan Steward, JD, “30 days to the GMAT CAT”, Arco Publishers, 2nd Edition 2016.

CO	Mapping of COs with POs and PSOs															
	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4

CO1	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO2	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO3	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO4	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	-
CO5	3	3	3	3	3	-	-	-	2	-	2	-	3	3	2	3
Avg.	3	3	3	3	3	-	-	-	2		2	-	3	3	2	0.6

Semester III

MC22301	INTERNET OF THINGS				L	T	P	C	
					3	0	2	4	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To understand the concepts of IoT and its working models To know the various IoT protocols To understand the IoT Physical devices and Endpoints To know the security and privacy issues connected with IoT To apply the concept of Internet of Things in a real world scenario 									
Unit I	FUNDAMENTALS OF IOT							9+6	
Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.									
Lab Components									
(i) To study various IoT protocols – 6LowPAN, IPv4/IPv6, Wifi, Bluetooth, and MQTT.									
(ii) IoT Application Development Using sensors and actuators (temperature sensor, light-sensor, infrared sensor)									
Unit II	IOT PROTOCOLS							9+6	
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols– Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security.									
Lab Components									
(i) To develop an application that measures the room temperature and posts the temperature value on the cloud platform.									
(ii) To develop an application that measures the moisture of soil and post the sensed data Over Google Firebase cloud platform									
Unit III	IOT PHYSICAL DEVICES AND END POINTS							9+6	
Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, and reading input from pins.									

Lab Components		
(i) To study Raspberry Pi development board and to implement LED blinking applications		
(ii) To develop an application to send and receive data with Arduino using HTTP request		
Unit IV	INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE	9+6
Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.		
Lab Components		
(i) To develop an application for measuring the distance using ultrasonic sensor and pos distance value on Google Cloud IoT platform		
(ii) Develop a simple application based on sensors.		
Unit V	APPLICATIONS	9+6
IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.		
Lab Components		
(i) Develop IoT applications using Django Framework and Firebase/ Bluemix platform		
(ii) Develop a commercial IoT application		
TOTAL : 75 PERIODS		
SUGGESTED ACTIVITIES		
1. Study of 5 different types of sensors and actuators available in Market		
2. Study of commercial IoT available in any one domain		
3. Study the recent developments in IoT Protocol		
4. Implement simple Python programs for IoT		
5. Study on the latest government policies on IoT security and Privacy		
6. A study on how to use IoT to solve some problems in your neighborhood.		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Illustrate the infrastructure for supporting IoT deployments.	
CO 2	Explain the usage of IoT protocols for communication between various IoT devices.	
CO 3	Design portable IoT using Arduino/Raspberry Pi /equivalent boards.	
CO 4	Apply the basic concepts of security and governance to IoT.	
CO 5	Develop applications of IoT in real time scenario.	
REFERENCES		
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547		
2.Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.		
3.David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, “IoT Fundamentals, Networking Technologies, Protocols, and Use cases for the Internet of Things”, Cisco Press, First Edition,2017.		
4.Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”,		

ADVANCED JAVA PROGRAMMING		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the fundamentals of web programming and client side scripting. To learn server side development using servlets, web sockets. To learn the Spring framework and build applications using Spring. To learn and implement the concept of Java Persistence API. To learn the advanced client side scripting and framework. 					
Unit I	INTRODUCTION TO WEB & JAVASCRIPT	9			
Introduction to Web: Server - Client - Communication Protocol (HTTP), Javascript Prototypes - Classes - Modules – Fetch API – JS Canvas - Storage: Local Storage, Cookies, Indexed DB, JSON					
Unit II	SERVER SIDE PROGRAMMING	9			
Web Server: Web Containers - Web Components, Servlet: Lifecycle - Request - Servlet Context - Response - Filter - Session - Dispatching Requests, WebSocket, Logging - Log4j2, Build tool - Gradle. Introduction to Spring: IoC Container and Dependency Injection (DI)					
Unit III	SPRING	9			
Spring Configuration and Spring Boot, Spring MVC, Spring Bean Lifecycle – Dispatcher Servlet and Configuration - Interceptors – Annotations, Controllers - Views - Input Validation -File Upload- Container, Dependency and IOC .					
Unit IV	AOP, JAVA PERSISTENCE API AND HIBERNATE	9			
Aspect Oriented Programming(AOP) - Entity: Basic, Embeddable and Collection Types – Identifiers - Entity Relationship - Inheritance, Persistence Context and Entity Manager, JPQL, Criteria API, Spring Data JPA - Specification and Projection.					
Unit V	ADVANCED SPRING PROGRAMMING	9			
Spring Boot JDBC - Spring Boot Actuator - Spring Cloud -Spring Boot Testing - Spring Security Architecture , Spring Cache - Building RESTful Web Services					
COURSE OUTCOMES					
Upon completion of the course, the students will be able to:					
CO 1	To write client side scripting.				
CO 2	To implement the server side of the web application.				
CO 3	To implement Web Application using Spring.				
CO 4	To implement a Java application using Java Persistence API.				
CO 5	To implement a full-stack Single Page Application using React, Spring and JPA..				
TOTAL :45 PERIODS					
REFERENCES					
1. David Flanagan, “Java Script: The Definitive Guide”, O’Reilly Media, Inc, 7th Edition, 2020					
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019					
3. Alex Banks, Eve Porcello, "Learning React", O’Reilly Media, Inc, 2nd Edition, 2020					
4. David R. Heffelfinger, "Java EE 8 Application Development", Packt Publishing, First Edition 2017					

5. Benjamin Muschko, "Gradle in Action", Manning Publications, First edition 2014
 6. Iuliana Cosmina, Rob Harrop, Chris Schaefer, Clarence Ho, "Pro Spring 5: An In-Depth Guide to the Spring Framework and Its Tools", Apress, Fifth edition 2017

Mapping of COs with POs and PSOs																
CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	3	3	-	-	-	-	-	-	-	3	-	-	-
CO2	3	1	3	3	3	-	2	1	2	1	-	2	2	3	-	2
CO3	1	3	2	3	3	-	-	-	-	-	-	-	2	3	3	1
CO4	3	3	3	3	3	-	2	-	-	-	2	1	-	3	-	-
CO5	3	3	3	-	3	-	1	2	2	-	-	-	3	-	2	-
Avg.	2.2	2.6	2.8	2.4	3	-	1	0.6	0.8	0.2	0.4	0.6	2	1.8	1	0.6

Table of specification for End Semester Question Paper						
Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO WEB AND JAVA SCRIPT	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: SERVER SIDE PROGRAMMING	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: SPRING	2	1 either or	2(2)-CO3	-	1 either or (16) -CO3	-
Unit-IV: AOP, JAVA PERSISTENCE API AND HIBERNATE	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) -CO4	-
Unit-V: ADVANCED SPRING PROGRAMMING	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) -CO5	-
Total Qns. Title	10	5 either or	8(2)	2(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	16	36	48	-
Weightage	20%	80%	16%	36%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22304	ADVANCED JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES																
<ul style="list-style-type: none"> To understand the fundamentals of web programming and client side scripting. To learn server side development using servlets, web sockets. To learn the Spring framework and build applications using Spring. To learn and implement the concept of Java Persistence API. To learn the advanced client side scripting and framework. 																
List of Experiments																
1. Create an event registration application using javascript. It should implement different widgets for registration form and registered records view using tabs. It should perform the form validation.																
2. Create a javascript application in an Object Oriented way using Classes and Modules. It should also use browser storage for persistence.																
3. 1 Build a web application using Gradle. The server side of the application should implement RESTful APIs using Servlet and do necessary logging. The client side of the application should be a single page application which consumes the RESTful APIs through AJAX.																
4. Build a chat application using Web Socket.																
5. Create a Spring MVC application. The application should handle form validation, file upload, session tracking.																
6. Implement a RESTful Spring Boot application using Spring REST, Spring Security and Spring Cache.																
7. Design a system using JPA and Hibernate. The system should have multiple entities and relationships between the entities. The database schema should be generated through Hibernate.																
8. Create a Spring RESTful Application with Spring Data JPA. Support pagination and searching using Specifications.																
9. Create a React application with different components and interactions between the components.																
10. Develop a full-stack application using React and Spring. Make use of Spring REST, Spring Security, Spring Data JPA, Hibernate, Spring Boot, Gradle and ReactJS state and component mechanism.																
TOTAL : 60 PERIODS																
COURSE OUTCOMES																
Upon completion of the course, the students will be able to:																
CO 1	To write client side scripting.															
CO 2	To implement the server side of the web application.															
CO 3	To implement Web Application using Spring.															
CO 4	To implement a Java application using Java Persistence API.															
CO 5	To implement a full-stack Single Page Application using React, Spring and JPA..															
SOFTWARE REQUIREMENTS																
<ul style="list-style-type: none"> Eclipse, ReactJS, NOTEPAD++/ Visual Studio code MySQL 																
CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	2	2	3	-	3	-	1	2	2	3	-	2
CO2	3	3	1	2	2	-	2	-	3	-	2	1	3	2	-	2
CO3	3	3	2	2	3	-	-	-	2	-	-	-	2	-	2	1
CO4	3	3	2	3	2	-	-	2	2	1	2	-	2	1	1	3
CO5	3	3	3	3	3	1	1	1	1	2	2	2	3	1	3	-
Avg.	3	3	2.0	2.6	2.4	0.6	1.2	0.6	2.2	0.6	1.4	1.0	2.4	1.4	1.2	1.6

SD22304	CODING SKILLS AND QUANTITATIVE APTITUDE TRAINING–PHASE II	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES					
1. To help students on developing basic programming logics.					
2. To train them on building logics using OOPs.					
3. To make them build applications using Packages, Exception Handling and help them know the use of Access Modifiers.					
4. To improve aptitude, problem solving skills and reasoning ability of the students					
5. Demonstrate the use of mathematical reasoning by justifying through numerical skills.					
Unit I	LOGIC BUILDING USING BASIC PROGRAMMING CONSTRUCTS & QUANTS–TIME, SPEED AND DISTANCE				10
Output of Programs on I/O Functions – Programming using conditional and Looping Statements – Puzzles - Output of Programs - Company Specific Programming Examples Quants:Time, Speed and Distance - Problems on Trains-Boats & Stream					
Unit II	OBJECTS AND CLASSES, INHERITANCE & QUANTS – PERCENTAGE & INTEREST				15
HR Questions on OOPS Concepts – Logic Building using Objects and Classes – Working with Methods – Programming using This, Static Keywords – Logic Building Using Inheritance - Puzzles - Output of Programs - Company Specific Programming Examples Quants : Percentage & Interest - Simple Interest, Compound Interest-Profit & Loss					
Unit III	POLYMORPHISM & QUANTS–PROBABILITY				15
Understanding the Concept of Polymorphism – Programming Using Polymorphism – Working with Super and Final Keywords - Puzzles - Output of Programs - Company Specific Programming Examples Quants: Probability -Permutations &Combinations					
Unit IV	ABSTRACTION AND ENCAPSULATION & LOGICAL REASONING				10
Understanding the Concept of Abstraction – Working with Abstract Class and Interfaces - Understanding the Concept of Encapsulation – Programming Using Encapsulation - Puzzles - Output of Programs - Company Specific Programming Examples Logical Reasoning: Data Interpretation (Tabulation, Bar Chart, PieChart, Line Graphs)- Direction sense test - Linear/Seating Arrangements - Series completion					
Unit V	PACKAGES AND EXCEPTION HANDLING & LOGICAL REASONING				10
Understanding Access Modifiers – Understanding Packages – Working Arrays and Strings – Logic Building Using Exception Handling - Puzzles - Output of Programs - Company Specific Programming Examples Logical Reasoning: Logical Venn Diagram/Syllogisms - Odd man out/Finding missing elements - Crypt arithmetic Questions – Puzzles					
SUGGESTIVE ASSESSMENT METHODS					
1) Pre Assessment Test – To check the student’s previous knowledge in Programming skills and quantitative aptitude and logical reasoning.					
2) Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 20.					
3) Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 20.					
4) Model Exam for coding skills and quantitative aptitude will be conducted for 100 marks which are then reduced to 20					

- 5) For assignments, students should attend all the practice tests conducted online on HackerRank and Google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
- 6) The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Develop and implement basic programming logics.
CO 2	Develop logics using OOPs Concepts.
CO 3	Develop applications using Packages, Exception Handling and Access Modifiers.
CO 4	Apply quantitative techniques to solve variety of problems and can enhance their employability quotient and to establish a stronger connect with the technical environment in which they operate
CO 5	Find solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems

TEXT BOOKS

- Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
- Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.
- Agarwal R.S, "Quantitative Aptitude," S.Chand and Company Pvt.Ltd., New Delhi, First Edition 1989, Reprint, 2016.

REFERENCE BOOKS

- Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
- Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
- Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.
- Anand PA, "Quantitative Aptitude," Wiley India Pvt .Ltd., New Delhi, Edition, 2016
- Arun Sharma, "How to Prepare for Logical Reasoning," Tata-McGraw Hill Education Series. New Delhi, First Edition 2016
- Sharon Weiner Green, Ira K Wolf, "Barron's GRE," Barron Publishers. First Edition 1995, Reprint, 2016
- The Princeton Review, "Cracking the GRE", Random House Publisher, Premium Edition 2016.
- Mark Alan Steward, J D, "30 days to the GMAT CAT", Arco Publishers, 2nd Edition 2016.
- Agarwal R.S, "A Modern Approach to Verbal and Non-Verbal Reasoning," S. Chand and Company Pvt. Ltd., New Delhi, First Edition 1994, Reprint, 2016.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	1	1	1	-	-	-	1	2	1	2	3	2
CO2	3	2	2	-	1	1	1	-	-	-	1	2	1	2	3	2
CO3	3	2	2	-	1	1	1	-	-	-	1	2	1	2	3	2
CO4	-	-	-	-	-	-	-	1	2	3	-	2	-	1	-	-
CO5	-	-	-	-	-	-	-	1	2	3	-	2	-	1	-	-
Avg.	1.8	1.2	1.2	-	0.6	0.6	0.6	0.4	0.8	1.2	0.6	2	0.6	1.6	1.8	1.2

PROFESSIONAL ELECTIVE I

MC22211	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> • To know how to do project planning for the software process. • To learn the cost estimation techniques during the analysis of the project. • To understand the quality concepts for ensuring the functionality of the software 					
Unit I	SOFTWARE PROJECT MANAGEMENT CONCEPTS	9			
Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- Six Sigma, Software Quality: defining software quality, ISO9126, External Standards					
Unit II	SOFTWARE EVALUATION AND COSTING	9			
Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods					
Unit III	SOFTWARE ESTIMATION TECHNIQUES	9			
Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model.					
Unit IV	RISK MANAGEMENT	9			
Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.					
Unit V	GLOBALIZATION ISSUES IN PROJECT MANAGEMENT	9			
Globalization issues in project management: Evolution of globalization- challenges in building global teams-models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management: Introduction – the effect of the internet on project management – managing projects for the internet – effect on project management activities. Comparison of project management software: dot Project, Launch pad, openProj. Case study: PRINCE2					
TOTAL : 45 PERIODS					
SUGGESTED ACTIVITIES					

1. Reducing process variability using six-sigma model DMAIC on software company applications with respect to factors like quality aspects, production bugs classified and measured, the causes of the large number of production bugs leading to different improvement suggestions
2. Do cost benefit analysis using Ms-Excel for Selecting the project (from available data in the web like <https://img.chandoo.org/a/24-cost-benefit-analysis.xlsx>)
3. Frequencying and Scheduling the Project activities using open source Ms-Project
4. Risk analysis of any project with special reference to performance time cost trilogy
5. Set up a project and its tasks; Communicate with everyone on the project team from within dotProject software.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Describe the activities during the project scheduling of any software application.
CO 2	Describe the risk management activities and the resource allocation for the projects.
CO 3	Apply the software estimation and recent quality standards for evaluation of the software projects.
CO 4	Construct highly reliable software project.
CO 5	Create reliable, replicable cost estimation that links to the requirements of project planning and managing.

REFERENCES

1. Bob Hughes, Mike Cotterell & Rajib Mall “Software Project Management”, McGraw- Hill Publications, 6th Edition 2017.
2. Ian Somerville, “Software Engineering”, 10th Edition, Pearson Education, 2017.
3. Robert T. Futrell, “Quality Software Project Management”, Pearson Education India, 2008.
4. Gopalaswamy Ramesh, “Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models”, McGraw Hill Education, 2017.
5. Richard H. Thayer “Software Engineering Project Management”, 2nd Edition, Wiley, 2006.
6. S. A. Kelkar, “Software Project Management” PHI, New Delhi, Third Edition, 2013

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	-	3	-	3	-	-	3	3	-	3	-	-	3	3	3
CO4	3	3	3	3	3	3	-	3	3	3	3	3	-	-	-	3
CO5	3	3	3	3	2	-	-	3	2	3	3	-	-	3	3	-

Avg.	3	1.2	1.8	1.2	1.6	0.6	-	1.8	0.6	1.2	1.8	0.6	-	2.4	1.2	2.4
Table of specification for End Semester Question Paper																
Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level													
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)										
			No. of Qns. (marks) and CO													
Unit-I: SOFTWARE PROJECT MANAGEMENT CONCEPTS	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-										
Unit-II: SOFTWARE EVALUATION AND COSTING	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-										
Unit-III: SOFTWARE ESTIMATION TECHNIQUES	2	1 either or	2(2)-CO3	-	1 either or (16) – CO3	-										
Unit-IV: RISK MANAGEMENT	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) – CO4	-										
Unit-V: GLOBALIZATION ISSUES IN PROJECT MANAGEMENT	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) – CO5	-										
Total Qns. Title	10	5 either or	8(2)	2(2) 2 either or (16)	3 either or (16)	-										
Total Marks	20	80	16	36	48	-										
Weightage	20%	80%	16%	36%	48%	-										
Weightage for COs																
	CO1	CO2	CO3	CO4	CO5											
Total marks	20	20	20	20	20											
Weightage	20%	20%	20%	20%	20%											

MC22212	PROFESSIONAL ETHICS IN IT	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES						
<ul style="list-style-type: none"> To understand the concepts of computer ethics in work environment. To understand the threats in computing environment To Understand the intricacies of accessibility issues To ensure safe exits when designing the software projects 						
Unit I	INTRODUCTION TO ETHICS					9

<p>Definition of Ethics- Right, Good, Just- The Rational Basis of Ethics -Theories of Right: Intuitionist vs. End-Based vs. Duty-Based -Rights, Duties, Obligations -Theory of Value -Conflicting Principles and Priorities -The Importance of Integrity -The Difference Between Morals, Ethics, and Laws -Ethics in the Business World - Corporate Social Responsibility -Creating an Ethical Work Environment -Including Ethical Considerations in Decision Making</p>		
Unit II	ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME	9
<p>IT Professionals - Are IT Workers Professionals- Professional Relationships That Must Be Managed -Professional Codes of Ethics - Professional Organizations - Certification – IT Professional Ethics, Three Codes of Ethics, Management Conflicts. The Reveton Ransomware Attacks -IT Security Incidents: A Major Concern - Why Computer Incidents Are So Prevalent -Types of Exploits -Types of Perpetrators-Federal Laws for Prosecuting Computer Attacks-Implementing Trustworthy Computing - Risk Assessment - Establishing a Security Policy -Educating Employees and Contract Workers.</p>		
Unit III	FREEDOM OF EXPRESSION, PRIVACY	9
<p>First Amendment Rights -Obscene Speech-Defamation -Freedom of Expression: Key Issues-Controlling Access to Information on the Internet -Strategic Lawsuit Against Public Participation (SLAPP)-Anonymity on the Internet-Hate Speech- Privacy Protection and the Law- Information Privacy- Privacy Laws, Applications, and Court Rulings-Key Privacy and Anonymity Issues- Data Breaches -Electronic Discovery- Consumer Profiling- Workplace Monitoring -Advanced Surveillance Technology.</p>		
Unit IV	FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS	9
<p>Intellectual Property Rights-Copyrights-Copyright Term - Eligible Works -Fair Use Doctrine -Software Copyright Protection –Copyright Laws and the internet-Copyright and Piracy–Patents- -Software Patents - Cross-Licensing Agreements -Trade Secrets-Trade Secret Laws-Employees and Trade Secrets-Key Intellectual Property Issues-Plagiarism -Reverse Engineering-Open-Source Code- Competitive Intelligence -Trademark Infringement -Cyber squatting.</p>		
Unit V	SOCIAL NETWORKING ETHICS AND ETIQUETTES	9

Social Networking Web Site- Business Applications of Online Social Networking-Social Network Advertising-The Use of Social Networks in the Hiring Process-Social Networking Ethical Issues –Cyber bullying- Online Virtual Worlds-Crime in Virtual Worlds-Educational and Business Uses of Virtual Worlds.

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES

1. Prepare a report of CSR activities of any three organizations.
2. Study of the government rules and regulations for prosecuting Computer Attacks
3. Do case study of two incidents that lead to IT Security breach in any of the organizations
4. Recent cases (within last 5 years duration) of infringement of intellectual property rights
5. A study on Creative commons and its effect on Open Educational Resources
6. A study on the role of social networking advertising in the development of Business and Educational Sectors

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1	Examine situations and to internalize the need for applying ethical principles, values to tackle various situations
CO2	Develop a responsible attitude towards the use of computers as well as the technology.
CO3	Analyze professional responsibility and empower access to information in the workplace.
CO4	Analyze the IPR issues and the procedure to protect different forms of IPR.
CO5	Apply social networking advertising in the development of Business and Educational Sectors

REFERENCES

1. Caroline Whitback,” Ethics in Engineering Practice and Research “, Cambridge University Press, 2ndEdition2011.
2. George Reynolds, “Ethics in Information Technology”, Cengage Learning,6thEdition2018.
3. Barger, Robert. (2008). Computer ethics: A case-based approach.Cambridge University Press 1stEdition.
4. John Weckert and Douglas Adeney, Computer and Information Ethics, Greenwood Press,FirstEdition1997.
5. Penny Duquenoy, Simon Jones and Barry G Blundell, “Ethical, legal and professional issues in computing”, Middlesex University Press, First Edition2008.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	3	-	-	2	1	3	-	-	-	-	2

CO2	-	-	-	-	-	3	-	-	2	1	3	-	-	-	-	2
CO3	-	-	-	-	-	3	-	-	2	1	3	-	-	-	-	2
CO4	-	-	-	-	-	3	-	-	2	1	3	-	-	-	-	2
CO5	-	-	-	-	-	3	-	-	2	1	3	-	-	-	-	2
Avg.	-	-	-	-	-	3	-	-	2	1	3	-	-	-	-	2

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO ETHICS	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: FREEDOM OF EXPRESSION, PRIVACY	2	1 either or	2(2)-CO3	-	1 either or (16) –CO3	-
Unit-IV: FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: SOCIAL NETWORKING ETHICS AND ETIQUETTES	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	8(2)	2(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	16	36	48	-
Weightage	20%	80%	16%	36%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22213	E- LEARNING				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> To learn the various E-learning approaches and Components. To explore Design Thinking. 								

<ul style="list-style-type: none"> To learn the types of design models of E-learning. To learn about E-learning Authoring tools. To know about evaluation and management of E-learning solutions 		
Unit I	INTRODUCTION	9
Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.		
Unit II	DESIGNING E-LEARNING COURSE CONTENT	9
Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.		
Unit III	CREATING INTERACTIVE CONTENT	9
Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests–Adding Additional Resources– Courseware Development Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool.		
Unit IV	LEARNING PLATFORMS	9
Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS –Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.		
Unit V	COURSE DELIVERY AND EVALUATION	9
Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1.Prepare the E-Learning Components and how will you measure the quality of the contents. Also, analyze synchronous and Asynchronous Modes of Learning, and discuss the advantages and disadvantages of both.		
2. Explain how the course instructor design and create effective E-Learning content		
3. List the types of authoring tools and discuss which tool is best according to you.		
4. Explain about different types of Learning Platforms		
5. Discuss about the Evaluation process of E-Learning courses in detail		
COURSE OUTCOMES		

Upon completion of the course, the students will be able to:	
CO 1	Distinguish the phases of activities in models of E-learning.
CO 2	Identify appropriate instructional methods and delivery strategies.
CO 3	Choose appropriate E-learning Authoring tools.
CO 4	Create interactive E-learning courseware.
CO 5	Evaluate the E-learning courseware

REFERENCES

1. Clark, R. C., Mayer, R. E., "E-Learning and the Science of Instruction". Third Edition, 2011.
2. Crews, T. B., Sheth, S. N., Horne, T. M., "Understanding the Learning Personalities of Successful Online Students", 1st Edition, Educause Review, 2014.
3. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", 1st Edition, O'Reilly Media, 2017.
4. MadhuriDubey, "Effective E-learning Design, Development and Delivery", 1st Edition, University Press, 2011.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3	PSO4
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	2	1	3	1		2	-	3	-	2
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	2	-	-	-	3	1	-	3	-	-
CO5	3	3	3	-	-	-	1	2	2	-	-	-	-		-	-
Avg.	-	-	-	-	-	3	-	-	2	1	3	-	-	-	-	2

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: DESIGNING E-LEARNING COURSE CONTENT	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-

Unit-III: CREATING INTERACTIVE CONTENT	2	1 either or	2(2)-CO3	-	1either or (16) –CO3	
Unit-IV: LEARNING PLATFORMS	2	1 either or	1(2)-CO4	1(2)-CO4	1either or (16) –CO4	-
Unit-V: COURSE DELIVERY AND EVALUATION	2	1 either or	1(2)-CO5	1(2)-CO5	1either or (16) –CO5	-
Total Qns.Title	10	5 either or	8(2)	2(2) 2 either or (16)	3either or (16)	-
Total Marks	20	80	16	36	48	-
Weightage	20%	80%	16%	36%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22214	FUNDAMENTALS OF ACCOUNTING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the basic principles of Accounting To understand the Double entry system and the preparation of ledger. To understand the process and importance of the electronic accounting system. To Prepare the estimate for various business activities such as purchase, sale, production and cash budgets To ensure the decision making process of an organization. 					
Unit I	INTRODUCTION TO ACCOUNTING				9
Introduction to Financial, Cost and Management Accounting - Objectives of Financial Accounting – Accounting Principles, Concepts and Conventions – Bookkeeping and Accounting					
Unit II	MANAGEMENT ACCOUNTING AND BOOKKEEPING				9
Meaning-Objectives of Management Accounting-Accounting System – Preparation of Journal, Ledger, Cash Book and Trial Balance – Errors disclosed and not disclosed by Trial Balance –Final Accounts - Ratio Analysis.					
Unit III	BUDGETS AND BUDGETARY CONTROL				9
Budgets and Budgetary Control-Meaning-Types-Sales Budget-Production Budget-Cost of Production Budget-Flexible Budgeting-Cash Budget-Master Budget-Zero Base Budgeting- Computerized Accounting – with adjustments.					
Unit IV	FINANCIAL MANAGEMENT				9

Objectives of Financial Management- preparation of Suspense Account – Depreciation – Meaning and Types – Methods of Charging and Providing depreciation – Inventory.

Unit V	BANK RECONCILIATION STATEMENT AND REPORTING	9
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Preparing Bank Reconciliation Statement (simple problems) – Insurance Claim – Average Clause - Export and Import of Data, Data Security,

TOTAL : 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Describe the basic concepts of Accounting standards.
CO 2	Illustrate the process of maintaining Accounts in an organization.
CO 3	Apply the process of Budget and calculating the financial position of an organization
CO 4	Apply Financial Management concepts and its components
CO 5	Apply BRS and generation of various financial reports

REFERENCES

1. I.M.Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 9th Edition, 2009.
2. M.Y.Khan and P.K.Jain, "Financial Management , Text, Problems and Cases", Tata McGraw Hill, 5th Edition,2008.
3. Reddy and Murthy, Financial Accounting by Margham Publications, 2015,Chennai
4. I.M.Pandey, "Management Accounting", Vikas Publishing House Pvt. Ltd., 3rd Edition, 2009
5. Advanced Accounting, R.L.Gupta and P.K.Gupta, Advanced Accounting, Sultan Chand, New Delhi

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	2	-	-	3	3	2	2	2	2	1	3	-
CO2	1	3	3	3	3	-	-	3	3	-	-	2	3	-	-	1
CO3	2	-	3	-	3	1	2	-	3	3	3	2	-	1	2	2
CO4	1	2	-	3	3	3	-	-	2	3	3	-	1	-	-	-
CO5	3	-	3	-	3	-	3	-	2	1	3	2	1	1	-	2
Avg.	2	1.6	2.4	1.2	2.8	0.8	1	1.2	2.6	1.8	2.2	1.6	1.4	0.6	1	1

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			

Unit-I: INTRODUCTION TO ACCOUNTING	2	1 either or	2(2)-CO1	1either or (16) - CO1	-	-
Unit-II: MANAGEMENT ACCOUNTING AND BOOKKEEPING	2	1 either or	1(2)-CO2	1(2)-CO2 1 either or (16)-CO2	-	-
Unit-III: BUDGETS AND BUDGETARY CONTROL	2	1 either or	2(2)-CO3	-	1either or (16) –CO3	-
Unit-IV: FINANCIAL MANAGEMENT	2	1 either or	1(2)-CO4	1(2)-CO4	1either or (16) –CO4	-
Unit-V: BANK RECONCILIATION STATEMENT AND REPORTING	2	1 either or	1(2)-CO5	1(2)-CO5	1either or (16) –CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or (16)	3either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22215	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the basics of information retrieval with pertinence to modeling, query operations and indexing To get an understanding of machine learning techniques for text classification and clustering. To understand the various applications of information retrieval giving emphasis to multimedia IR, websearch To understand the concepts of digital libraries 					
Unit I	INTRODUCTION: MOTIVATION	9			
Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval- Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine.					
Unit II	MODELING	9			

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting – Scoring and Ranking – Language Models – Set Theoretic Models – Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing.		
Unit III	INDEXING	9
Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching-Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion – Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency		
Unit IV	CLASSIFICATION AND CLUSTERING	9
Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning		
Unit V	SEARCHING THE WEB	9
Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries		
TOTAL : 45 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO1	Identify and design the various components of an Information Retrieval system	
CO2	Model an information retrieval system	
CO3	Apply information retrieval with pertinence to modeling, query operations and indexing	
CO4	Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.	
CO5	·Design an efficient search engine and analyze the Web content structure.	
REFERENCES		
1. Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, First Edition 2010		
2. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, —Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition, 2011.		
3. tefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, —Information Retrieval First Edition 2010		
4. Manning Christopher D., Raghavan Prabhakar & Schutze Hinrich, “ Introduction to Information Retrieval”, Cambridge University Press, Online Edition, 2009		
Mapping of COs with POs and PSOs		

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		2	3	1	3	-	2	-	-	-	2	2	3	3	2	-
CO2		2	3	-	-	-	1	-	-	-	3	-	-	3	2	-
CO3		3	2	-	2	-	2	-	-	-	2	3	2	-	-	-
CO4		3	3	2	3	-	2	-	-	1	2	2	-	3	-	3
CO5		2	3	-	-	-	-	-	-	-	3	3	3	2	-	1

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION: MOTIVATION	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: MODELING	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: INDEXING	2	1 either or	1(2)-CO3	1(2)-CO3-	1 either or (16) –CO3	
Unit-IV: CLASSIFICATION AND CLUSTERING	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: SEARCHING THE WEB	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22216	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					

<ul style="list-style-type: none"> • To gain knowledge of soft computing theories and its fundamentals. 		
<ul style="list-style-type: none"> • To design a soft computing system required to address a computational task. 		
<ul style="list-style-type: none"> • To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience. 		
<ul style="list-style-type: none"> • To introduce the ideas of fuzzy sets, fuzzy logic and to become familiar with neural networks that can learn 		
Unit I	FUZZY COMPUTING	9
<p>Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion Membership Functions, Interference in Fuzzy Logic, Fuzzy If – Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications and Defuzzifications, Fuzzy Controller, Industrial Applications.</p>		
Unit II	FUNDAMENTALS OF NEURAL NETWORKS	9
<p>Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning Techniques; Perception and Convergence Rule, Auto- Associative and Hetero-Associative Memory.</p>		
Unit III	BACK PROPAGATION NETWORKS	9
<p>Back Propagation Networks Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model; Back Propagation Learning Methods, Effect of Learning Rule Co – Efficient ;Back Propagation Algorithm, Factors Affecting Back Propagation Training, Applications.</p>		
Unit IV	COMPETITIVE NEURAL NETWORKS	9
<p>Kohonen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization – learning by LVQ; Adaptive Resonance Theory – Learning procedure – Applications</p>		
Unit V	GENETIC ALGORITHM	9
<p>Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications.</p>		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Prepare a weekly timetable for classes in a college for different groups of students so that there are no clashes between classes. The task is to search for the optimum using GA		
2. Species identification of a plant using Back propagation Algorithm		
3. Bandwidth allocation for wireless system using Neural network		
4. Apply Fuzzy logic for washing machines to determine the correct amount of water and detergent, speed of agitation, and length of the wash cycles.		
5. Apply Fuzzy logic for breast cancer diagnosis		

6. Do a Case Study Effect of Road Traffic Noise Pollution on Human Work Efficiency in Offices/

7. Organizations/ Commercial Business Centers in cities Using Fuzzy Expert System.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
CO2	.Describe the fundamental concepts of Neural Networks
CO3	Describe Artificial Neural Network techniques and their roles in building intelligent machines
CO4	Apply Competitive Neural Networks and. algorithms in problem solving
CO5	Apply genetic algorithms to optimization problems

REFERENCES

1. S. Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, 2003
2. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro – Fuzzy and Soft Computing", Pearson Education, 2004
3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Second Edition, Wiley, 2007.
4. Simon Haykin, "Neural Networks", Prentice Hall, 2nd Edition, 1999.
5. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, First Edition, 2008.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	-	-	-	-	-	-	-	2	-	2	-	3	-
CO2	1	-	-	1	-	-	1	-	-	2	1	3	-	2	1	-
CO3	3	3	3	1	-	-	2	-	-	2	3	2	3	-	1	2
CO4	2	3	3	1	-	-	2	-	2	-	3	2	-	3	-	-
CO5	3	3	3	3	3	1	3	-	-	2	3	3	2	-	1	3
Avg.	2.4	1.8	2	1.2	0.6	0.2	1.6	-	0.4	1.2	2.4	2	1.4	1	1.2	1

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: FUZZY COMPUTING	2	1 either or	1(2)-CO1	1(2)-CO1	1 either or (16) - CO1	-
Unit-II: FUNDAMENTALS OF NEURAL NETWORKS	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: BACKPROPAGATION NETWORKS	2	1 either or	2(2)-CO3	1 either or (16) -CO3	-	-

Unit-IV: COMPETITIVE NEURAL NETWORKS	2	1 either or	1(2)-CO4	1(2)-CO4	1either or (16) –CO4	-
Unit-V: GENETIC ALGORITHM	2	1 either or	1(2)-CO5	1(2)-CO5	1either or (16) –CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or (16)	3either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22217	OPERATIONS RESEARCH				L	T	P	C	
					3	0	0	3	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To provide the concept and an understanding of basic concepts in Operations Research techniques for Analysis and Modeling in Applications. To understand , develop and solve mathematical model of linear programming problems To understand , develop and solve mathematical model of Transport and assignment problems To Understand network modeling for planning and scheduling the project activities 									
Unit I	LINEAR PROGRAMMING MODELS							9	
Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables: big-M method, degeneracy and unbound solutions.									
Unit II	TRANSPORTATION AND ASSIGNMENT MODELS							9	
Formulation - Methods for finding basic Feasible Solution - Optimality Test - MODI method – Degeneracy in Transportation Problem -Unbalanced Transportation Problem. Assignment Method: Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem									
Unit III	SCHEDULING BY PERT AND CPM							9	
Introduction - Rules to frame a Network - Fulkerson’s Rule to numbering of events - Activity,Times - Critical Path Computation - Slack and Float - PERT- Steps and computing variance,Merits and demerits of PERT, CPM- Time estimating & Limitations, Comparison betweenPERT & CPM.									
Unit IV	QUEUEING MODELS							9	

Characteristics of Queueing Models–Poisson Queues-(M /M/1):(FIFO/∞/∞), (M / M / 1) :(FIFO / N / ∞), (M / M / C) : (FIFO / ∞ / ∞), (M / M / C) : (FIFO / N / ∞)models.		
Unit V	GAME THEORY	9
Competitive game, rectangular game, saddle point, minimax (maximin) method of optimal strategies- value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Do some research on nutrients that are essential for a balanced diet. Select three or four nutrients and constraints on it. Explore the framework of LPP. Formulate an LPP with suitable objective function and constraints.		
2. Identify some electricity distribution centers and areas which have requirements. Think of the objective and try to provide the solution framework.		
3. Break down the stages of completing a construction of a house (like Start, Framing, Plumbing etc...) and find the minimum days to complete the construction.		
4. Try to observe the customer arrival rate in a departmental store near your residence for a week. Also the service rate rendered. Make your inference on appointing an extra salesgirl.		
5. Decision making is very crucial. Consider the situation where two companies share a market, in which they currently make Rs 50, 00,000 each. Both need to determine whether they should advertise. For each company advertising costs Rs 20, 00,000 and captures Rs 30, 00, 000 from the competitor provided the competitor doesn't advertise. What should the companies do?		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Apply linear programming to solve operational problem with constraints.	
CO 2	Apply transportation and assignment models to find optimal solution..	
CO 3	Develop project scheduling using PERT and CPM.	
CO 4	Identify appropriate queuing models to reduce the waiting time in queue.	
CO 5	Identify the best strategy using decision making methods under game theory.	
REFERENCES		
1. Taha H.A., “Operations Research: An Introduction”, 10th Edition, Prentice Hall of India, New Delhi, 2016.		
2. KantiSwarup, P.K. Gupta, Man Mohan, “Operations Research”, 15th Revised Edition,		
3. S. Chand& Sons Education Publications, New Delh Ronald L Rardin, Optimization In Operations Research, 2nd Edition, Pearson Education, India, 2018.		
4. Jatinder Kumar, Optimization Techniques in Operations Research, LAP LAMBERT Academic Publishing, 2015.		
5. D.S.Hira and P.K.Gupta, Operations Research, 5th Edition, S.Chand& Sons, 2015.		

Mapping of COs with POs and PSOs

CO	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	-	-	-	1	1	-	1	-	1	2	1	2	2
CO2	1	3	3	1	-	-	-	-	1	2	1	1	2	1	2	2
CO3	1	2	2	2	1	-	1	2	1	2	1	1	2	1	2	2
CO4	1	3	2	2	1	1	1	1	1	2	2	1	2	1	2	2
CO5	1	2	2	2	1	1	1	1	1	1	2	1	2	1	2	2
Avg.	1	1.4	2.2	1.4	0.6	0.4	0.8	1	0.8	1.6	1.2	1	2	1	2	2

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: LINEAR PROGRAMMING MODELS	2	1 either or	-	2(2)- CO1	1either or (16) - CO1	-
Unit-II: TRANSPORTATION AND ASSIGNMENT MODELS	2	1 either or	-	2(2)- CO2	1either or (16)-CO2	-
Unit-III: SCHEDULING BY PERT AND CPM	2	1 either or	-	2(2)-CO3	1either or (16) –CO3	-
Unit-IV: QUEUEING MODELS	2	1 either or	1(2)-CO4	1(2)-CO4	1either or (16) –CO4	-
Unit-V: GAME THEORY	2	1 either or	1(2)-CO5	1(2)-CO5	1either or (16) –CO5	-
Total Qns.Title	10	5 either or	2(2)	8(2)	5either or (16)	-
Total Marks	20	80	4	16	80	-
Weightage	20%	80%	4%	16%	80%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22218	BUSINESS DATA ANALYTICS				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES		
<ul style="list-style-type: none"> To understand the basics of business analytics and its life cycle. 		
<ul style="list-style-type: none"> To gain knowledge about fundamental business analytics. 		
<ul style="list-style-type: none"> To learn modeling for uncertainty and statistical inference. 		
<ul style="list-style-type: none"> To understand analytics using Hadoop and Map Reduce frameworks 		
<ul style="list-style-type: none"> To acquire insight on other analytical frameworks 		
Unit I	OVERVIEW OF BUSINESS ANALYTICS	9
Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support – Skills Required for a Business Analyst – Framework for Business Analytics Life Cycle for Business Analytics Process.		
Unit II	ESSENTIALS OF BUSINESS ANALYTICS	9
Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map – Data Dashboards		
Unit III	MODELING UNCERTAINTY AND STATISTICAL INFERENCE	9
Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis Testing.		
Unit IV	ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK	9
Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (Hadoop Distributed File System) – Processing Data with Hadoop – Introduction to MapReduce –Features of MapReduce – Algorithms Using Map-Reduce: Matrix-Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce		
Unit V	OTHER DATA ANALYTICAL FRAMEWORKS	9
Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Study some application of Business analytics in organizations of any domain		

2. Study the statics and data visualization charts of sales data like Amazon using R
3. Study on new strategies derived using data analytic tools on some business data set available and its impact on company progress
4. Prepare a report on the use of Hadoop framework in any two companies
5. Compare and contrast the various Data Analytical Frameworks.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Identify the real world business problems and model with analytical solutions.
CO 2	Solve analytical problem with relevant mathematics background knowledge.
CO 3	Convert any real world decision making problem to hypothesis and apply suitable statistical testing
CO 4	Write and demonstrate simple applications involving analytics using Hadoop and Map Reduce
CO 5	Apply open source frameworks for modeling and storing data.

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1. U. Dinesh Kumar, “Business Analytics: The Science of Data-Driven Decision Making”, Wiley, First Edition, 2017.
2. Umesh R Hodeghatta, UmeshaNayak, “Business Analytics Using R – A Practical Approach”, Apress, First Edition, 2017.
- 3 Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David Anderson, “Essentials of Business Analytics”, Cengage Learning, second Edition, 2016
3. Rui Miguel Forte, “Mastering Predictive Analytics with R”, Packt Publication, First Edition, 2015.
4. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, First Edition, 2013.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	-	-	2	-	-	-	2	3	3		1	3
CO2	2	3	3	1	2	-	-	-	-	-	2	-	-	3	-	2
CO3	2	2	3	-	-	-	-	-	-	-	2	-	2	1	-	-
CO4	3	2	2	1	3	-	3	-	-	-	3	-	1	-	3	-
CO5	2	3	3	-	-	-	2	-	-	-	3	3	-	-	3	-
Avg.	1	2.4	2.2	1.4	0.6	0.4	0.8	1	0.8	1.6	1.2	1	2	1	2	2

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)

		No. of Qns. (marks) and CO				
Unit-I: OVERVIEW OF BUSINESS ANALYTICS	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: ESSENTIALS OF BUSINESS ANALYTICS	2	1 either or	-	2(2)-CO2	1 either or (16)-CO2	-
Unit-III: MODELING UNCERTAINTY AND STATISTICAL INFERENCE	2	1 either or	-	2(2)-CO3	1 either or (16) – CO3	-
Unit-IV: ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) – CO4	-
Unit-V: OTHER DATA ANALYTICAL FRAMEWORKS	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) – CO5	-
Total Qns. Title	10	5 either or	4(2)	6(2) 1 either or (16)	4 either or (16)	-
Total Marks	20	80	8	28	64	-
Weightage	20%	80%	8%	28%	64%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22219	CYBER SECURITY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To learn the principles of cyber security and to identify threats and risks. To learn how to secure physical assets and develop system security controls. To understand how to apply security for Business applications and Network Communications. To learn the technical means to achieve security. To learn to monitor and audit security measures. 					
Unit I	PLANNING FOR CYBER SECURITY	9			
Best Practices-Standards and a plan of Action-Security Governance Principles, components and Approach-Information Risk Management-Asset Identification-Threat Identification-Vulnerability Identification-Risk Assessment Approaches-Likelihood and Impact Assessment-Risk Determination, Evaluation and Treatment-Security Management Function-Security Policy- Acceptable Use Policy-Security Management Best Practices - Security Models: Bell La Padula model, Biba Integrity Model -Chinese Wall model					

Unit II	SECURITY CONTROLS	9
People Management-Human Resource Security-Security Awareness and Education-Information Management-Information Classification and handling-Privacy-Documents and Record Management-Physical Asset Management-Office Equipment-Industrial Control Systems-Mobile Device Security- System Development-Incorporating Security into SDLC - Disaster management and Incident response planning.		
Unit III	CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS	9
Business Application Management-Corporate Business Application Security-End user Developed Applications-System Access- Authentication Mechanisms-Access Control-System Management- Virtual Servers-Network Storage Systems-Network Management Concepts-Firewall-IP Security- Electronic Communications - Case study on OWASP vulnerabilities using OWASP ZAP tool.		
Unit IV	TECHNICAL SECURITY	9
Supply Chain Management-Cloud Security-Security Architecture-Malware Protection-Intrusion Detection-Digital Rights Management-Cryptographic Techniques-Threat and Incident Management-Vulnerability Management-Security Event Management-Forensic Investigations- Local Environment Management-Business Continuity.		
Unit V	SECURITY ASSESSMENT	9
Security Monitoring and Improvement-Security Audit-Security Performance-Information Risk Reporting-Information Security Compliance Monitoring-Security Monitoring and Improvement Best Practices.		
TOTAL : 45 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO1	Apply the principles of cyber security and to identify threats, risks and security requirements in an organization's security practices	
CO2	Apply system security controls to secure physical assets.	
CO3	Apply security for Business applications and Network Communications.	
CO4	Develop the managerial, operational and technical means for effective cyber security.	
CO5	Develop security measures to monitor, audit process and to device improvements.	
REFERENCES		
1. William Stallings, “Effective Cyber Security - A guide to using Best Practices and Standards”, Addison-Wesley Professional, First Edition, 2019.		
2. Adam Shostack, “Threat Modelling - Designing for Security”, Wiley Publications, First Edition, 2014.		
3. Gregory J. Touhill and C. Joseph Touhill, “Cyber Security for Executives - A Practical Guide”, Wiley Publications, First Edition, 2014.		
4. Raef Meeuwisse, “Cyber Security for Beginners”, Second Edition, Cyber Simplicity Ltd, 2017. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, 2 nd Edition, Syngress, 2013.		
5. Charles P. Pfleeger, Shari Lawrence Pfleeger Jonathan Margulies, “Security in Computing”, Fifth		

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	2	3	3	2	3	3	3	3	3	-	1	3
CO2	2	3	3	3	2	3	3	3	2	2	3	3	3	3	-	2
CO3	2	3	3	3	2	3	3	3	3	3	3	3	2	3	3	2
CO4	2	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	2	3	3	3	2	3	3	3	-	-	3	1
Avg.	2	3	3	3	2	3	3	2.8	8.7	2.8	3	3	2.2	1.8	0.7	0.7

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: PLANNING FOR CYBER SECURITY	2	1 either or	1(2)-CO1	1(2)-CO2 1 either or (16) – CO4	-	-
Unit-II: SECURITY CONTROLS	2	1 either or	1(2)-CO1	1(2)-CO2 1 either or (16)-CO4	-	-
Unit-III: CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16) –CO5	-
Unit-IV: TECHNICAL SECURITY	2	1 either or	2(2)-CO4	1 either or (16) –CO5	-	-
Unit-V: SECURITY ASSESSMENT	2	1 either or	1(2)-CO1	1(2)-CO3 1 either or (16) –CO5-	-	-
Total Qns.Title	10	5 either or	6(2)	4(2) 4 either or (16)	1 either or (16)	-
Total Marks	20	80	12	72	16	-
Weightage	20%	80%	12%	72%	16%	-
Weightage for Cos						
	CO1	CO2	CO3	CO4	CO5	
Total marks	12	4	4	32	48	
Weightage	12%	4%	4%	32%	48%	

PROFESSIONAL ELECTIVE II

MC22311	DEVOPS AND MICROSERVICES	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> • To introduce Microservices and Containers. • To understand the key concepts and principles of DevOps. • To be familiar with most common DevOps tools • To explain the business benefits of DevOps and continuous delivery. • To recall specific DevOps methodologies and frameworks. 					
Unit I	INTRODUCTION TO MICROSERVICES	9			
Definition of Microservices – Characteristics - Microservices and Containers – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud.					
Unit II	MICROSERVICES ARCHITECTURE	9			
Monolithic architecture- Microservice architectural style- Benefits - Drawbacks of Microservice architectural style - decomposing monolithic applications into Microservices.					
Unit III	BASICS OF DEVOPS	9			
History of DevOps- DevOps and software development life cycle- water fall model – agile model –DevOps life cycle – DevOps tools: distributed version control tool –Git- automation testing tools – Selenium - reports generation – TestNG - User Acceptance Testing – Jenkins.					
Unit IV	MICROSERVICES IN DEVOPS ENVIRONMENT	9			
Evolution of Microservices and DevOps – Benefits of combining DevOps and Micro services working of DevOps and Microservices in Cloud environment - DevOps Pipeline representation for a NodeJS based Microservices.					
Unit V	VELOCITY AND CONTINUOUS DELIVERY	9			
Velocity - Delivery Pipeline- test stack - Small/Unit Test – medium /integration testing – system testing- Job of Development and DevOps - Job of Test and DevOps – Job of Op and DevOps- Infrastructure and the job of Ops.					
TOTAL : 45 PERIODS					
SUGGESTED ACTIVITIES					
1. Write your understanding about Microservices and how it works. How you deploy Microservices on cloud.					
2. Discuss about Microservices Architecture.					
3. Write a report on about DevOps tools					
4. Explaining the benefits of combining DevOps.and Microservices with case study					
5. Describe continuous integration and continuous delivery by taking a case study					
COURSE OUTCOMES					

Upon completion of the course, the students will be able to:	
CO 1	Select the Microservices design and apply the principles
CO 2	Apply Microservices in DevOps
CO 3	Understand about DevOps and the common tools used in DevOps.
CO 4	Develop and integrate projects using DevOps
CO 5	Deploy and monitor projects using DevOps

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- 1.Namit Tanasseri, RahulRai, Microservices with Azure, 1st Edition, Packt Publishing, UK, 2017
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3. James A Scott, A Practical Guide to Microservices and Containers, MapR Data Technologies
e – book. <https://mapr.com/ebook/microservices-and-containers/assets/microservices-and-containers.pdf>
4. Joyner Joseph, Devops for Beginners, First Edition, MihailsKonoplovs publisher, 2015.
5. Gene Kim, Kevin Behr, George Spafford, The Phoenix Project, A Novel about IT, DevOps, 5th Edition, IT Revolution Press, 2018 .

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	2	1	-	-	-	1	1	2	1	2	2
CO2	2	2	2	2	2	1	1	-	-	-	1	1	2	1	2	2
CO3	2	2	2	2	2	1	1	-	-	-	1	1	2	1	2	2
CO4	2	2	3	2	1	1	1	-	-	-	1	1	2	1	2	2
CO5	3	2	3	2	2	1	1	-	-	-	1	1	2	1	2	2
Avg.	2.4	2	2.4	2	1.8	1.2	1	-	-	-	1	1	2	1	2	2

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO MICROSERVICES	2	1 either or	2 (2)-CO1	1 either or (16) - CO1	-	-
Unit-II: MICROSERVICES ARCHITECTURE	2	1 either or	2 (2)-CO2	1 either or (16) –CO2	-	-
Unit-III: BASICS OF DEVOPS	2	1 either or	2 (2)-CO3	1 either or (16) –CO3	-	-
Unit-IV: MICROSERVICES IN DEVOPS ENVIRONMENT	2	1 either or	2 (2)-CO4	-	1 either or (16) – CO4	-

Unit-V: VELOCITY AND CONTINUOUS DELIVERY	2	1 either or	2 (2)-CO5	-	1 either or (16) – CO5	-
Total Qns.Title	10	5 either or	10 (2)	3 (16) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	20	48	32	-
Weightage	20%	80%	20%	48%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22312	ADVANCES IN NETWORKING				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> To understand the theme underlying IPv6 Structure and addressing methods To understand and analyse the protocols for IPv6 Implementation To identify and provide solutions for QoS and Security Issues with IPv6 To learn about Software Defined concepts, architectures, protocols and applications To explore the significance of Network Function Virtualization 								
Unit I	IPv6 STRUCTURE AND ADDRESSING							9
IPv4 Address Depletion- IPv6 Transition Issues-IPv6 Structure: IPv6 Header, Extension Headers: Hop-by-Hop Options Header, Destination Options Header, Routing Header, Fragment Header, AH, ESP- IPv6 Addresses: Unicast, Anycast, Multicast – Address Autoconfiguration								
Unit II	IPv6 NETWORKING							9
IPv6 Internet Control Message Protocol (ICMPv6): ICMPv6 Messages, Fragmentation and Path MTU- IPv6 Neighbor Discovery- IPv6 Routing: RIPng, EIGRP for IPv6, OSPFv3 - Mobile IPv6								
Unit III	QoS, PROVISIONING AND SECURITY WITH IPv6							9
QoS in IPv6 Protocols: Differentiated Services and IPv6, IPv6 Flows, Explicit Congestion Notification in IPv6 –Provisioning: Stateless DHCPv6, Stateful DHCPv6, DNS Extensions for IPv6- Security with IPv6: IP Security Protocol (IPsec) Basics, IPv6 Security Elements, Interaction of IPsec with IPv6 Elements.								
Unit IV	SOFTWARE DEFINED NETWORKING							9
Genesis of SDN – Separation of Control Plane and Data Plane – Distributed Control Plane – IP and MPLS – Characteristics of SDN – Operation – Devices – Controller – OpenFlow Specification.								
Unit V	NETWORK FUNCTION VIRTUALIZATION							9
Building SDN Framework – Network Functions Virtualization – Introduction – Virtualization and Data Plane I/O – Service Locations and Chaining – Applications – Use Cases of SDNs: Data Centers, Overlays, Big Data and Network Function Virtualization.								
SUGGESTED ACTIVITIES								
1. IPv6 Packet Analysis Using Wireshark								
2. Verifying the Router’s Link-Local Address on Ethernet and Serial Interfaces using Cisco Packet Tracer								
3. Configuring a Windows Host to Use EUI-64 using Cisco Packet Tracer								

4. Analysis of Router Advertisement Using Wireshark Simulating the basic network topology with SDN based Open Flow Switch using NS3																
COURSE OUTCOMES																
Upon completion of the course, the students will be able to:																
CO 1	Describe how IPv6 interacts with data link layer with IPv6 Structure and addressing methods															
CO 2	To develop the strategies for deploying IPv6 in the place of IPv4															
CO 3	Analyze the security issues for IPv6 in emerging applications															
CO 4	Analyze the need for separation of data and control plane in Networking															
CO 5	To use SDN to enable and enhance NFV															
REFERENCES																
1. Rick Graziani, "IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6" Second Edition, Cisco Press, 2017.																
2. Peter Loshin, "IPv6: Theory, Protocol, and Practice" Second Edition, Morgan Kaufmann Publishers, 2004																
3. William Stallings, "Foundations of Modern Networking – SDN, NFC, QoE, IoT and Cloud" Third Edition, Pearson Publications, 2019.																
4. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with Open Flow", Second Edition, Packt Publishing, 2017.																
5. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Publisher, First Edition 2014.																
6. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", O'Reilly Media, First Edition August 2013.																
Mapping of COs with POs and PSOs																
CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	-	1	-	2	-	-	-	2	-	-	-	-	1	1	-	-
CO3	-	2	-	-	-	3	-	2	-	-	-	-	2	1	-	-
CO4	-	2	-	-	-	-	-	-	-	-	-	-	2	1	-	-
CO5	1	1	-	2	2	-	-	-	-	2	-	-	3	1	2	-
Avg.	0.2	1.4	-	0.8	0.4	0.6	-	0.8	-	0.4	-	-	1.8	1	0.4	-
Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level				Remember (KN)	Understand (KN)	Apply (Ap)	Analyse (An) Evaluate (Ev)						
			No. of Qns. (marks) and CO													
Unit-I: IPv6 STRUCTURE AND ADDRESSING	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-										
Unit-II: IPv6 NETWORKING	2	1 either or	2(2)-CO2	-	1 either or (16) -CO2	-										
Unit-III: QoS, PROVISIONING AND SECURITY WITH IPv6	2	1 either or	2(2)-CO3	1 either or (16) -CO3												
Unit-IV: SOFTWARE	2	1 either or	2(2)-CO4	1 either or (16) -CO4												

DEFINED NETWORKING						
Unit-V: NETWORK FUNCTION VIRTUALIZATION	2	1 either or	2(2)-CO5	-	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	10(2)	3 either or (16)	2 either or (16)	-
Total Marks	20	80	20	48	32	-
Weightage	20%	80%	20%	48%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22313	DIGITAL IMAGE PROCESSING				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> Learn digital image fundamentals. Be exposed to simple image processing techniques. Learn to represent image enhancement in the spatial and frequency domain.. Be familiar with image restoration and segmentation techniques. 								
Unit I	DIGITAL IMAGE FUNDAMENTALS							9
Elements of visual perception, Image Acquisition Systems, Sampling and Quantization, Image Formation, Image Geometry, Different types of digital images. Relationship between pixels, Basic concepts of distance transform, Color Image fundamentals-RGB-HIS Models, Different color models-conversion.								
Unit II	IMAGE TRANSFORMS							9
1D Discrete Fourier Transform (DFT), 2D transforms – DFT, Discrete Cosine Transform, Walsh and PCA								
Unit III	IMAGE ENHANCEMENT							9
Gray Level transformations, Histogram Equalization, Spatial Domain: Basics of Spatial Filtering: smoothing and sharpening spatial filters. Frequency domain: smoothing and sharpening frequency domain filters, Ideal, Gaussian filters.								
Unit IV	IMAGE SEGMENTATION AND FEATURE EXTRACTION							9
Segmentation: Point detection, line detection, edge detection, Region based segmentation, Region Splitting and Merging Technique. Thresholding Techniques: multilevel thresholding, optimal thresholding using Bayesian classification. Feature Extraction: GLCM, Hough Transform, Morphological operation								
Unit V	IMAGE COMPRESSION							9
Lossy and lossless compression schemes, prediction based compression schemes, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme								
TOTAL : 45 PERIODS								
SUGGESTED ACTIVITIES								
1. Compute the GLCM Gray Level Co-occurrence Matrix matrix at ($d=1, \theta=0^\circ$) for the image of size $n \times n$ and derive the possible features from the GLCM matrix.								
2. For the given 3×3 input matrix, perform histogram equalization (Assume the image is 5 bit)								
3. Classify an image 8×8 into 3 classes using K- means clustering. Tools – OpenCV/ Python / Matlab Trial Version								

4. To read, view any image and convert a color image (peppers.png) into greyscale image, binary Image.
5. To obtain Discrete Cosine transform of any grey scale image (eg: cameraman.tiff).
6. Apply Principal Component Analysis (PCA) transform of any color image (eg: peppers.png) and prove that it reduces the dimensionality of the data.
7. By using (GLCM), extract the different features of any image (cameraman.tiff) like energy feature Segment any image (peppers.png) by using thresholding, and compute Euclidean distance for classifying using k-NN classifier.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Digitize the input image using appropriate sampling and quantizing techniques
CO 2	Transform the input images to various domains and classify the images.
CO 3	Enhance the images using spatial domain and frequency domain for better visualrepresentation.
CO 4	To extract the features of a image by applying Morphological Image Processing techniques.
CO 5	Analyze the different image compression techniques and its significance.

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1. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", 4th Edition, Pearson Education, New Delhi, 2018
2. Jain Anil K., "Fundamentals of Digital Image Processing", 1st Edition, Prentice Hall of India, New Delhi, 2002.
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6. Dr.S.Sridhar, Digital Image Processing, Second Edition, Oxford University Press, 2016.

Mapping of COs with POs and PSOs

CO	Program outcomes											Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	-	3	-	-	-	-	-	-	1	2	2	1	-
CO2	3	3	3	-	3	-	-	-	-	-	-	1	2	2	1	-
CO3	3	2	3	-	3	-	-	-	-	-	-	1	2	2	1	-
CO4	3	2	3	-	3	-	-	-	-	-	-	1	2	2	1	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	2.8	2.4	2.4	-	2.4	-	-	-	-	-	-	0.8	1.6	1.6	0.8	-

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (KN)	Apply (Ap)	Analyse (An) Evaluvate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: DIGITAL IMAGE FUNDAMENTALS	2	1 either or	1(2)-CO1	1(2)-CO1	1 either or (16) –CO1	-
Unit-II: IMAGE TRANSFORMS	2	1 either or	2(2)-CO2	1 either or (16) –CO2	-	-
Unit-III: IMAGE ENHANCEMENT	2	1 either or	2(2)-CO3	-	1 either or (16) –CO3	-
Unit-IV: IMAGE SEGMENTATION	2	1 either or	2(2)-CO4	1 either or (16) –CO4	-	-

AND FEATURE EXTRACTION						
Unit-V: IMAGE COMPRESSION	2	1 either or	2(2)-CO5	1 either or (16) –CO5	-	-
Total Qns.Title	10	5 either or	9(2)	1(2) 3 either or (16)	2 either or (16)	-
Total Marks	20	80	18	50	32	-
Weightage	20%	80%	18%	50%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22314	SOCIAL NETWORK ANALYTICS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To gain knowledge about social networks, its structure and their data sources. To study about the knowledge representation technologies for social network analysis. To analyze the data left behind in social networks. To gain knowledge about the community-maintained social media resources. To learn about the visualization of social networks. 					
Unit I	INTRODUCTION TO SEMANTIC WEB	9			
The development of Semantic Web – Emergence of the Social Web – The Development of Social Network Analysis – Basic Graph Theoretical Concepts of Social Network Analysis – Electronic Sources for Network Analysis – Electronic Discussion Networks, Blogs and Online Communities.					
Unit II	KNOWLEDGE REPRESENTATION ON THE SEMANTIC WEB	9			
Ontology-based knowledge Representation – Ontology languages for the Semantic Web: RDF and OWL					
Unit III	SOCIAL NETWORK MINING	9			
Detecting Communities in Social Network – Evaluating Communities –Methods for Community Detection – Applications of Community Mining Algorithms – Tools for detecting communities – Application: Mining Facebook					
Unit IV	COMMUNITY MAINTAINED SOCIAL MEDIA RESOURCES	9			
Community Maintained Resources – Supporting technologies for community maintained resources– User motivations-Location based social interaction – location technology– mobile location sharing – Automated recommender system.					
Unit V	VISUALIZATION OF SOCIAL NETWORKS	9			
Visualization of Social Networks - Node-Edge Diagrams – Random Layout – Force-Directed Layout – Tree Layout – Matrix Representations –Matrix and Node-Link Diagrams– Visualizing Online Social Networks.					
TOTAL : 45 PERIODS					
SUGGESTED ACTIVITIES					

1. Create complex topologies for a social network (Eg: Society of Friends (Quakers) https://programminghistorian.org/assets/exploring-and-analyzing-network-data-with-python/quakers_nodelist.csv) using an open source library (NetworkX) and analyse multiple metrics (Node degree, Node strength, Average path length, Clustering coefficient, Node centralities and Ego-betweenness centrality).
2. Describe the steps in Ontology development using Uniform Modeling Language. Also discuss how to interact with the ontology by extending UML.
3. Collect t community welfare application in social network analysis using an open source tool (Gephi).
4. Consider a data set (eg: Flavor Network <https://github.com/lingcheng99/Flavor-Network/tree/master/datdifferent> types of data from Twitter by using an open source library (Tweepy) and build your own Twitter data crawler.
5. Discuss about a). Transform mathematical representations of the given network (adjacency matrix) with features (eg: flavour compounds) into a graphical representation (Node-Edge Diagrams).

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	create entities and relationships of data as network and do analysis
CO 2	Model and represent knowledge for social semantic Web.
CO 3	Use extraction and mining tools for analyzing Social networks.
CO 4	Collect data from various social media resources and analyse.
CO 5	Develop personalized visualization for Social networks.

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2. Jain Anil K.,”Fundamentals of Digital Image Processing”, 1st Edition, Prentice Hall of India, NewDelhi, 2002.
3. Kenneth R.Castleman, “Digital Image Processing”, 1st Edition, Prentice Hall of India, New Delhi, 2006.
4. John C.Russ, “The Image Processing Handbook”, 5thEdition, Prentice Hall, New Jersey, 2002.
5. William K Pratt, “Digital Image Processing”, 3rd Edition, John Willey,2002.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	3	-	-	2	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	2	-	-	3	3	3	-
CO4	-	3	3	3	2	-	3	3	3	3	3	3	2	3	3	-
CO5	3	3	-	-	3	-	-	1	3	1	-	3	3	2	2	2
Avg.	2.4	2.4	0.6	1.2	1.0	-	0.6	0.8	1.2	1.8	0.6	1.2	2.0	2.2	1.6	0.4

Table of specification for End Semester Question Paper						
Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (KN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTI ON TO SEMANTIC WEB	2	1 either or	2(2)-CO1	1 either or (16) –CO1	-	
Unit-II: KNOWLEDGE REPRESENTA TION ON THE SEMANTIC WEB	2	1 either or	2(2)-CO2	1 either or (16) –CO2	-	-
Unit-III: SOCIAL NETWORK MINING	2	1 either or	2(2)-CO3	-	1 either or (16) –CO3	-
Unit-IV: COMMUNITY MAINTAINED SOCIAL MEDIA RESOURCES	2	1 either or	2(2)-CO4	1 either or (16) –CO4	-	-
Unit-V: VISUALIZATI ON OF SOCIAL NETWORKS	2	1 either or	2(2)-CO5	-	1 either or (16) –CO5	
Total Qns. Title	10	5 either or	10(2)	3(16)	2(16)	-
Total Marks	20	80	20	48	32	-
Weightage	20%	80%	20%	48%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22315	BLOCKCHAIN FOR BUSINESS				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> To discover blockchain technology. To understand how blockchain works and the underlying technology of transactions ,blocks, proof-of-work, and consensus building. To understand how blockchain is simulated without any central controlling or trusted agency and how 								

bitcoin cryptocurrency works.		
<ul style="list-style-type: none"> To understand the value of a digital currency and how it can be protected against scam, fraud, hacking and devaluation. 		
<ul style="list-style-type: none"> To design and implement new ways of using block chain for applications other than cryptocurrency and explore platforms such as Ethereum to build applications. 		
<ul style="list-style-type: none"> To build their career as Blockchain generalist, blockchain developers and Blockchain contract developer. 		
Unit I	DISCOVER BLOCKCHAIN TECHNOLOGY	9
Introduction: History of centralized services, trusted third party for transactions, Making a case for a trustless system, Understand the differences between centralised, decentralised and distributed peer to peer networks, Types of Blockchain, History of Bitcons: Milestones on the development of bitcoin, The problem area and promise of bitcoin, Requirements for blockchain in a business environment, Requirements deep dive, Sharing economy, Internet of Value.		
Unit II	FUNDAMENTAL CONCEPTS OF BLOCKCHAIN	9
Overview of blockchain technology: Transactions, Blocks, Hashes, Consensus, Verify and confirm blocks, Hashes: Hash cryptography, Encryption vs hashing, Transactions: Recording transactions, Digital signature, Verifying and confirming transactions, Blocks and blockchain: Hash pointers, Blocks, Consensus building: Distributed consensus, Byzantine generals problem, Consensus mechanisms: POW, POS, POB, POA and POET, Blockchain Architecture, Markle Root Tree, blockchain and future world of Web 3.0.		
Unit III	MINING AND SIMULATING BLOCKCHAIN	9
Mining and simulating blockchain: Game theory behind competitive mining, Race to beat the others (including hackers), Incentives - mining and transaction fees, CPU considerations, Energy expended in mining, Profitability, Mining pools, Blockchain for Bigdata		
Unit IV	BITCOINS, SECURITY AND SAFEGUARD	9
Bitcoin: Bitcoin creation and economy, Bitcoin exchanges, Bitcoin limited supply and deflation, Famous hacks, Wallets, Security and safeguards: Protecting blockchain from attackers, Forks - soft and hard, Blockchain Security: Key Management in Bitcoin, Case Studies.		
Unit V	PLATFORMS AND BUSINESS APPLICATIONS	9
Introduction to Blockchain platform: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, Corda, Openchain, SOLIDITY, Design a new blockchain, Potential for disruption, How to incentivize blockchain, Design a Distributed Application (DAPP), Blockchain applications: Government, Identity management, Auto executing contracts, Three signature escrow, Triple entry accounting, Elections and voting, Property records, titles, Micropayments, Notary, Sidechains, Blockchain Smart Contracts, Challenges and Research Issues in Blockchain.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Explore various popular blockchain applications. Create list of those applications and the industries/business they are impacting.		
2. Build a transaction then hash it. Generate private and public keys. Digitally sign a transaction		
3. .Setup the hyperledger composer playground.		
4. Transfer assets in a blockchain network.		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO1	Identify the blockchain technology and requirements for blockchain in a business environment	
CO2	Identify the basic concepts of blockchain and its architecture.	

CO3	Build and simulate a model for blockchain.
CO4	Create bitcoin and maintain the security.
CO5	Design and develop new blockchain applications.

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1. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Arvind Narayana.
2. Blockchain Basics 2019: The New Updated Investing Bible for Cryptocurrency Economy, Trading, Investment, Mining (Ethereum, Ripple, Bitcoin(Paperback)), by Bradley Lakeman
3. Blockchain: Step-By- Step Guide to Understand by Paul Laurence
4. Introducing Ethereum and Solidity Foundations of Cryptocurrency and Blockchain Programming for Beginners by Chris Dannen, Apress
5. Hands-On Blockchain for Python Developers: Gain blockchain programming skills to build decentralized applications using Python Paperback
6. Building Blockchain Projects (English, Paperback, Prusty Narayan), Packt
7. Blockchain: The comprehensive beginners guide, (Paperback),by frank walrtin
8. Ultimate Blockchain Technology, Mega Edition — Six Books — Best Deal For Beginners inBlockchain, Blockchain Applications, Cryptocurrency, Bitcoin, Mining and Investing by Lee Sebastian
9. Blockchain And Decentralized Systems(Paperback) by Pavel Kravchenko, Bohdan Skriabin

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	3	-	2	2	1	2	1	1	-	2	-	2
CO2	3	1	-	-	2	-	3	1	2	-	2	2	2	3	-	2
CO3	3	3	2	1	2	-	3	-	-	-	2	1	1	-	2	2
CO4	3	3	2	2	3	-	3	-	1	-	3	3	3	2	3	3
CO5	3	3	3	3	3	-	3	1	2	-	3	3	2	2	3	3
Avg.	3	2.4	1.6	1.4	2	-	2.8	0.8	1.2	-	2.2	2	1.6	1.8	1.6	2.4

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (KN)	Apply (Ap)	Analyse (An) Evaluvate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: DISCOVER BLOCKCHAIN TECHNOLOGY	2	1 either or	2(2)-CO1	1either or (16) - CO1	-	-
Unit-II: FUNDAMENTA L CONCEPTS OF BLOCKCHAIN	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: MINING AND SIMULATING BLOCKCHAIN	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: BITCOINS, SECURITY AND SAFEGUARD	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: PLATFORMS	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-

AND BUSINESS APPLICATIONS						
Total Qns. Title	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22316	BIO INSPIRED COMPUTING				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> To Learn bio-inspired theorem and algorithms To Understand random walk and simulated annealing To Learn genetic algorithm and differential evolution To Learn swarm optimization and ant colony for feature selection To understand bio-inspired application in various fields 								
Unit I	INTRODUCTION							9
Introduction to algorithm - Newton ' s method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Metaheuristics -Analysis of Algorithms -Nature Inspired Algorithms -Parameter tuning and parameter control								
Unit II	RANDOM WALK AND ANNEALING							9
Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling								
Unit III	GENETIC ALGORITHMS AND DIFFERENTIAL EVOLUTION							9
Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.								
Unit IV	SWARM OPTIMIZATION AND FIREFLY ALGORITHM							9
Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization toward feature selection								
Unit V	APPLICATIONS OF BIO INSPIRED COMPUTING							9
Improved Weighted Threshold Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search- Bio inspired algorithms in cloud computing- Wireless Sensor Networks using Bio inspired Algorithms								
TOTAL : 45 PERIODS								
SUGGESTED ACTIVITIES								
1. Identify problems with domains where Bio inspired computing will be most suitable to find a solution								
2. Identify the applications of Random walk								

- List out the applications of Genetic algorithms in AI and machine learning
- Apply swarm intelligence and Firefly algorithm to find an optimal solution for a problem
Compare their efficiency and accuracy
- Try to implement a Bio inspired computing in Networks/Biomedical/Cloud computing applications to obtain an optimal solution

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Implement and apply bio-inspired algorithms
CO 2	Explain random walk and simulated annealing
CO 3	Implement and apply genetic algorithms
CO 4	Explain swarm intelligence and ant colony for feature selection
CO 5	Apply bio-inspired techniques in various fields

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- Xin-She Yang, Joao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing", Elsevier First Edition, 2016
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- Yang, Cui, Xiao, Gandomi, Karamanoglu, "Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO10	PO1 1	PO1 2	PSO 1	PSO2	PSO3	PSO 4
CO1	3	3	2	3	3	-	3	-	-	-	-	-	3	2	1	-
CO2	3	3	2	3	3	-	3	-	-	-	-	-	3	3	1	-
CO3	3	3	2	3	3	-	2	-	-	-	-	-	3	3	1	-
CO4	3	3	2	3	3	-	2	-	-	-	-	-	3	3	1	-
CO5	3	3	3	3	3	2	3	2	2	2	1	2	3	3	3	2
Avg.	3	3	2.2	3	3	0.4	2.6	0.4	0.4	0.4	0.2	0.4	3	3	1.4	0.4

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (KN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION	2	1 either or	2(2)-CO1	1 either or (16) –CO1	-	-
Unit-II: RANDOM WALK AND ANNEALING	2	1 either or	2(2)-CO2	1 either or (16) –CO2	-	-
Unit-III: GENETIC ALGORITHMS AND DIFFERENTIAL EVOLUTION	2	1 either or	2(2)-CO3	-	1 either or (16) – CO3	-

Unit-IV: SWARM OPTIMIZATION AND FIREFLY ALGORITHM	2	1 either or	2(2)-CO4	1either or (16) –CO4	-	-
Unit-V: APPLICATIONS OF BIO INSPIRED COMPUTING	2	1 either or	2(2)-CO5	-	1either or (16) – CO5	-
Total Qns. Title	10	5 either or	10(2)	3(16)	2(16)	-
Total Marks	20	80	20	48	32	-
Weightage	20 %	80%	20%	48%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22317	DIGITAL MARKETING				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> To understand the difference between Traditional Marketing and digital Marketing To understand and analyze the search engine functions To develop a deep knowledge about the Digital marketing platforms and the theoretical aspects of creating a website To analyze inbuilt tools for digital Marketing 								
Unit I	INTRODUCTION TO DIGITAL MARKETING							9
What is Digital Marketing- Need of Digital Marketing-Digital Marketing Platforms – Understanding digital marketing process- Difference between Traditional Marketing and digital Marketing- tools of Digital marketing - Advantage of Digital Marketing-Digital Marketing Manager Role and functions - How we use both Digital & Traditional Marketing								
Unit II	WEBSITE & SEARCH ENGINE							9
Website –Hosting and Domain– Different platforms for website creation- Introduction to SERP- What are search engines- How search engines work- Major functions of a search engine- What are keywords - Different types of keywords- Google keyword planner tool.								
Unit III	MISC TOOLS- GOOGLE WEB MASTER TOOLS							9
Site Map Creators- Browser-based analysis tools-Page Rank tools-pinging & indexing tools- Dead links identification tools- Open site explorer Domain information / who is tools- Quick sprout								
Unit IV	LEAD MANAGEMENT & DIGITAL MARKETING							9
Web to lead forms- Web to case forms- Lead generation techniques- Leads are everywhere- Social media and lead gen Inbuilt tools for Digital Marketing-Ip Tracker- CPC reduction (in case of paid ads) Group posting on Social Media platforms								
Unit V	TRENDING DIGITAL MARKETING SKILLS							9
Search Engine Optimization(SEO)-Search Engine Marketing(SEM).-Social Media Marketing/Optimization-Email Marketing. Website :Product Marketing- Content Writing. Marketing the created content online Copywriting- Blogging- Local Marketing. Google Ad Words - Campaign Management- PPC Advertising-Affiliate Marketing. Mobile and SMS Marketing- Marketing Automation-Web Analytics- Growth Hacking								

SUGGESTED ACTIVITIES																
1. Subscribe to a weekly/quarterly newsletter and analyze how it's content and structure aid with the branding of the company and how it aids its potential customer segments.																
2. Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.																
3. Demonstrate how to use the Google WebMasters Indexing API																
4. Discuss an interesting case study regarding how an insurance company manages leads.																
5. Discuss negative and positive impacts and ethical implications of using social media for political advertising.																
6. Discuss how Predictive analytics is impacting marketing automation.																
COURSE OUTCOMES																
Upon completion of the course, the students will be able to:																
CO 1	Describe the concept of digital marketing and the role of a digital manager.															
CO 2	Illustrate and administer the website and the search engines.															
CO 3	Apply the use of MISC and Google Webmaster tools.															
CO 4	Explain the concepts of lead management and digital marketing.															
CO 5	Apply the knowledge on latest digital marketing trends															
REFERENCES																
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5. Dodson, I. (2016). The art of digital marketing: the definitive guide to creating strategic, targeted, and measurable online campaigns. John Wiley & Sons.																
Mapping of COs with POs and PSOs																
CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	3	3	-	-	3	-	-	-	-	2	-	-	-	-
CO2	2	3		3	3	2	-	-	3	-	-	2		3	-	2
CO3	-	3	3	3	3	-	-	3	3		2	-	3	2	-	2
CO4	3	3	3	3	-	1	3		3	3	-	-	3	1	-	1
CO5	-	3		3	3	-	-	3	3	-	3	1	-	-	-	-
Avg.	1.0	2.4	1.8	3	1.8	0.6	1.2	1.2	2.4	0.6	1.0	1.0	1.2	1.2	-	1.0
Table of specification for End Semester Question Paper																
Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level													
			Remember (KN)	Understand (KN)	Apply (Ap)	Analyse (An) Evaluate (Ev)										
			No. of Qns. (marks) and CO													
Unit-I: INTRODUCTION TO DIGITAL MARKETING	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-										

Unit-II: WEBSITE & SEARCH ENGINE	2	1 either or	2(2)-CO2	1either or (16) –CO2	-	-
Unit-III: MISC TOOLS- GOOGLE WEBMASTER TOOLS	2	1 either or	2(2)-CO3	-	1either or (16) –CO3	-
Unit-IV: LEAD MANAGEMENT & DIGITAL MARKETING	2	1 either or	2(2)-CO4	1either or (16) –CO4	-	-
Unit-V: TRENDING DIGITAL MARKETING SKILLS	2	1 either or	2(2)-CO5	-	1either or (16) –CO5	-
Total Qns. Title	10	5 either or	10(2)	3 either or (16)	2 either or (16)	-
Total Marks	20	80	20	48	32	-
Weightage	20%	80%	20%	48%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

PROFESSIONAL ELECTIVE III

MC22321	SOFTWARE ARCHITECTURE	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> Understand software architectural requirements and drivers Be exposed to architectural styles and views Be familiar with architectures for emerging technologies 					
Unit I	INTRODUCTION AND ARCHITECTURAL DRIVERS	9			
Introduction – Software architecture - Architectural structures – Influence of software architecture on organization - both business and technical – Architecture Business Cycle- Functional requirements – Technical constraints – Quality Attributes					
Unit II	QUALITY ATTRIBUTE WORKSHOP	9			
Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.					
Unit III	ARCHITECTURAL VIEWS	9			
Introduction – Standard Definitions for views – Structures and views – Representing views- available notations – Standard views – 4+1 view of RUP, Siemens 4 views, SEI’s perspectives and views – Case studies					
Unit IV	ARCHITECTURAL STYLES	9			
Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style					
Unit V	DOCUMENTING THE ARCHITECTURE	9			
Good practices – Documenting the Views using UML – Merits and Demerits of using visual languages –					

Need for formal languages – Architectural Description Languages – ACME – Case studies. Special topics: SOA and Web services – Cloud Computing – Adaptive structures

SUGGESTED ACTIVITIES

1. List the stakeholders for a software architecture. How do project managers, chief technical officers, chief information officers, analysts, customers, and users fit into your list?
2. Which quality attributes tend to be the most important to systems in your organization? How are those attributes specified? How does the architect know what they are, what they mean, and what precise levels of each are required?
3. Software architecture is often compared to building architecture. What are the strong points of this comparison? What is the correspondence in buildings to software architecture structures and views? To patterns? What are the weaknesses of the comparison? When does it break down?
4. How does a UML class diagram relate to the styles discussed? Does that diagram show decomposition, uses, generalization, or another combination?
5. You are a new hire to a project. Lay out a sequence of documentation you would like to have to acquaint you with your new position

TOTAL : 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- | | |
|-------------|---|
| CO 1 | Explain influence of software architecture on business and technical activities |
| CO 2 | Summarize quality attribute workshop |
| CO 3 | Identify key architectural structures |
| CO 4 | Use styles and views to specify architecture |
| CO 5 | Design document for a given architecture |

REFERENCES

1. Len Bass, Paul Clements, and Rick Kazman, “Software Architectures Principles and Practices”, 2nd Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, “Architecting Software Intensive System. A Practitioner's Guide”, 1st Edition, Auerbach Publications, 2010.
3. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, “Documenting Software Architectures. Views and Beyond”, 2nd Edition, Addison-Wesley, 2010
4. Paul Clements, Rick Kazman, and Mark Klein, “Evaluating software architectures: Methods and casestudies.”, 1st Edition, Addison-Wesley, 2001.
5. Mark Hansen, “SOA Using Java Web Services”, 1st Edition, Prentice Hall, 2007
6. David Garlan, Bradley Schmerl, and Shang-Wen Cheng, “Software Architecture-Based Self-Adaptation,” 31-56. Mieso K Denko, Laurence Tianruo Yang, and Yan Zang (eds.), “Autonomic Computing and Networking”. 1st Edition, Springer Verlag 2009.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	3	-	-	3	2	3	2	1	3	3	3	-	-	-
CO2	-	-	3	3	3	3	3	-	-	1	-	-	2	-	-	-
CO3	2	2	3	3	3	2	3	-	-	3	-	-	3	-	-	3
CO4	3	3	-	-	-	-	2	-	-	3	-	-	2	2	3	2
CO5	3	3	-	-	-	-	3	1	3	3	2	3	3	3	3	3
Avg.	1.6	1.6	1.8	1.2	1.2	1.6	2.6	0.2	1.0	2.2	1.0	1.2	2.6	1.0	1.2	1.6

Table of specification for End Semester Question Paper						
Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluvate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION AND ARCHITECTURAL DRIVERS	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: QUALITY ATTRIBUTES WORKSHOP	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: ARCHITECTURAL VIEWS	2	1 either or	1(2)-CO3	1(2)-CO3 1 either or (16) -CO3	-	-
Unit-IV: ARCHITECTURAL STYLES	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) -CO4	-
Unit-V: DOCUMENTING ARCHITECTURE	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) -CO5	-
Total Qns. Title	10	5 either or	7(2)	3(2) 3 either or (16)	2 either or (16)	-
Total Marks	20	80	14	54	32	-
Weightage	20%	80%	14%	54%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22322	DIGITAL FORENSICS				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> To learn the security issues network layer and transport layer. To be exposed to security issues of the application layer. To be familiar with forensics tools. To analyze and validate forensics data. To perform digital forensic analysis based on the investigator's position. 								
Unit I	INTRODUCTION						9	
Digital Forensics – Uses- Digital Forensics Process – Locard’s Exchange Principle – Scientific Method – Role of Forensic examiner in Judicial System – Key technical concepts – Bits, bytes and numbering schemes- File extension and file signatures – Storage and memory- computing environment - Legal, Professional and Ethical aspects of Cyber Forensics								
Unit II	ANTI-FORENSICS & LEGAL						9	

Introduction – Hiding data – Password attacks – Additional resources – Steganography – Data destruction. Legal: Fourth Amendment – Criminal law-searches without a warrant – searching with a warrant- Electronic discovery-Expert testimony		
Unit III	EVIDENCE COLLECTION	9
Evidence Collection – Collection option – Obstacles – Types of Evidence – The rules of Evidence – General Procedure – Collection and archiving – Methods of collection – Artifacts – Collection steps – Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the digital Crime Scene – Computer Evidence processing steps – Legal Aspects of Collecting and Preserving Computer Forensic Evidence - Computer Image Verification and Authentication.		
Unit IV	COMPUTER FORENSICS	9
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition		
Unit V	NETWORK FORENSICS & MOBILE DEVICE FORENSICS	9
Introduction – Network fundamentals – Network Security tools – Network evidence and investigations. Mobile device forensics: Cellular Network – Cell phone evidence – Cell phone forensic tools- Global Positioning systems.		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Illustrate with an example about file signature. Why file signature is important in digital forensics.		
2. Explore the legal Fourth amendment related to criminal laws in digital forensics.		
3. Write about searching and seizing computers, laptops, and other electronic gadgets as an evidence in Criminal Investigations		
4. Describe legal aspects of collecting and preserving computer forensic evidence.		
5. Explain the steps involved in incident response methodology.		
6. Give the guidelines for mobile device forensics. Why mobile forensic is important?		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Illustrate the digital forensic process and to play the role of forensic examiner.	
CO 2	Include the Legal amendments in the analysis of the digital forensic process	
CO 3	Demonstrate evidence collection related to digital forensic process	
CO 4	Explore the computer forensics, network forensics and mobile device forensics.	
CO 5	Use the forensics tools for real world problem	
REFERENCES		
1. John Sammons, The Basics of Digital Forensics The Primer for Getting Started in Digital Forensics, Second Edition, Syngress, 2015.		
2. Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, 1st Edition, Cengage Learning, 2014		

3. Cory Altheide and Harlan Carvey, —Digital Forensics with Open Source Tools, 1st Edition, Elsevier publication, April 2011.
4. Nihad A. Hassan, Digital Forensics Basics: A Practical Guide Using Windows OS, 1 st Edition, A Press, 2019
5. Thomas J. Holt, Adam M.Bossler, K.C.Seigfried – Spellar, Cybercrime and Digital Forensics An Introduction, 1st Edition, Taylor and Francis,New York, 2015.
6. Darren R. Hayes, A Practical Guide to Digital Forensics Investigations,2nd Edition , Pearson Education, 2020.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	2	1	-	3	1	-	2	3	2	-	-	3	-	3
CO2	2	3	3	2	2	3	2	-	3	3	2		-	3	-	3
CO3	2	3	3	2	3	3	3	2	3	3	1	1	-	3	-	3
CO4	2	3	3	2	3	3	3	2	3	3	1	1	-	3	-	3
CO5	3	3	3	2	3	3	3	2	3	3	1	-	-	3	-	3
Avg.	1.8	2.4	2.8	1.8	2.2	3.0	2.4	1.2	1.8	3.0	1.4	0.4	-	3.0	-	3.0

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluvate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION	2	1 either or	2(2)-CO1	1either or (16) - CO1	-	-
Unit-II: ANTI-FORENSICS & LEGAL	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: EVIDENCE COLLECTION	2	1 either or	2(2)-CO3	1either or (16) –CO3	-	-
Unit-IV: COMPUTER FORENSICS	2	1 either or	2(2)-CO4		1either or (16) –CO4	-
Unit-V: NETWORK FORENSICS & MOBILE DEVICE FORENSICS	2	1 either or	2(2)-CO5		1either or (16) –CO5	-
Total Qns.Title	10	5 either or	10 (2)	3 either or (16)	2 either or (32)	-
Total Marks	20	80	20	48	32	-
Weightage	20%	80%	20%	48%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	

Weightage	20%	20%	20%	20%	20%
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MC22323	WIRELESS NETWORKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To learn about evolution of 4G Networks, its architecture and applications
- To explore the architecture of 5G, 5G Modulation Schemes and to analyse the concept of MIMO and other research areas in 5G

Unit I	WIRELESS LAN	9
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Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, Wireless HART- IEEE802.16- WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

Unit II	MOBILE NETWORK LAYER	9
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Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination-Sequenced Distance-Vector (DSDV), Dynamic source routing, IoT: CoAP. TCP enhancements for wireless protocols

Unit III	3G OVERVIEW	9
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Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, 3GPP Architecture, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD- CDMA, TD – SCDMA

Unit IV	4G NETWORKS	9
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Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Cognitive Radio, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

Unit V	5G NETWORKS	9
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Introduction to 5G, vision and challenges, 5G NR – New Radio – air interface of 5G, radio access, Ultra-Dense Network Architecture and Technologies for 5G- Generalized frequency division multicarrier (GFDM)- Principles, Transceiver Block diagram-MIMO in LTE, Theoretical background, Single user MIMO, Multi-user MIMO, Capacity of massive MIMO: a summary, Basic forms of massive MIMO implementation.

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES

1. Build a simple WLAN Topology using ns-3 scripting or CORE GUI
2. Performance Analysis of MANET Routing Protocols using ns3 or INET Framework
3. 5G NR Network Simulation using Simu 5G or 5G-LENA
4. Describe some problems with Wi-Fi access for an apartment building and explain how it can be rectified.

5. Study error and throughput varies in a wireless LAN network changes as the distance between the Access Point and the wireless nodes is varied with NetSim or any Simulation tool																
6. Study how call blocking probability varies as the load on GSM network increases continuously.																
COURSE OUTCOMES																
Upon completion of the course, the students will be able to:																
CO 1	Explain the concept of Wireless networks, protocol stack and standards															
CO 2	Describe Packet Delivery from source to destination in a mobile network															
CO 3	Illustrate 3G wireless technology and protocol based on the requirement															
CO 4	Analyze various 4G networking technologies and their unique functionalities															
CO 5	Analyze an overview of the latest network Architecture , its principles and evolution															
REFERENCES																
1. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.																
2. Vijay Garg, —Wireless Communications and networking, First Edition, Elsevier 2007.																
3. Afif Osseiran, Jose.F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press First Edition 2016.																
4. Anurag Kumar, D.Manjunath, Joy kuri, —Wireless Networking, First Edition, Elsevier 2011.																
5. Xiang, W; Zheng, K; Shen, X.S; "5G Mobile Communications", Springer, First Edition 2016																
6. Saad Z Asif, "5G Mobile Communication, Concepts and Challenges", First Edition CRC Press																
7. Thomas L. Marzetta, Erik G. Larsson, Hong Yang, Hien Quoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press, First Edition 2018																
Mapping of COs with POs and PSOs																
CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	3	-	3	-	-	3	2	-	2	3	3	-
CO2	-	3	3	2	3	-	3	3	-	3	-	-	2	2	3	3
CO3	3	3	3	1	-	-	-	-	-	1	-	-	3	1	2	-
CO4	3	3	3	1	-	-	-	-	-	1	-	-	3	1	2	-
CO5	3	3	3	3	-	-	-	3	-	3	2	-	3	3	3	3
Avg.	2.4	3.0	2.4	2.0	1.2	-	1.2	1.2	-	2.2	0.8	-	2.6	2.0	2.6	1.2
Table of specification for End Semester Question Paper																
Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level													
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)										
			No. of Qns. (marks) and CO													
Unit-I: WIRELESS LAN	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-										
Unit-II: MOBILE NETWORK LAYER	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-										

Unit-III: 3G OVERVIEW	2	1 either or	2(2)-CO3	1either or (16) –CO3	-	-
Unit-IV: 4G NETWORKS	2	1 either or	2(2)-CO4		1either or (16) –CO4	-
Unit-V: 5G NETWORKS	2	1 either or	2(2)-CO5		1either or (16) –CO5	-
Total Qns.Title	10	5 either or	10 (2)	3 either or (16)	2 either or (32)	-
Total Marks	20	80	20	48	32	-
Weightage	20%	80%	20%	48%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22324	DEEP LEARNING				L	T	P	C	
					3	0	0	3	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To understand Deep Neural Networks. To learn a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition. To understand RNNs, NLP and Word Embedding's. To learn the internal structure of LSTM and GRU and the differences between them. To study Auto Encoders for Image Processing. 									
Unit I	DEEP LEARNING CONCEPTS							6	
Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.									
Unit II	NEURAL NETWORKS							9	
About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Underfitting. Hyperparameters.									
Unit III	CONVOLUTIONAL NEURAL NETWORK							10	
About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. R- CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO									
Unit IV	NATURAL LANGUAGE PROCESSING USING RNN							10	
About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Co- occurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe.									

Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.

Unit V	DEEP REINFORCEMENT & UNSUPERVISED LEARNING	10
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About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Auto encoding. Convolutional Auto Encoding. Variational Auto Encoding. Generative Adversarial Networks. Auto encoders for Feature Extraction. Auto Encoders for Classification. Denoising Auto encoders. Sparse Auto encoders

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES

1. Feature Selection from Video and Image Data
2. Image and video recognition
3. Image Colorization
4. Aspect Oriented Topic Detection & Sentiment Analysis
5. Object Detection using Autoencoder

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Feature Extraction from Image and Video Data
CO 2	Implement Image Segmentation and Instance Segmentation in Image
CO 3	Implement image recognition and image classification using a pretrained network (Transfer Learning)
CO 4	Traffic Information analysis using Twitter Data
CO 5	Autoencoder for Classification & Feature Extraction

REFERENCES

1. Deep Learning A Practitioner’s Approach Josh Patterson and Adam Gibson O’Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017
5. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	-	-	-	-	2	2	2	3	3	3	-
CO2	3	2	3	2	3	-	-	-	-	2	2	2	3	3	3	-
CO3	3	2	3	2	3	-	-	-	-	2	2	2	3	3	3	-
CO4	2	3	2	2	3	-	-	-	-	2	2	2	3	3	3	-
CO5	3	2	3	2	3	-	-	-	-	2	2	2	3	3	3	-
Avg.	2.8	2.0	3.0	2.0	3.0	-	-	-	-	2.0	2.0	2.0	3.0	3.0	3.0	-

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (KN)	Apply (Ap)	Analyse (An) Evaluvate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: DEEP	2	1 either or	2(2)-CO1	1either or	-	-

LEARNING CONCEPTS				(16) - CO1		
Unit-II: NEURAL NETWORKS	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: CONVOLUTIONAL NEURAL NETWORK	2	1 either or	1(2)-CO3	1(2)-CO3	1either or (16)–CO3	-
Unit-IV: NATURAL LANGUAGE PROCESSING USING RNN	2	1 either or	1(2)-CO4	1(2)-CO4	1either or (16)–CO4	-
Unit-V: DEEP REINFORCEMENT & UNSUPERVISED LEARNING	2	1 either or	1(2)-CO5	1(2)-CO5	1either or (16)–CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22325	DATAMINING IN HEALTHCARE				L	T	P	C	
					3	0	0	3	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To understand data warehouse concepts, architecture, business analysis and tools To understand data pre-processing and data visualization techniques To study algorithms for finding hidden and interesting patterns in data and clustering techniques To understand the data mining techniques in healthcare To study the applications of data mining in healthcare 									
Unit I	DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)							9	
Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.									
Unit II	DATA MINING – INTRODUCTION							9	
Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.									
Unit III	FREQUENT PATTEN ANALYSIS AND CLUSTERING							9	
Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel– Constraint Based Frequent Pattern Mining- Clustering Techniques – Cluster Analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods-Outlier analysis-outlier detection methods.									

Unit IV	DATA MINING AND ANALYTICS IN HEALTHCARE MANAGEMENT												9			
Urgency in healthcare data analytics-Analytics and knowledge management in healthcare -visualization-association rules, cluster analysis– time series forecasting- classifications models.																
Unit V	APPLICATIONS IN HEALTHCARE MANAGEMENT												9			
Application of predictive data mining in healthcare – decision analysis and application in healthcare – analysis of four medical datasets- multiple criteria decision models in healthcare – naïve based models in healthcare.																
TOTAL:45PERIODS																
SUGGESTED ACTIVITIES																
1. Perform attribute ranking for a dataset (Eg: contact-lenses dataset https://archive.ics.uci.edu/ml/datasets/lenses) using any two attribute ranking methods.																
2. Identify the association rules in the above dataset using Apriori algorithm.																
3. Implement K-Nearest Neighbor for classification of a dataset (Eg: Iris dataset https://archive.ics.uci.edu/ml/datasets/Iris).																
4. Demonstrate the K-means clustering process in the above dataset.																
5. Describe the steps in building Data ware house using open source tools (Eg:PentahoDataIntegrationTool)																
COURSE OUTCOMES																
Upon completion of the course, the students will be able to:																
CO 1	Design a Data warehouse system and perform business analysis with OLAP tools.															
CO 2	Apply suitable pre-processing and visualization techniques for data analysis															
CO 3	Apply frequent pattern and association rule mining techniques and clustering techniques for data analysis															
CO 4	Apply data mining techniques in healthcare.															
CO 5	Design data mining models in healthcare.															
REFERENCES																
1. Jiawei Han and Micheline Kamber, -Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.																
2. Alex Berson and Stephen J.Smith, -Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 35th Reprint 2016.																
3. K.P. Soman, Shyam Diwakar and V. Ajay, -Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.																
4. Ian H.Witten and Eibe Frank, -Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.																
5. David L Olson and Ozgur M Araz-Data mining and analytics in healthcare management, Springer,2023																
Mapping of COs with POs and PSOs																
	Program outcomes												Program Specific Outcomes			
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	1	2	1	1	-	1	1	2	1	2	1	2	2
CO2	3	2	2	1	3	1	1	-	1	2	2	2	2	1	2	2
CO3	2	2	2	2	2	1	1	-	1	2	2	1	1	1	2	2
CO4	3	3	3	2	2	3	2	1	2	1	3	2	2	2	3	2
CO5	3	3	3	2	3	3	3	2	2	2	3	3	2	3	3	3
Avg.	2.8	2.4	2.6	1.6	2.4	1.8	1.6	0.6	1.4	1.6	2.4	1.8	1.8	1.6	2.4	2.2

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: DATA MINING – INTRODUCTION	2	1 either or	2(2)-CO2		1 either or (16)-CO2	-
Unit-III: FREQUENT PATTEN ANALYSIS AND CLUSTERING	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: DATA MINING AND ANALYTICS IN HEALTHCARE MANAGEMENT	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: APPLICATIONS IN HEALTHCARE MANAGEMENT	2	1 either or	1(2)-CO5	1(2)-CO5 1 either or (16) –CO5	-	-
Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22326	AGILE METHODOLOGIES				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES								
<ul style="list-style-type: none"> To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software. To provide a good understanding of software design and a set of software technologies and APIs. To do a detailed examination and demonstration of Agile development and testing techniques. To understand the benefits and pitfalls of working in an Agile team. 								

• To understand Agile development and testing		
Unit I	AGILE FUNDAMENTAL	9
Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values		
Unit II	AGILE PROCESSES	9
Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices		
Unit III	AGILITY AND KNOWLEDGE MANAGEMENT	9
Agile Information Systems – Agile Decision Making –Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM)		
Unit IV	AGILITY AND REQUIREMENTS ENGINEERING	9
Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment,– Agile Requirements Modeling and Generation		
Unit V	AGILITY AND QUALITY ASSURANCE	9
Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Agile Approach in Global Software Development - Agile Scrum - Scrum Master – Scaling Projects using Scrum		
TOTAL : 45 PERIODS		
SUGGESTED ACTIVITIES		
1. Describe all the phases of Agile software development methodologies for student enrollment system		
2. Discuss the five values of Extreme programming practices and explain the use cases involved in airline reservation system		
3. Describe about agile knowledge sharing and the role of Story-Card Maturity Model for airline reservation system		
4. Describe the requirement engineering challenges for agile software development of any one the system (Use Jira Software for project planning)		
5. Discuss the role and responsibility of quality assurance in an agile methodology for airline reservation system		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Describe all the phases of Agile software development methodologies	
CO 2	Illustrate iterative software development processes: how to plan them,how to execute them.	
CO 3	Point out the impact of social aspects on software development success.	
CO 4	Develop techniques and tools for improving team collaboration and software quality.	
CO 5	Show how agile approaches can be scaled up to the enterprise level	
REFERENCES		
1. David J. Anderson and Eli Schragenheim,, “Agile Management for Software Engineering: Applyingthe Theory of Constraints for Business Results”, Illustrated Edition, Prentice Hall PTR 2004		
2. Orit Hazza and Yaepl Dubinsky, “Agile Software Engineering,: Undergraduate Topics in Computer Science, Springer Verlag, First Edition,2009		
3. Craig Larman, “Agile and Iterative Development: A Manager’s Guide”, Pearson Education,Second		

Impression, 2007

4. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management”, Elsevier, Butterworth-Heinemann, FirstEdition,2007

5. Ken Schwaber, “Agile Project Management with Scrum”, Illustrated, Revised Edition MicrosoftPress, 2004

6. Konnor Cluster, “Agile Project Management: Learn How To Manage a Project With AgileMethods, Scrum, Kanban and Extreme Programming”, Independently Published,FirstEdition,2019

Mapping of COs with POs and PSOs

CO	Program outcomes											Program SpecificOutcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	3	1	3	1	-	-	2	-	-	-	3	3	-	-	-
CO2	-	1	2	2	2	-	-	-	2	-	2	-	3	2	-	3
CO3	-	-	-	3	3	-	-	1	-	-	3	-	-	1	1	-
CO4	-	1	3	1	-	2	-	2	-	-	-	1	-	3	3	2
CO5	3	2	3	-	3	-	3	-	-	3	-	-	-	1	1	3
Avg.	0.6	1.4	1.8	1.8	1.8	0.4	0.6	1.0	0.4	0.6	1.0	0.2	1.2	1.4	1.0	1.6

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: AGILE FUNDAMENTAL	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: AGILE PROCESSES	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: AGILITY AND KNOWLEDGE MANAGEMENT	2	1 either or	1(2)-CO3	1(2)-CO3 1 either or (16) –CO3	-	-
Unit-IV: AGILITY AND REQUIREMENTS ENGINEERING	2	1 either or	1(2)-CO4	1(2)-CO4	1either or (16) –CO4	-
Unit-V: AGILITY AND QUALITY ASSURANCE	2	1 either or	1(2)-CO5	1(2)-CO5	1either or (16) –CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 3 either or (16)	2 either or (16)	-
Total Marks	20	80	14	54	32	-
Weightage	20%	80%	14%	54%	32%	-

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

MC22337	ORGANIZATIONAL BEHAVIOR				L	T	P	C
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		3	0	0	3
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To enable the students to understand the Organizational Behavior To analyse various factors affecting Personality Organizational Change dynamic of groups To Understand various type of Group Behavior 					
Unit I	ORGANIZATIONAL BEHAVIOR INTRODUCTION	9			
Organization Behaviour – Definition – Scope and Application in Management – Contributions of Other Disciplines to OB. Emerging Issues in Organizational Behaviour- Organizational behaviour models					
Unit II	INDIVIDUAL PROCESSES	9			
Personality – types – Factors influencing personality– Theories. Emotions - Theories – Emotional Intelligence- Learning – Types of learners – The learning process – Learning theories. Perceptions – Importance – Factors influencing perception- Attitudes – Nature of Attitudes Components of Attitudes Formation of Attitude Benefits of Positive Attitude Functions of Attitudes– Measurement-Motivation – Importance – Types – Theories.					
Unit III	LEADERSHIP AND POWER	9			
Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.					
Unit IV	GROUP DYNAMICS	9			
Meaning – Types of Groups – Functions of Small Groups – Group Size Status – Managerial Implications – Group Behaviour – Group Norms – Cohesiveness – Group Thinking					
Unit V	ORGANIZATIONAL CHANGE AND DEVELOPMENT	9			
Organizational Change: Meaning – Nature of Work Change – Need for Change – Change Process – Types of Change – Factors Influencing Change – Resistance to Change – Overcoming Resistance – Organizational Development: Meaning and Different Types of OD Interventions					
SUGGESTED ACTIVITIES					
1. To analyze and understand the impact of various functional modules on the behaviour of individuals with real time examples like buying behavior of consumers in supermarkets.					
2. To Analyze and understand the Perception of individuals and performance based on situations like an individual’s effectiveness in the workplace(often depends on their personality, attitudes and values along with their motivation) to succeed.					
3. Conduct a group discussion among 10 members on some topic and write a report on analysis of behaviour of team members in group decision making					
4. Justify the selection of team members for executing a project with the analysis of various factors like domain expertise ,communication skill of members etc					
5. To study the Performance of employees on organizational change with respect to environment					
COURSE OUTCOMES					
Upon completion of the course, the students will be able to:					
CO 1	Explain the fundamentals of human behavior in organization.				
CO 2	Discuss the Characteristics of attitudes and components of attitudes.				
CO 3	Describe the framework for managing individual and group performance.				
CO 4	Explain the Group dynamics				
CO 5	Analyse various factors affecting Personality Organizational Change dynamic of groups				
REFERENCES					
1. K. Aswathappa, “Organisational behaviour”, Himalaya Publishing House Pvt. Ltd.11 th Edition.					
2. Stephen P. Robbins, “Organizational Behavior”, PHI Learning / Pearson Education, Edition 17, 2016					

(Global edition)
3. Fred Luthans, “Organizational Behavior”, McGraw Hill, 12 th Edition
4. Nelson, Quick, Khandelwal. “ORGB – An innovative approach to learning and teaching”. Cengage, 2 nd edition 2012
5. Ivancevich, Konopaske Matteson, “Organizational Behaviour & Management”, Tata McGraw Hill, 7 th edition, 2008

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	2	2	3	2	3	2	-	3	-	2	1	3	3
CO2	-	1	-	-	-	3	-	3	-	-	3	3	-	2	-	1
CO3	2	-	-	-	2	3	1	3	2	-	3	-	-	1	2	3
CO4	2	-	2	1	-	3	-	1	-	-	3	3	1	-	-	-
CO5	-	3	1	1	2	2	=	2	-	-	3	-	1	1	-	2
Avg.	1.0	1.2	1.2	0.8	1.2	2.8	0.6	2.4	0.8	-	3	1.2	0.8	1.0	1.0	1.8

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: ORGANIZATIONAL BEHAVIOR INTRODUCTION	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: INDIVIDUAL PROCESSES	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-III: LEADERSHIP AND POWER	2	1 either or	2(2)-CO3	1 either or (16) –CO3	-	-
Unit-IV: GROUP DYNAMICS	2	1 either or	2(2)-CO4	1 either or (16) –CO4	-	-
Unit-V: ORGANIZATIONAL CHANGE AND DEVELOPMENT	2	1 either or	2(2)-CO5	1 either or (16) –CO5	-	-
Total Qns. Title	10	5 either or	10(2)	4 either or (16)	1 either or (16)	-
Total Marks	20	80	20	64	16	-
Weightage	20%	80%	20%	64%	16%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

PROFESSIONAL ELECTIVE IV

MC22331	WEB DESIGN	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the concepts and architecture of the World Wide Web. To understand and practice markup languages To understand and practice embedded dynamic scripting on client-side Internet Programming To understand and practice web development techniques on client-side 					
Unit I	INTRODUCTION TO WWW	9+6			
Understanding the working of Internet-Web Application Architecture-Brief history of Internet-Web Standards – W3C-Technologies involved in Web development – Protocols-Basic Principles involved in developing a website-Five Golden Rules of Web Designing					
Unit II	UI DESIGN	9+6			
SVG- Iframes - HTML5 Video and Audio tags - CSS Specificity - Box model - Margins, padding and border – Inline and block elements - Structuring pages using Semantic Tags - Positioning with CSS: Positions, Floats, z-index – CSS with CSS Preprocessors: SASS					
Unit III	ADVANCED UI WITH CSS3	9+6			
Layouts with CSS Grids Flexbox– Responsive web design with media queries - Advanced CSS Effects – Gradients, opacity, box-shadow - CSS3 Animations: Transforms and Transitions - CSS Frameworks: Bootstrap.					
Unit IV	JAVA SCRIPT	9+6			
JavaScript Events - Modifying CSS of elements using JavaScript- Javascript Classes- Introduction to JQuery– JQuery Selectors - Using JQuery to add interactivity - JQuery Events-Modifying CSS with JQuery -Adding and removing elements with JQuery-AJAX with JQuery-Animations with JQuery (hide, show, animate, fade methods, Slide Method)					
Unit V	SERVER-SIDE PROGRAMMING WITH PHP	9+6			
PHP basic syntax-PHP Variables and basic data structures-Using PHP to manage form submissions-File Handling -Cookies and Sessions with PHP-Working with WAMP and PHPMYADMIN-Establishing connectivity with MySQL using PHP					
Lab Components					
1. Design a landing page for a website using Adobe XD (Unit 1)					
2. Design an Admin Dashboard for an E-commerce website using Adobe XD (Unit 1)					
3. Design and develop an event registration form. (Unit 2)					
4. Design and develop a sticky navbar using floats and SASS. (Unit 2)					
5. Design and develop a developer portfolio page. Develop the layout using flexbox and ensure the page is responsive. (Unit 3)					
6. Design and develop pricing card list which are responsive using plain CSS and Flexbox (Unit 3)					
7. Develop a register form and validate it using JavaScript. Design the forms using CSS3 and displayError Messages in the HTML page. (Unit 4)					
8. Develop a website that uses the ‘json placeholder’ Api to get posts data and display them in the form of a card. Use Flexbox to style the cards (Unit 4)					

9. Develop a php server that Creates, Reads, Updates and Deletes Todo and save them in MySQL database. (Unit 5)
10. Develop a php server that registers and authenticates user session and stores user data in MySQL database. (Unit 5)

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Explain the concepts and architecture of the World Wide Web.
CO 2	Create a basic website using HTML and Cascading Style Sheets.
CO 3	Create websites with complex layouts
CO 4	Design rich client presentation using AJAX and add interactivity to websites using simple scripts
CO 5	Add business logic to websites using PHP and databases

TOTAL :75 PERIODS

REFERENCES

1. David Flanagan, “JavaScript: The Definitive Guide”, 7th Edition, O’Reilly Publications,2020
2. Danny Goodman, “Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript” , O’Reilly Publications, 3rd Edition,2007
3. Robin Nixon; “Learning PHP, MySQL, JavaScript & CSS: A Step-by-Step Guide to Creating Dynamic Websites”, O’Reilly Publications, 2nd Edition,2018
4. David Sawyer McFarland, “CSS: The Missing Manual”, O’Reilly Publications, 4th edition, 2015
5. Keith J Grant; “CSS in Depth”, Manning Publications. 1st edition,2018
6. Elizabeth Castrol, “HTML5 & CSS3 Visual Quickstart Guide”, Peachpit Press, 7th Edition, 2012.
7. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and WorldWide Web - How to Program”, Fifth Edition, Pearson Education, 2012
8. <https://developer.mozilla.org/en-US/>

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	-	-	-	2	-	-	-	-	-	-	-	1	1	1	-
CO 2	2	3	3	3		-	-	-	-	-	-	2	2	2	2	-
CO 3	-	-	-	-	-	-	-	-	-	2	-	2	2	-	2	-
CO 4	-	-	-	3	3	-	-	-	-	-	-	-	1	-	1	-
CO 5	2	-	-	-	-	-	-	1	-	-	-	2	3	-	3	1
Avg.	1.2	0.6	0.6	1.2	1.0	--		0.2	-	0.4		1.2	1.8	0.6	1.8	0.2

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-

WWW						
Unit-II UI DESIGN	2	1 either or	1(2)-CO2	12)-CO2	1 either or (16)-CO2	-
Unit-III: ADVANCED UI WITH CSS3	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: JAVA SCRIPT	2	1 either or	1(2)-CO4	1(2)-CO4 1 either or (16) –CO4	-	-
Unit-V: SERVER- SIDE PROGRAMMING WITH PHP	2	1 either or	2(2)-CO5	-	1either or (16) –CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	20	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22332	C# AND .NET PROGRAMMING				L	T	P	C	
					3	0	2	4	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To learn the technologies of the .NET framework. To cover all segments of programming in C# starting from the language basis, followed by the object oriented programming concepts. To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET. To introduce advanced topics namely data connectivity, WPF, WCF and WPF with C# and NET 4.5. To implement mobile applications using .Net Compact Framework 									
Unit I	.NET FRAMEWORK INTRODUCTION							9+6	
.Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and Types- Classes and Structs – Inheritance- Generics – Arrays and Tuples – Operators and Casts – Indexers- Assemblies – Shared Assemblies – CLR Hosting – App domains									
Unit II	C# ADVANCED FEATURES							9+6	
Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection									
Unit III	BASE CLASS LIBRARIES AND DATA MANIPULATION							9+6	
Diagnostics Tasks – Threads and Synchronization – Manipulating XML – SAX and DOM – Manipulating files and the Registry – Transactions – Data access with ADO.NET: Introduction, LINQ to Entities and the ADO.NET Entity Framework, Querying a Database with LINQ – Creating the ADO.NET Entity Data Model Class Library, Creating a Windows Forms Project – Data Bindings between Controls									
Unit IV	WINDOW AND WEB BASED APPLICATIONS							9+6	

Window Based Applications – Core ASP.NET – ASP.NET Web Forms – Server Controls, Data Binding – ASP.NET State Management, Tracing, Caching, Error Handling, Security, Deployment, User and Custom Controls – Windows Communication Foundation (WCF)

Unit V | NET COMPACT FRAMEWORK **9+6**

Reflection – .Net Remoting-.Net Security – Localization – Peer-to-Peer Networking – Building P2P Applications – .Net Compact Framework – Compact Edition DataStores – Testing and Debugging – Optimizing performance – Packaging and Deployment

1. Write a program in C# to check whether a number is palindrome or not
2. Design a simple calculator using switch statement in C#
3. Write a program in C# to find the roots of quadratic equation.
4. Using try, catch and finally blocks write a program in C# to demonstrate error handling
5. Write a program in C# to build a class which implements an interface which already exists.
6. Implement linked lists in C# using the existing collections name space
7. Write a C# program to create a dataset for student details, use grid view to display information.
8. Write a C# program to add new rows and new columns in the above program (student details) and create methods to access the dataset
9. Write an ASP.Net program to display a welcome message in the form when the button is clicked.
10. Write an ASP.Net program containing a listbox, button, an image and label controls. When the user clicks on an item in the listbox, its image should be displayed in the image control. When the user clicks the button, the cost of the selected item should be displayed in the control.

List of Experiments

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- | | |
|-------------|--|
| CO 1 | Explain the difference between .NET and Java framework. |
| CO 2 | Apply the basic and advanced features of C# language. |
| CO 3 | Create applications using various data providers. |
| CO 4 | Create a web application using ASP.NET. |
| CO 5 | Create mobile applications using .NET compact framework. |

TOTAL :75 PERIODS

REFERENCES

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, “Professional C# and .NET 4.5”, Wiley, First Edition 2012
2. Andrew Troelsen, “Pro C# 5.0 and the .NET 4.5 Framework”, Apress publication, First Edition 2012
3. Ian Gariffiths, Mathew Adams, Jesse Liberty, “Programming C# 4.0”, O’Reilly, Sixth Edition, 2010
4. Andy Wigley, Daniel Moth, “Peter Foot, —Mobile Development Handbook”, Microsoft Press, 2nd Edition, 2011
5. Herbert Schildt, “C# - The Complete Reference”, Tata McGraw Hill, First Edition 2010.

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2-	-	-	-
CO2	3	1	3	3	3	-	2	1	3	1	-	2	-	3	-	2

CO3	2	3	2	3	3	-	-	-	-	-	-	1-	3	3	1	
CO4	2	3	3	3	3	-	2	-	-	3	1	-	3	-	-	
CO5	1	3	3	1	3	-	1	2	2	-	-	1	-	-	-	
Avg.	2.2	2.6	2.8	2.6	3.0	-	1.0	0.6	1.0	0.2	0.6	0.6	0.8	1.8	0.6	0.6

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: .NET FRAMEWORK INTRODUCTION	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: C# ADVANCED FEATURES	2	1 either or	1(2)-CO2	12)-CO2	1 either or (16)-CO2	-
Unit-III: BASE CLASS LIBRARIES AND DATA MANIPULATION	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: WINDOW AND WEB BASED APPLICATIONS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16) –CO4	-
Unit-V: .NET COMPACT FRAMEWORK	2	1 either or	2(2)-CO5	-	1 either or (16) –CO5	-
Total Qns. Title	10	5 either or	7(2)	3(2) 1 either or (16)	3 either or (16)	-
Total Marks	20	80	20	22	64	-
Weightage	20%	80%	14%	22%	64%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22333	BIG DATA ANALYTICS				L	T	P	C	
					3	0	2	4	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To understand fundamentals of BigData and Hadoop To learn about file system configuration in HADOOP To learn Map Reduce concept of Hadoop in executing Task To learn the Queue Processing and stream processing of Data To learn about Hadoop Frameworks 									
Unit I	INTRODUCTION TO BIG DATA AND HADOOP							9+6	
Types of Digital Data - Introduction to Big Data - Challenges of conventional systems - Web data – Evolution of Analytic scalability - Analytic Processes and Tools - Analysis vs Reporting -History of Hadoop - Apache Hadoop - Analyzing Data with Hadoop - Hadoop Streaming									

Lab Components:		
1. Perform setting up and Installing Hadoop		
Unit II	HDFS & HADOOP I/O	9+6
Hadoop Distributed File System :The Design of HDFS- HDFS Concepts- The Command-Line Interface- Hadoop File Systems- Data Flow- Parallel Copying with distcp- Hadoop Archives- Hadoop I/O: Data Integrity- Compression- Serialization		
Lab Components:		
1. Implement HDFS Command Reference:		
2. ·Listing contents of directory, Displaying and printing disk usage, Moving files & directories ,Copyingfiles and directories		
3. Implement the following file management tasks in Hadoop: Writing a file into HDFS		
4. Reading data from HDFS, Retrieving files , Deleting files		
Unit III	MAP REDUCE	9+6
Analyzing the Data with Hadoop- Hadoop Pipes- MapReduce Types - Input Formats- Output Formats- MapReduce Features - MapReduce Works - Anatomy of a MapReduce Job Run – Failures - Job Scheduling - Shuffle and Sort - Task Execution		
Lab Components:		
1. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.		
2. Implement Matrix vector multiplication map reduce program		
Unit IV	QUEUEING AND STREAM PROCESSING SYSTEMS	9+6
Queueing: Queueing systems, Introduction to kafka, producer consumer, brokers, types of queues - single consumer, multi consumer queue servers. Streaming systems: Stream processing – queues and workers - micro batch streaming processing - introduction to kafka streaming processing API		
Lab Components:		
1. Implement Single consumer queue in Kafka		
2. Implement video streaming with producer consumer in Kafka		
Unit V	HADOOP FRAMEWORKS	9+6
Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.		
Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data		
Lab Components:		
1. Install and Run Pig then write Pig Latin scripts to sort, group, join your data.		
2. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at:Project Gutenberg)		
3. Install and Run Hive then use Hive to create, alter, and drop databases, tables		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Apply Hadoop for analyzing Big Volume of Data	
CO 2	Access ,store , do operations on data as Files and directories	
CO 3	Implement MapReduce Concept in analyzing BigData	
CO 4	Implement event streaming using Kafka API	
CO 5	Access volume of data with Hadoop Framework	
TOTAL :75 PERIODS		
REFERENCES		
1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data		

Streamswith advanced analytics, John Wiley & sons, 2012.

2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007

3. Tom White, Hadoop: The Definitive Guide, O'Reilly, 2009

4. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles ,David Corigan

5. , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

6. Kafka: The Definitive Guide- Real-Time Data and Stream Processing at Scale, by [Gwen Shapira](#), [NehaNarkhede](#) ,[Todd Palino](#)

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	2	-	2	-	-	-	-	2	3	3	1	3
CO2	3	3	3	2	1	-	-	1	-	2	2	-	2	3	-	-
CO3	3	3	3	3	2	-	2	-	-	2	2	1	3	1	2	3
CO4	3	3	2	2	3	-	3	-	1	2	3	3	1	-	3	3
CO5	3	3	3	-	2	-	2	1	-	-	3	3	2	-	3	3
Avg.	3.0	2.8	2.6	1.4	2.0	=	1.8	0.4	0.2	1.2	2.0	1.8	2.2	1.4	1.8	2.4

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluvate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO BIG DATA AND HADOOP	2	1 either or	2(2)-CO1	1either or (16) - CO1	-	-
Unit-II: HDFS & HADOOP I/O	2	1 either or	2(2)-CO2		1either or (16) –CO2	-
Unit-III: MAP REDUCE	2	1 either or	1(2)-CO3	1(2)-CO3	1either or (16) –CO3	-
Unit-IV: QUEUEING AND STREAM PROCESSING SYSTEMS	2	1 either or	1(2)-CO4	1(2)-CO4 1either or (16)-CO4	-	-
Unit-V: HADOOP FRAMEWORKS	2	1 either or	1(2)-CO5	1(2)-CO5	1either or (16) –CO5	-
Total Qns.Titile	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22334	SOFTWARE QUALITY AND TESTING	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To know the behavior of the testing techniques and to design test cases to detect the errors in the software To get insight into software testing methodologies To understand standard emerging areas in testing To learn about the software quality models. To understand the models and metrics of software quality and reliability 					
Unit I	INTRODUCTION	9+6			
Basic concepts and Preliminaries – Theory of Program Testing– Unit Testing – Control Flow Testing – DataFlow Testing– System Integration Testing					
Unit II	SOFTWARE TESTING METHODOLOGY	9+6			
Software Test Plan–Components of Plan - Types of Technical Reviews - Static and Dynamic Testing- – Software Testing in Spiral Manner - Information Gathering - Test Planning - Test Coverage - Test Evaluation - Acceptance Test – Summarize Testing Results.					
Unit III	EMERGING SPECIALIZED AREAS IN TESTING	9+6			
Test Process Assessment – Test Automation Assessment - Test Automation Framework –Agile Testing – Testing Center of Excellence – Onsite/Offshore Model - Modern Software Testing Tools – Software Testing Trends – Methodology to Develop Software Testing Tools.					
Unit IV	SOFTWARE QUALITY MODELS	9+6			
Software quality –Verification versus Validation– Components of Quality Assurance – SQA Plan – Quality Standards – CMM – PCMM – CMMI – Malcolm Baldrige National Quality Award					
Unit V	QUALITY THROUGH CONTINUOUS IMPROVEMENT PROCESS	9+6			
Role of Statistical Methods in Software Quality – Transforming Requirements into Test Cases – Deming’s Quality Principles – Continuous Improvement through Plan Do Check Act (PDCA)					
List of Experiments					
1. Perform data flow testing for any C program to verify the def-use variables (Ex: largest of two numbers)					
2. Using Selenium IDE, Write a test suite containing minimum 4 test cases for any simple C program (Ex:To check Adam Number)					
3. Write and test a program to update 10 student records into tables into Excel file. (Selenium)					
4. Write and test a program to select the number of students who have scored more than 60 in any onesubject (or all subjects). (Selenium)					
5. Write and test a program to login to a specific web page. (Selenium)					
6. Write and test a program to provide a total number of objects present / available on the page. (Selenium)					
7. Write and test a program to get the number of list items in a list / combo box. (Selenium)					
8. Identify system specification and design test cases to test any application using any one of a testing tool(Selenium/Bugzilla/Test Director)					
9. Automate the test cases of the above system using any test automation tool (Bugzilla /QA Complete)					
10. Design test cases for web pages to test any web sites (Web Performance Analyzer/Open STA)					
COURSE OUTCOMES					
Upon completion of the course, the students will be able to:					
CO 1	Choose the software testing techniques to cater to the need of the project				
CO 2	Identify the components of software quality assurance systems				

CO 3	Apply various software testing strategies
CO 4	Design and develop software quality models
CO 5	Use statistical methods in software quality.

TOTAL :75 PERIODS

REFERENCES

1. William E.Lewis, “Software Testing and Continuous Quality Improvement”, 3rd Edition, Auerbach Publications, 2011
2. Kshirasagar Naik and Priyadarshi Tripathy, “Software Testing and Quality Assurance Theory and Practice”, 2nd Edition, John Wiley & Sons Publication, 2011
3. Ron Patton, “Software Testing”, 2nd Edition, Pearson Education, 2007
4. Glenford J. Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”, 3rd Edition, John Wiley & Sons Publication, 2012.
5. Paul C. Jorgensen, “Software Testing, A Craftman’s Approach”, CRC Press Taylor & Francis Group, Fourth Edition, 2018

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	-	3	-	3	1	-	-	-	-	-	-	-	3	-	-	-
CO 2	-	-	3	3	2	-	-	-	2	-	2	-	3	3	-	3
CO 3	-	-	-	3	3	-	-	-	-	-	3	-	-	3	3	-
CO 4	-	-	3	1	3	2	-	-	-	-	-	-	-	3	3	-
CO 5	3	3	3	-	3	-	3	-	-	3	-	-	-	3	3	-
Avg.	0.6	1.2	1.8	2.0	2.4	0.4	0.6	-	0.4	0.6	1.0	-	1.2	2.4	1.8	0.6

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluatve (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: SOFTWARE TESTING METHODOLOGY	2	1 either or	2(2)-CO2	1 either or (16) –CO2		-
Unit-III EMERGING SPECIALIZED AREAS IN TESTING	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: SOFTWARE QUALITY MODELS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16)-CO4	-
Unit-V: QUALITY THROUGH CONTINUOUS IMPROVEMENT PROCESS	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-

Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22335	MACHINE LEARNING				L	T	P	C	
					3	0	2	4	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To select the appropriate model and use feature engineering techniques To gain knowledge on Probability and Bayesian Learning to solve the given problem To design and implement the machine learning techniques for real world problems To analyze, learn and classify complex data without predefined models 									
Unit I	INTRODUCTION							9+6	
Human Learning - Types – Machine Learning - Types - Problems not to be solved - Applications - Languages/Tools– Issues. Preparing to Model: Introduction - Machine Learning Activities - Types of data - Exploring structure of data - Data quality and remediation - Data Pre-processing									
Unit II	MODEL EVALUATION AND FEATURE ENGINEERING							9+6	
Model Selection - Training Model - Model Representation and Interpretability - Evaluating Performance of a Model - Improving Performance of a Model - Feature Engineering: Feature Transformation - Feature Subset Selection									
Unit III	BAYESIAN LEARNING							9+6	
Basic Probability Notation- Inference – Independence - Bayes’ Rule. Bayesian Learning: Maximum Likelihood and Least Squared error hypothesis-Maximum Likelihood hypotheses for predicting probabilities- Minimum description Length principle -Bayes optimal classifier - Naïve Bayes classifier - Bayesian Belief networks -EM algorithm.									
Unit IV	PARAMETRIC MACHINE LEARNING							9+6	
Logistic Regression: Classification and representation – Cost function – Gradient descent – Advanced optimization – Regularization - Solving the problems on overfitting. Perceptron – Neural Networks – Multi – class Classification - Backpropagation – Non-linearity with activation functions (Tanh, Sigmoid, Relu, PRelu) - Dropout as regularization,									
Unit V	NON PARAMETRIC MACHINE LEARNING							9+6	
k- Nearest Neighbors- Decision Trees – Branching – Greedy Algorithm - Multiple Branches – Continuous attributes – Pruning. Random Forests: ensemble learning. Boosting – Adaboost algorithm. Support Vector Machines – Large Margin Intuition – Loss Function - Hinge Loss – SVM Kernels, Applications of Machine Learning : precision agriculture, product recommendation system.									
List of Experiments									
1. Demonstrate how do you structure data in Machine Learning									
2. Implement data preprocessing techniques on real time dataset									
3. Implement Feature subset selection techniques									
4. Demonstrate how will you measure the performance of a machine learning model									
5. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.									

6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file.
8. Write a program to implement k-Nearest Neighbor algorithm to classify the data set.
9. Apply the technique of pruning for a noisy data monk2 data, and derive the decision tree from this data. Analyze the results by comparing the structure of pruned and unpruned tree.
10. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
11. Implement Support Vector Classification for linear kernels.
12. Implement Logistic Regression to classify problems such as spam detection. Diabetes predictions and so on.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1	Apply data preprocessing technique and explore the structure of data to prepare for predictive modeling
CO 2	Apply data and train a model and measure the performance and use feature selection techniques in Machine Learning
CO 3	Construct Bayesian Network for appropriate problems.
CO 4	Learn about parametric machine Learning algorithms and implement to practical situations
CO 5	Learn about non-parametric machine Learning algorithms and implement to practical situations

TOTAL :75 PERIODS

REFERENCES

1. William E.Lewis, “Software Testing and Continuous Quality Improvement”, 3 rd Edition, AuerbachPublications, 2011
2. KshirasagarNaik and PriyadarshiTripathy, “Software Testing and Quality Assurance Theory and Practice”, 2 nd Edition, John Wiley & Sons Publication, 2011
3. Ron Patton, “Software Testing”, 2 nd Edition, Pearson Education, 2007
4. Glenford J. Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”, 3rd Edition, JohnWiley & Sons Publication, 2012.
5. Paul C. Jorgensen, “Software Testing, A Craftman’sApproach”, CRC Press Taylor & Francis Group,Fourth Edition, 2018

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	-	3	-	3	1	-	-	-	-	-	-	-	3	-	-	-
CO 2	-	-	3	3	2	-	-	-	2	-	2	-	3	3	-	3
CO 3	-	-	-	3	3	-	-	-	-	-	3	-	-	3	3	-
CO 4	-	-	3	1	3	2	-	-	-	-	-	-	-	3	3	-
CO 5	3	3	3	-	3	-	3	-	-	3	-	-	-	3	3	-
Avg.	0.6	1.2	1.8	2.0	2.4	0.4	0.6	-	0.4	0.6	1.0	-	1.2	2.4	1.8	0.6

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I:	2	1 either or	2(2)-CO1	-	1 either or	-

INTRODUCTION					(16) - CO1	
Unit-II: MODEL EVALUATION AND FEATURE ENGINEERING	2	1 either or	2(2)-CO2	-	1 either or (16) –CO2	-
Unit-III BAYESIAN LEARNING	2	1 either or	1(2)-CO3	1(2)-CO3 1 either or (16) –CO3	-	-
Unit-IV: PARAMETRIC MACHINE LEARNING	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16)-CO4	-
Unit-V: NON PARAMETRIC MACHINE LEARNING PROCESS	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 1 either or (16)	3 either or (16)	-
Total Marks	20	80	14	22	64	-
Weightage	20%	80%	14%	22%	64%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22336	NETWORK PROGRAMMING AND SECURITY				L	T	P	C	
					3	0	2	4	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To understand the basics of Network Programming To be familiar with building network applications To design and implement client server Applications using TCP and UDP Sockets To expose with various socket options To get aware of Network security for Network Programming 									
Unit I	INTRODUCTION							9+6	
TCP/IP Layer Model – Multicast, broadcast and Anycast - Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write , close functions – Iterative Server – Concurrent Server									
Lab Components									
1. Socket Creation									
2. Implementation of Client-Server Communication Using TCP									
Unit II	TCP CLIENT SERVER APPLICATIONS							9+6	
TCP Echo Server – TCP Echo Client – Posix Signal handling – Server with multiple clients – boundaryconditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown									

Lab Components		
1. Implementation of TCP Echo Client Server 2. Design a multiuser TCP client - server chat application		
Unit III	SOCKET OPTIONS AND MULTIPLEXING	9+6
Spring Configuration and Spring Boot, Spring MVC, Spring Bean Lifecycle - DispatcherServlet and Configuration - Interceptors – Annotations, Controllers - Views - Input Validation -File Upload-Container,Dependency and IOC .		
Lab Components		
1. Create a Spring MVC application. The application should handle form validation, file upload, session tracking. 2. Implement a RESTful Spring Boot application using Spring REST, Spring Security and Spring Cache.		
Unit IV	ELEMENTARY UDP SOCKETS	9+6
UDP echo Server – UDP echo Client – Multiplexing TCP and UDP sockets – Domain name system – gethostbyname function – Ipv6 support in DNS – gethostbyadr function – getservbyname and getservbyport functions		
Lab Components		
Design a UDP client/server Chat application 1. Design a UDP Domain Name Server (DNS)		
Unit V	NETWORK SECURITY	9+6
SSL - SSL Architecture, SSL Protocols, SSL Message, Secure Electronic Transaction (SET). TLS – TLSProtocols, DTLS Protocols, PKI – Fundamentals, Standards and Applications		
Lab Components		
1. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool .		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Design and implement the client/server programs using variety of protocols	
CO 2	Implement the server side of the web application.	
CO 3	Demonstrate advanced knowledge of programming interfaces for network communication	
CO 4	Use the basic tools for design and testing of network programs in Unix environment..	
CO 5	Identify some of the factors driving the need for network security	
TOTAL :75 PERIODS		
REFERENCES		
1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff ,”Unix Network Programming, Volume 1: The Sockets Networking API”, Third Edition, ISBN:0-13-141155-1, Addison Wesley Pearson Education,2004		
2. Behrouz A Forouzan,DebdeepMukhopadhyay “Cryptography and Network Security” Second Edition, ISBN -13:978-0-07—070208-0 Tata McGraw Hill Education Private Limited 2010		
3. William Stallings, “Cryptographic and network security Principles and Practices”,Fourth Edition,Publisher Prentice Hall, November 2005		
4. Andre Perez, ”Network Security”, First Edition, Publisher John Wiley & Sons, 2014		
5. Gary R. Wright , W. Richard Stevens, ”TCP/IP Illustrated: The Implementation” , ISBN 0- 201-63354-X, Vol. 2, 1 st Edition , Addison Wesley Professional, January 2008		
Mapping of COs with POs and PSOs		

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3	-	1	2	-	-	-	1	-	-	2	-	-
CO2	-	2	-	-	-	-	2	-	-	-	-	2	-	2	-	-
CO3	2	2	3	3	-	-	2	1	2	1	-	-	-	2	-	-
CO4	2	2	3	-	2	-	2	1	-	-	-	-	-	2	-	-
CO5	-	-	3	-	2	2	-	-	1	1	2	2	2	2	-	2
Avg.	1.2	1.6	2.4	1.2	1.0	0.6	1.6	0.4	0.6	0.4	0.6	0.8	0.4	2.0	-	0.4

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: TCP CLIENT SERVER APPLICATIONS	2	1 either or	2(2)-CO2	-	1 either or (16) –CO2	-
Unit-III SOCKET OPTIONS AND MULTIPLEXING	2	1 either or	2(2)-CO3	1 either or (16) –CO3	-	-
Unit-IV: ELEMENTARY UDP SOCKETS	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16)-CO4	-
Unit-V: NETWORK SECURITY	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	8(2)	2(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	16	36	48	-
Weightage	20%	80%	14%	22%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

OPEN ELECTIVE

MC22681	BLOCKCHAIN TECHNOLOGY	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES						
<ul style="list-style-type: none"> Explain the history, types and applications of Blockchain To acquire knowledge about cryptography and consensus algorithms. Develop private blockchain environment and develop a smart contract on Ethereum Build the hyperledger architecture and the consensus mechanism applied in the hyperledger 						
Unit I	INTRODUCTION TO BLOCKCHAIN					9

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain.																
Unit II BLOCKCHAIN ARCHITECTURE															9	
Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)																
Unit III BITCOIN															9	
Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions Parameters that invalidate the transactions- Scripting language in Bitcoin- Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem.																
Unit IV ETHEREUM															9	
The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- different stages of a contract deployment- Deploying contract from web and console.																
Unit V HYPERLEDGER															9	
Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layersApplication programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Blockchain network- Creating andDeploying a business network on Hyperledger.																
TOTAL : 45 PERIODS																
COURSE OUTCOMES																
Upon completion of the course, the students will be able to:																
CO 1		Explain the basics of block chain technology.														
CO 2		Illustrate cryptography and Consensus algorithms.														
CO 3		Develop an application for bitcoin transaction.														
CO 4		Describe the ethereum and smart contracts.														
CO 5		Design the hyper ledger frameworks application.														
REFERENCES																
1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smartcontracts explained”, 2nd Edition, Packt Publishing Ltd, March 2018																
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, “Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger”, Packt Publishing Limited, 2018.																
3. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015																
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton UniversityPress, 2016.																
5. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos, 2018																
Mapping of COs with POs and PSOs																
CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4

CO1	3	3	3	3	2	3	-	-	-	-	-	1	-	2	2	-
CO2	2	3	2	3	3	-	2	-	-	2	2	-	3	3	3	2
CO3	3	2	3	3	3	3	-	-	2	-	-	2	3	2	1	2
CO4	2	3	3	3	-	2	2	-	1	-	2	-	3	1	-	1
CO5	3	2	-	3	3	-	-	-	-	-	-	-	-	-	-	-
Avg.	2.6	2.6	2.2	3.0	2.2	1.6	0.8	=-	0.6	0.4	0.8	0.6	1.8	1.8	1.2	1.0

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO BLOCKCHAIN	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II: BLOCKCHAIN ARCHITECTURE	2	1 either or	1(2)-CO2	1(2)-CO2 1 either or (16) –CO2	-	-
Unit-III BITCOIN	2	1 either or	2(2)-CO3	-	1 either or (16) –CO3	-
Unit-IV: ETHEREUM	2	1 either or	2(2)-CO4	1 either or (16)-CO4	-	-
Unit-V: HYPERLEDGER	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-
Total Marks	20	80	16	52	32	-
Weightage	20%	80%	16%	52%	32%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22781	PYTHON FOR DATA SCIENCE				L	T	P	C	
					3	0	0	3	
COURSE OBJECTIVES									
• To learn the basic concepts of Python									
• To know the fundamental concepts of data science and analytics.									
• To know the basics libraries in Python for Data Science									
• To learn various python data visualization techniques									
• To learn the fundamentals of statistical analysis and probability theory									
Unit I	INTRODUCTION TO PYTHON							9	
Applications of Data Science - Introduction to Python - Operators and Variables in Python - Data Types in Python - Control Flow in Python - Functions in Python - Packages and Modules in Python - File Handling in Python									
Unit II	NUMPY AND PANDAS FOR DATA SCIENCE							9	
Introduction to NumPy Arrays - Basic NumPy Operations - NumPy Functions - Indexing and Slicing of NumPy Arrays - Array Manipulation - File Handling using NumPy - Introduction to Pandas Library in									

Python - Pandas Data Structures - Importing and Exporting Data Using Pandas																	
Unit III DATA VISUALIZATION															9		
Functionality of Pandas Series - Functionality of Pandas Data Frames - Combining Data using Pandas - Data Cleaning using Pandas - Grouping Data using Pandas Data Visualization Library: Matplotlib - Data Visualization Library: Seaborn - Visualizing Matplotlib Plots and Charts - Customizing Visualizations and Saving Plots																	
Unit IV STATISTICAL ANALYSIS IN DATA SCIENCE															9		
Statistical Analysis in Data Science - Measures of Central Tendency - Measures of Dispersion - Measures of Position Univariate Non-Graphical EDA - Univariate Graphical EDA - Multivariate Non-Graphical EDA- Multivariate Graphical EDA																	
Unit V PROBABILITY THEORY FOR DATA SCIENCE															9		
Introduction To Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window.																	
TOTAL : 45 PERIODS																	
COURSE OUTCOMES																	
Upon completion of the course, the students will be able to:																	
CO 1		Explain the fundamental concepts and packages in Python															
CO 2		Apply Numpy and Pandas for Data processing															
CO 3		Analyze data visualization techniques															
CO 4		Apply statistical testing on real world problems															
CO 5		Apply probability theory for data science on real world datasets															
REFERENCES																	
1. Jake VanderPlas, “Python Data Science Handbook”, O'Reilly Media, Inc., 2016																	
2. Yuli Vasiliev, “Python for Data Science: A Hands-On Introduction”, No Starch Press, 2022																	
3. Joel Grus, “Data Science from Scratch : First Principles with Python”, O'Reilly Media, Inc., 2nd edition, 2019																	
4. https://www3.cs.stonybrook.edu/~skiena/519/																	
Mapping of COs with POs and PSOs																	
CO		Program outcomes											Program Specific Outcomes				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		3	3	3	3	3	-	-	-	2	-	2	-	3	3	3	-
CO2		3	3	3	3	3	-	-	-	2	-	2	-	3	3	3	-
CO3		2	2	3	3	3	-	-	-	2	-	2	-	3	3	3	-
CO4		3	3	3	3	3	-	-	-	2	-	2	-	3	3	3	-
CO5		3	3	3	3	3	-	-	-	2	-	2	-	3	3	3	-
Avg.		2.8	2.8	3.0	3.0	3.0	-	-	-	2.0	-	2.0	-	3.0	3.0	3.0	-
Table of specification for End Semester Question Paper																	
Unit No. and Title		Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level													
				Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)										
				No. of Qns. (marks) and CO													
Unit-I: INTRODUCTION TO PYTHON		2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-										
Unit-II: NUMPY AND PANDAS FOR DATA		2	1 either or	1(2)-CO2	1(2)-CO2	1 either or (16) –CO2	-										

SCIENCE						
Unit-III DATA VISUALIZATION	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: STATISTICAL ANALYSIS IN DATA SCIENCE	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16)-CO4	-
Unit-V: PROBABILITY THEORY FOR DATA SCIENCE	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16) –CO5	-
Total Qns.Title	10	5 either or	6(2)	4(2) 1 either or (16)	4 either or (16)	-
Total Marks	20	80	12	24	64	-
Weightage	20%	80%	12%	24%	64%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

MC22782	WEB DESIGNING BASICS				L	T	P	C	
					3	0	0	3	
COURSE OBJECTIVES									
<ul style="list-style-type: none"> To understand the concepts and architecture of the World Wide Web. To understand and practice markup languages To understand and practice embedded dynamic scripting on client-side Internet Programming To understand and practice web development techniques on client-side. 									
Unit I	INTRODUCTION TO WWW							9	
Understanding the working of Internet-Web Application Architecture-Brief history of Internet-Web Standards – W3C-Technologies involved in Web development – Protocols-Basic Principles involved in developing a website-Five Golden Rules of Web Designing.									
Unit II	UI DESIGN							9	
SVG- Iframes - HTML5 Video and Audio tags - CSS Specificity - Box model - Margins, padding and border – Inline and block elements - Structuring pages using Semantic Tags - Positioning with CSS: Positions, Floats, z-index – CSS with CSS Preprocessors: SASS									
Unit III	ADVANCED UI WITH CSS3							9	
Layouts with CSS Grids Flexbox– Responsive web design with media queries - Advanced CSS Effects – Gradients, opacity, box-shadow - CSS3 Animations: Transforms and Transitions - CSS Frameworks: Bootstrap									
Unit IV	JAVA SCRIPT							9	
Introduction - Core features - Data types and Variables - Operators, Expressions, and Statements Functions - Objects - Array, Date and Math Related Objects - Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form validations.									
Unit V	SERVER-SIDE PROGRAMMING WITH PHP							9	
PHP basic syntax-PHP Variables and basic data structures-Using PHP to manage form submissions-File Handling -Cookies and Sessions with PHP-Working with WAMP and PHPMYADMIN-Establishing									

connectivity with MySQL using PHP.

TOTAL : 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1 Describe the concepts and architecture of the World Wide Web

CO 2 Create a basic website using HTML and Cascading Style Sheets.

CO 3 Create websites with complex layouts

CO 4 Apply interactivity to websites using simple scripts

CO 5 Apply business logic to websites using PHP and databases

REFERENCES

1. David Flanagan, “JavaScript: The Definitive Guide”, 7th Edition, O’Reilly Publications,2020

2. Danny Goodman, “Dynamic HTML: The Definitive Reference: A Comprehensive Resource forXHTML, CSS, DOM, JavaScript” , O’Reilly Publications, 3rd Edition,2007

3. Robin Nixon; “Learning PHP, MySQL, JavaScript & CSS: A Step-by-Step Guide to Creating DynamicWebsites”, O’Reilly Publications, 2nd Edition,2018

4. Keith J Grant; “CSS in Depth”, Manning Publications. 1st edition,2018

5. Elizabeth Castrol, “HTML5 & CSS3 Visual Quick start Guide”, Peachpit Press, 7thEdition, 2012.

6. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web -How to Program”, Fifth Edition, Pearson Education, 2012

Mapping of COs with POs and PSOs

CO	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	1	-	-	-	-	-	-	-	2	1	1	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	2	2	1	-
CO3	-	2	3	2	-	-	-	-	-	-	-	-	2	2	1	-
CO4	-	-	-	-	-	-	2	-	-	1	-	-	2	3	2	-
CO5	2	-	-	-	-	-	1	1	-	-	-	-	2	3	2	-
Avg.	0.8	0.4	0.6	0.4	0.6	-	0.6	0.2	-	0.2	-	-	2.0	2.2	1.4	-

Table of specification for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (KN)	Understand (UN)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: INTRODUCTION TO WWW	2	1 either or	2(2)-CO1	1 either or (16) - CO1	-	-
Unit-II UI DESIGN	2	1 either or	1(2)-CO2	12)-CO2	1 either or (16)-CO2	-
Unit-III: ADVANCED UI WITH CSS3	2	1 either or	1(2)-CO3	1(2)-CO3	1 either or (16) –CO3	-
Unit-IV: JAVA SCRIPT	2	1 either or	1(2)-CO4	1(2)-CO4 1 either or (16) –CO4	-	-
Unit-V: SERVER-SIDE PROGRAMMING WITH PHP	2	1 either or	2(2)-CO5	-	1either or (16) –CO5	-
Total Qns.Title	10	5 either or	7(2)	3(2) 2 either or	3 either or (16)	-

				(16)		
Total Marks	20	80	20	38	48	-
Weightage	20%	80%	14%	38%	48%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

BRIDGE COURSES

BX22101	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES					
<ul style="list-style-type: none"> • Be familiar with basic techniques of algorithm analysis. • Be exposed to the concept of ADTs. • Learn linear data structures-List, Stack and Queue. • Learn nonlinear data structures-Tree and Graphs. • Be exposed to sorting, searching and hashing algorithms 					
Unit I	INTRODUCTION	9+6			
Introduction - Abstract Data Types (ADT) – Arrays and its representation –Structures – Fundamentals of algorithmic problem solving – Important problem types – Fundamentals of the analysis of algorithm – analysis framework – Asymptotic notations, Properties, Recurrence Relation.					
Lab Experiments:					
<ol style="list-style-type: none"> 1. Develop a program to perform various array operation. 2. Write a program to find running time complexity by considering each statement in the program for a given set of numbers. 					
Unit II	LINEAR DATA STRUCTURES - STACK, QUEUE	9+6			
Stack ADT – Operations on Stack - Applications of stack – Infix to postfix conversion – evaluation of expression - Queue ADT – Operations on Queue - Circular Queue - Applications of Queue.					
Lab Experiments:					
<ol style="list-style-type: none"> 1. Infix to postfix using stack data structure 2. Develop a program to perform circular queue operations 					
Unit III	LINEAR DATA STRUCTURES – LIST	9+6			
List ADT - Array-based Implementation - Linked list implementation - Singly Linked Lists – Circularly linked lists – Doubly Linked Lists - Applications of linked list – Polynomial Addition.					
Lab Experiments:					
<ol style="list-style-type: none"> 1. Perform Polynomial Manipulation using Single Linked List. 2. Implement the various operations in double linked list. 					
Unit IV	SEARCHING, SORTING AND HASH TECHNIQUES	9+6			
Searching: Linear search – Binary Search- comparison of linear search and binary search, Sorting algorithms: Insertion sort - Bubble sort – selection sort - Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing.					
Lab Experiments:					
<ol style="list-style-type: none"> 1. write a program to perform binary search 2. Write a program to sort a given set of numbers and compare among Bubble Sort, Selection Sort and Insertion Sort with respect to computational complexity. 					

Unit V	NON LINEAR DATA STRUCTURES - TREES AND GRAPHS	9+6
Trees and its representation – left child right sibling data structures for general trees- Binary Tree – Binary tree traversals – Binary Search Tree - Graphs and its representation - Graph Traversals - Depth-first traversal – breadth-first traversal-Application of graphs.		
Lab Experiments:		
1. program to delete a node from a given Binary search tree 2. Write a program to perform Graph Traversals		
TOTAL : 75 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Analyze algorithms and determines their time complexity.	
CO 2	Apply the concepts of data types, data structures and linear structures	
CO 3	Apply List data structures to solve various problems	
CO 4	Apply different Sorting, Searching and Hashing algorithm	
CO 5	Apply non-linear data structures	
REFERENCES		
1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3 rd Edition, Pearson Education.		
2. A.K. Sharma, ” Data Structures using C”, 2 nd Edition, Pearson Education Asia, 2013.		
3. E. Horowitz, Anderson-Freed and S.Sahni, “Fundamentals of Datastructures in C”, 2 nd Edition, University Press, 2007		
4. E.Balagursamy, “Data Structures using C”, Tata McGraw Hill 2015 Reprint.		
5. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, India, 2016.		

BX22102	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To understand the basic concepts of problem solving approaches and to develop the algorithms To apply Techniques of structured (functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing. To design, implements, test, and apply the basic C programming concepts 					
Unit I	INTRODUCTION TO COMPUTER PROBLEM SOLVING	9			
Introduction – The Problem Solving aspect – Top down design – Implementation of algorithm –Program Verification – The efficiency of algorithms – The analysis of algorithms – Fundamental Algorithms.					
Unit II	PROGRAMMING AND ALGORITHM	9			
Programs and Programming – building blocks for simple programs -pseudo code representation – flow charts - Programming Languages - compiler –Interpreter, Loader and Linker - Program execution – Classification of Programming Language - Structured Programming Concept – Illustrated Problems: Algorithm to check whether a given number is Armstrong number or not- Find factorial of a number					
Unit III	BASICS OF ‘C’, INPUT / OUTPUT & STATEMENTS	9 +10			
Introduction- Identifier – Keywords - Variables – Constants – I/O Statements - Operators - Initialization – Expressions – Expression Evaluation – Lvalues and Rvalues – Type Conversion in C –Formatted input and output functions - Specifying Test Condition for Selection and Iteration- Conditional Execution - and Selection – Iteration and Repetitive Execution- go to Statement – Nested Loops- Continue and break statements.					
Lab Experiments:					
1. Write programs to get some input , perform some operation and display the output using I/O statements					

2. Write a program to execute some specific statements based on the test condition		
3. Write programs to implement nested loop		
Unit IV	ARRAYS, STRINGS, FUNCTIONS AND POINTERS	9+10
Array – One dimensional Character Arrays- Multidimensional Arrays- Arrays of Strings – Two dimensional character array – functions - parameter passing mechanism scope – storage classes – recursion - comparing iteration and recursion- pointers – pointer operators - uses of pointers- arrays and pointers –pointers and strings - pointer indirection pointers to functions - Dynamic memory allocation.		
Lab Experiments		
1. Write a program in C to get the largest element of an array using the function.		
2. Display all prime numbers between two intervals using functions.		
3. Reverse a sentence using recursion.		
4. Write a C program to concatenate two strings		
Unit V	USER-DEFINED DATATYPES & FILES	9+10
Structures – initialization - nested structures – structures and arrays – structures and pointers - union– type def and enumeration types - bit fields - File Management in C – Files and Streams – File handling functions –Sequential access file- Random access file – Command line arguments.		
Lab Experiments:		
1. Write a C program to Store Student Information in Structure and Display it.		
2. The annual examination is conducted for 10 students for five subjects.		
3. Write a program to read the data from a file and determine the following: Total marks obtained by each student; Topper of the class.		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Design a computational solution for a given problem.	
CO 2	Break and develop a problem into logical modules that can be solved.	
CO 3	Develop a problem solution into programs involving program constructs.	
CO 4	Develop programs using arrays, strings, functions and pointers for solving complex problems.	
CO 5	Develop programs using structures and files for solving complex computational problems.	
REFERENCES		
1. Deitel and Deitel, “C How to Program”, Pearson Education. 2013, 7 th Edition 1997, Reprint, 2016.		
2. Byron S Gottfried, —Programming with C, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006		
3. Brian W. Kernighan and Dennis M. Ritchie, “The C programming Language”, Edition? 2 nd edition 2015, Pearson Education India		
4. How to solve it by Computer, R. G. Dromey, Pearson education, Fifth Edition, 2007.		
5. Kamthane, A.N., “Programming with ANSI and Turbo C”, Pearson Education, Delhi, 3 rd Edition, 2015		

BX22201	INTRODUCTION TO COMPUTER ORGANIZATION AND OPERATING SYSTEMS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
• To learn the basic structure and operations of a computer.					
• To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.					
• To understand the memory hierarchies, cache memories and virtual memories and to learn the different ways of communication with I/O device.					
• To understand the basic concepts and functions of Operating Systems.					

• To understand Process and various Scheduling Algorithms of OS.		
Unit I	BASIC STRUCTURE AND ARITHMETIC OPERATIONS	9
Functional Units – Basic Operational Concepts – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – Decision Making – MIPS Addressing- Arithmetic for Computers		
Unit II	PROCESSOR AND CONTROL UNIT	9
A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions.		
Unit III	MEMORY & I/O SYSTEMS	9
Memory Hierarchy - Memory technologies – cache memory – measuring and improving cache performance – virtual memory – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Interface circuits – USB		
Unit IV	OPERATING SYSTEMS OVERVIEW	9
Operating system overview-objectives and functions, Evolution of Operating System- Operating System Structure - System Calls- Processes – Process Concept, Inter-process Communication		
Unit V	PROCESS MANAGEMENT	9
CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Threads Overview– The critical-section problem, Semaphores, Classical problems of synchronization, Critical regions.		
TOTAL : 45 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Understand the basics structure of computers, operations and instructions.	
CO 2	Design arithmetic and logic unit, control unit.	
CO 3	Understand the various memory systems and I/O communication.	
CO 4	Understand operating system functions, types, system calls	
CO 5	Analyze Process and various scheduling algorithms	
REFERENCES		
1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier		
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012		
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne - Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.		
4. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012		
5. John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.		

BX22202	BASICS OF COMPUTER NETWORKS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
• To understand networking concepts and basic communication model.					
• To understand network architectures and components required for data communication.					
• To analyze the function and design strategy of physical, data link, network layer and transport layer.					
• To acquire basic knowledge of various application protocol for internet security issues and					

services.		
Unit I	NETWORK FUNDAMENTALS	9
Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology - Transmission media		
Unit II	DATA LINK LAYER	9
Data link control - Flow Control – Error Detection and Error Correction - MAC – Ethernet, Tokenring, Wireless LAN MAC – Blue Tooth – Bridges.		
Unit III	NETWORK LAYER	9
Network layer – Switching concepts – Circuit switching – Packet switching –IP — Datagrams —IP addresses- IPV6– ICMP – Routing Protocols – Distance Vector – Link State- BGP		
Unit IV	TRANSPORT LAYER	9
Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol		
Unit V	APPLICATIONS AND SECURITY	9
Applications - DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA.		
TOTAL : 45 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Define the flow of information from one node to another node in the network	
CO 2	Identify the components required to build different types of networks	
CO 3	Illustrate the functionalities needed for data communication into layers	
CO 4	Identify the required functionality at each layer for given application	
CO 5	Apply the working principles of various application protocols and fundamentals of security issues and services available	
REFERENCES		
1. Larry L. Peterson & Bruce S. Davie, “Computer Networks – A systems Approach”, Fifth Edition, Morgan Kaufmann, 2012.		
2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-down Approach”, Pearson Education, Limited, sixth edition, 2012.		
3. Andrew S. Tannenbaum, David J. Wetherall, “Computer Networks” Fifth Edition, Pearson Education 2011.		
4. Forouzan, “Data Communication and Networking”, Fifth Edition, TMH 2012.		
5. William Stallings, —Data and Computer Communications, Tenth Edition, Pearson Education, 2013.		

AUDIT COURSES

AC22101	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0
COURSE OBJECTIVES					
• Teach how to improve writing skills and level of readability					
• Tell about what to write in each section					
• Summarize the skills needed when writing a Title					
• Infer the skills needed when writing the Conclusion					
• Ensure the quality of paper at very first-time submission					
Unit I	INTRODUCTION TO RESEARCH PAPER WRITING	6			
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness					
Unit II	PRESENTATION SKILLS	6			

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction		
Unit III	TITLE WRITING SKILLS	6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check		
Unit IV	RESULT WRITING SKILLS	6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions		
Unit V	VERIFICATION SKILLS	6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission		
TOTAL : 30 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
COv1	Develop your writing skills and level of readability.	
COv2	Learn about what to write in each section.	
COv3	Develop the skills needed when writing a Title.	
COv4	Develop the skills needed when writing the Conclusion.	
COv5	Ensure the good quality of paper at very first-time submission.	
REFERENCES		
1. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011		
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006		
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006		
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook 1998.		
5. Sher Singh Bhakar, Tarika Singh Sikarwar, Hand book for writing research paper, Bharathi Publications, First Edition, January 2014.		

AC22102	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0
COURSE OBJECTIVES					
<ul style="list-style-type: none"> Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism. To address the role of socialism in India after the commencement of the Bolshevik Revolution 1917 and its impact on the initial drafting of the Indian Constitution. 					
Unit I	HISTORY OF MAKING OF THE INDIAN CONSTITUTION	6			
History, Drafting Committee, (Composition & Working)					
Unit II	PHILOSOPHY OF THE INDIAN CONSTITUTION	6			
Preamble, Salient Features					
Unit III	CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	6			

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.		
Unit IV	ORGANS OF GOVERNANCE	6
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.		
Unit V	LOCAL ADMINISTRATION	6
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.		
Unit VI	LOCAL ADMINISTRATION	6
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO 1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	
CO4	Discuss the passage of the Hindu Code Bill of 1956.	
REFERENCES		
1. The Constitution of India, 1950 (Bare Act), Government Publication.		
2. M.P. Jain, Indian Constitution Law, 7 th Edn., Lexis Nexis, 2014.		
3. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.		

AC22201	DISASTER MANAGEMENT	L	T	P	C
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COURSE OBJECTIVES					
<ul style="list-style-type: none"> Summarize basics of disaster Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response. Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. Develop the strengths and weaknesses of disaster management approaches 					
Unit I	INTRODUCTION	6			
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster;					

Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.		
Unit II	REPERCUSSIONS OF DISASTERS AND HAZARDS	6
Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.		
Unit III	DISASTER PRONE AREAS IN INDIA	6
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics		
Unit IV	DISASTER PREPAREDNESS AND MANAGEMENT	6
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.		
Unit V	RISK ASSESSMENT	6
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival		
TOTAL : 30 PERIODS		
COURSE OUTCOMES		
Upon completion of the course, the students will be able to:		
CO1	Ability to summarize basics of disaster	
CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	
CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	
CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	
CO5	Ability to develop the strengths and weaknesses of disaster management approaches.	
REFERENCES		
1. Goel S. L., Disaster Administration And Management Text And Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.		
2. Nishitha Rai, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company, 2007.		
3. Sahni, Pardeep et.al. ,” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi, 2001.		

UNIT I சங்க இலக்கியம் 6

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
 - எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
 - இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)
 - போரை நிறுத்திய ஔவையார்

UNIT II அறநெறித் தமிழ் 6

1. அறநெறி வகுத்த திருவள்ளுவர்
 - அறம் வலியுறுத்தல், அன்புடமை, ஒப்பறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
 - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III இரட்டைக் காப்பியங்கள் 6

1. கண்ணகி புரட்சி
 - சிலப்பதிகார வழக்குரை காதை
2. சமூக சேவை இலக்கியம் மணிமேகலை
 - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV அருள்நெறித் தமிழ் 6

1. சிறுபாணாற்றுப் படை
 - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்.
2. நற்றிணை
 - அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
 - இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
 - சிறுவனே வள்ளலானான்

- | | |
|-----------------|--------------|
| 6. அகநானூறு (4) | - வண்டு |
| நற்றிணை (11) | - நண்டு |
| கலித்தொகை (11) | - யானை, புறா |
| ஐந்திணை 50 (27) | - மான் |
- ஆகியவை பற்றிய செய்திகள்

UNIT V நவீன தமிழ் இலக்கியம்

6

1. உரைநடைத் தமிழ்
 - தமிழின் முதல் புதினம்
 - தமிழின் முதல் சிறுகதை
 - கட்டுரை இலக்கியம்
 - பயண இலக்கியம்
 - நாடகம்
2. நாட்டு விடுதலை போராட்டமும், தமிழ் இலக்கியமும்
3. சமுதாய விடுதலையும், தமிழ் இலக்கியமும்
4. பெண் விடுதலையும், விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்
6. இணையத்தில் தமிழ்
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்

TOTAL 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள்/புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
 - <https://ta.wikipedia.org>
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம்
 - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
 - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
 - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்