KSR College of Engineering

NAAC ACCREDITED A++ | NBA ACCREDITED PROGRAMMES

AN AUTONOMOUS INSTITUTION

M. TECH - INFORMATION TECHNOLOGY

Curriculum &
Syllabus for Semester I and II

REGULATIONS 2024

(Academic Year 2024-25 Onwards)

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215

(Autonomous)

DEPARTMENT OF INFORMATION TECHNOLOGY

M.Tech. - Information Technology

(REGULATIONS 2024)

Vision of the Institution

IV	We envision to achieve status as an excellent Educational Institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department / Programme: Information Technology

DV	To produce excellent and competent software professional, researchers and responsible engineers, who can significantly contribute to environment friendly societal industry through quality education.

Mission of the Department / Programme: Information Technology

DM1	To make the students competitive and efficient in technical field through technological transformations in Information Technology, by providing them advanced curriculum, infrastructure and nurturing human values.
DM2	To provide an excellent forum for higher studies that leads to careers as Computer and IT professionals in the widely diversified domains of industry, government and academia.

Programme Educational Objectives (PEOs) of M.Tech. - Information Technology

PEO 1	**Evaluate Solutions:** Incorporate with necessary background and significantly contribute to contemporary research in information technology to investigate complex problems.
PEO 2	**Novelty in Technology:** Apply and disseminate intellectual ideas related to IT field and advance in their profession.
PEO 3	**Successful Career:** Enhancing the abilities for successful teaching/research careers in industry or academia.

Programme Outcomes (POs) of M.Tech.-Information Technology (Regulations 2024)

M.Tech. - Information Technology graduates will be able to:

PO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PSO1	**Research Culture:** Integrate and administrate the design and solutions through IT in software industry, society and R&D activities.
PSO2	**Core Values:** Contribute core universal values and social good in the community.

	K. S. R COLLEGE OF ENGINEERING **An Autonomous Institution** **Approved by AICTE and Affiliated to Anna University, Chennai** **Accredited by NAAC ('A++' Grade)**	**Curriculum** **PG** **R - 2024**
Department	**Department of Information Technology**	
Programme	**M.Tech.- Information Technology**	

SEMESTER I

S. No.	Course Code	Course Title	Category	Periods / Week				Credit	Max. Marks		
				L	T	P	Tot		CA	ES	Tot
THEORY COURSES											
1	MA24T16	Operations Research	FC	3	0	0	3	**3**	40	60	100
2	IT24T11	Advanced Data Structures	PCC	3	0	0	3	**3**	40	60	100
3	IT24T12	Research Methodology and IPR	RMC	3	0	0	3	3	40	60	100
4	IT24T13	Software Engineering Methodologies	PCC	3	0	0	3	3	40	60	100
5		Professional Elective - I	PEC	3	0	0	3	**3**	40	60	100
6		Professional Elective - II	PEC	3	0	0	3	**3**	40	60	100
LABORATORY COURSE											
7	IT24P11	Advanced Data Structures Laboratory	PCC	0	0	3	3	**2**	60	40	100
8	IT24P12	XML and Web Services Laboratory	PCC	0	0	3	3	**2**	60	40	100
			TOTAL	**18**	**0**	**6**	**24**	**22**	**800**		

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SEMESTER II

S. No.	Course Code	Course Title	Category	Periods / Week				Credit	Max. Marks		
				L	T	P	Tot		CA	ES	Tot
THEORY COURSES											
1	IT24T21	AI&ML Learning Techniques	PCC	3	0	0	3	**3**	40	60	100
2	IT24T22	Advanced Algorithm	PCC	3	0	0	3	**3**	40	60	100
3	IT24T23	Soft Computing	PCC	3	0	0	3	**3**	40	60	100
4	IT24T24	Full Stack Web Application Development	PCC	3	0	0	3	**3**	40	60	100
5		Professional Elective - III	PEC	3	0	0	3	**3**	40	60	100
6		Professional Elective - IV	PEC	3	0	0	3	**3**	40	60	100
LABORATORY COURSE											
7	IT24P21	AI&ML Learning Techniques Laboratory	PCC	0	0	3	3	**2**	60	40	100
8	IT24P22	Advanced Algorithm Laboratory	PCC	0	0	3	3	**2**	60	40	100
9	IT24P23	Mini Project with Seminar	EEC	0	0	3	3	**2**	60	40	100
			TOTAL	**18**	**0**	**9**	**27**	**24**	**900**		

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Department	**Department of Information Technology**	
Programme	**M.Tech.- Information Technology**	

SEMESTER III

S. No.	Course Code	Course Title	Category	Periods / Week				Credit	Max. Marks		
				L	T	P	Tot		CA	ES	Tot
THEORY COURSES											
1	IT24T31	Advanced Computer Networks	PCC	3	0	0	3	**3**	40	60	100
2	IT24T32	Cloud Computing Technologies	PCC	3	0	0	3	**3**	40	60	100
3		Professional Elective - V	PEC	3	0	0	3	**3**	40	60	100
4		Open Elective	OEC	3	0	0	3	**3**	40	60	100
5		Audit course	AC	2	0	0	0	**0**	40	60	100
LABORATORY COURSE											
6	IT24P31	Project Phase – I	EEC	0	0	10	10	**6**	60	40	100
			TOTAL	**14**	**0**	**10**	**22**	**18**	**600**		

SEMESTER IV

S. No.	Course Code	Course Title	Category	Periods / Week				Credit	Max. Marks		
				L	T	P	Tot		CA	ES	Tot
LABORATORY COURSE											
1	IT24P41	Project Phase – II	EEC	0	0	24	24	**12**	60	40	100
			TOTAL	0	0	24	24	**12**	**100**		
							TOTAL CREDITS		**76**		

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 76

Note: FC - Foundation Courses, RMC- Research Methodology Courses, PCC - Professional core courses, PEC - Professional Elective courses, EEC - Employability Enhancement Courses and AC - Audit courses.

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Department	**Department of Information Technology**	
Programme	**M.Tech.- Information Technology**	

S. No.	Course Code	Course Title	Category	Periods / Week				Credit	Max. Marks		
				L	T	P	Tot		CA	ES	Tot
FOUNDATION COURSES (FC)											
1	MA24T16	Operations Research	I	3	0	0	3	**3**	40	60	100
			TOTAL	**3**	**0**	**0**	**3**	**3**			
EMPLOYABILITY ENHANCEMENT COURSES (EEC)											
1	IT24P23	Mini Project with Seminar	II	0	0	3	3	**2**	60	40	100
2	IT24P31	Project Phase – I	III	0	0	12	12	**6**	60	40	100
3	IT24P41	Project Phase – II	IV	0	0	24	24	**12**	60	40	100
			TOTAL	**0**	**0**	**39**	**39**	**20**			
RESEARCH METHODOLOGY COURSES(RMC)											
1	IT24T12	Research Methodology and IPR	I	3	0	0	3	**3**	40	60	100
				3	0	0	3	**3**			
PROFESSIONAL CORE COURSES (PCC)											
1	IT24T11	Advanced Data Structures	PCC	3	0	0	3	**3**	40	60	100
2	IT24T13	Software Engineering Methodologies	PCC	3	0	0	3	**3**	40	60	100
3	IT24P11	Advanced Data Structures Laboratory	PCC	0	0	3	3	**2**	60	40	100
4	IT24P12	XML and Web Services Laboratory	PCC	0	0	3	3	**2**	60	40	100
5	IT24T21	AI&ML Learning Techniques	PCC	3	0	0	3	**3**	40	60	100
6	IT24T22	Advanced Algorithm	PCC	3	0	0	3	**3**	40	60	100
7	IT24T23	Soft Computing	PCC	3	0	0	3	**3**	40	60	100
8	IT24T24	Full Stack Web Application Development	PCC	3	0	0	3	**3**	40	60	100

9	IT24P21	AI&ML Learning Techniques Laboratory	PCC	0	0	3	3	**2**	60	40	100
10	IT24P22	Advanced Algorithm Laboratory	PCC	0	0	3	3	**2**	60	40	100
12	IT24T31	Advanced Computer Networks	PCC	3	0	0	3	**3**	40	60	100
13	IT24T32	Cloud Computing Technologies	PCC	3	0	0	3	**3**	40	60	100
			TOTAL	24	0	15	39	**32**			
PROFESSIONAL ELECT1VES – I and II (SEMESTER – I)											
1	IT24E01	Advanced Computer Architecture	PEC	3	0	0	3	**3**	40	60	100
2	IT24E02	Ad-Hoc and Sensor Networks	PEC	3	0	0	3	**3**	40	60	100
3	IT24E03	Computer Vision	PEC	3	0	0	3	**3**	40	60	100
4	IT24E04	Data Science	PEC	3	0	0	3	**3**	40	60	100
5	IT24E05	Scientific Computing	PEC	3	0	0	3	**3**	40	60	100
6	IT24E06	Digital Image Processing	PEC	3	0	0	3	**3**	40	60	100
7	IT24E07	XML and Web Services	PEC	3	0	0	3	**3**	40	60	100
8	IT24E08	Distributed Systems	PEC	3	0	0	3	**3**	40	60	100
9	IT24E09	Multimedia Communications	PEC	3	0	0	3	**3**	40	60	100
10	IT24E10	Information Retrieval Techniques	PEC	3	0	0	3	**3**	40	60	100
PROFESSIONAL ELECTIVES – III and IV (SEMESTER – II)											
1	IT24E11	Data Warehousing and Data Mining	PEC	3	0	0	3	**3**	40	60	100
2	IT24E12	Network Management	PEC	3	0	0	3	**3**	40	60	100
3	IT24E13	Object Oriented Programming in Python	PEC	3	0	0	3	**3**	40	60	100
4	IT24E14	Quantum Computing	PEC	3	0	0	3	**3**	40	60	100
5	IT24E15	Blockchain Technology and Applications	PEC	3	0	0	3	**3**	40	60	100
6	IT24E16	Digital Forensics	PEC	3	0	0	3	**3**	40	60	100
7	IT24E17	Social Network Analysis	PEC	3	0	0	3	**3**	40	60	100
8	IT24E18	Big Data and Analytics	PEC	3	0	0	3	**3**	40	60	100
9	IT24E19	Ontology and Semantic Web	PEC	3	0	0	3	**3**	40	60	100
10	IT24E20	Augmented Reality and Virtual Reality	PEC	3	0	0	3	**3**	40	60	100

PROFESSIONAL ELECTIVES – V (SEMESTER – III)											
1	IT24E21	Applied Cybersecurity Analytics and Risk Management	PEC	3	0	0	3	**3**	40	60	100
2	IT24E22	Deep Learning and Applications	PEC	3	0	0	3	**3**	40	60	100
3	IT24E23	Human Computer Interaction Techniques	PEC	3	0	0	3	**3**	40	60	100
4	IT24E24	AWS Cloud Solution Architecture	PEC	3	0	0	3	**3**	40	60	100
5	IT24E25	Internet of Things	PEC	3	0	0	3	**3**	40	60	100
6	IT24E26	GPU Computing	PEC	3	0	0	3	**3**	40	60	100
7	IT24E27	Interactive and Digital Marketing	PEC	3	0	0	3	**3**	40	60	100
8	IT24E28	Cognitive Science	PEC	3	0	0	3	**3**	40	60	100
9	IT24E29	Data Visualization	PEC	3	0	0	3	**3**	40	60	100
10	IT24E30	Advanced Business Analytics with R	PEC	3	0	0	3	**3**	40	60	100
OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT											
1	IT24O01	IoT for Smart System	OEC	3	0	0	3	**0**	40	60	100
2	IT24O02	Machine Learning for Intelligent Multimedia Analytics	OEC	3	0	0	3	**0**	40	60	100
3	IT24O03	DevOps and Microservices	OEC	3	0	0	3	**0**	40	60	100
4	IT24O04	Cyber security and Digital Awareness	OEC	3	0	0	3	**0**	40	60	100
AUDIT COURSE (SEMESTER – III)											
1	IT24A01	Disaster Management	AC	2	0	0	0	**0**	40	60	100
2	IT24A02	Value Education	AC	2	0	0	0	**0**	40	60	100
3	IT24A03	Constitution of India	AC	2	0	0	0	**0**	40	60	100
4	IT24A04	Indian Knowledge System	AC	2	0	0	0	**0**	40	60	100

TOTAL NUMBER OF CREDITS=76

OPEN ELECTIVE COURSES

S. No.	Course Code	Course Title	Category	Periods / Week				Credit	Max. Marks		
				L	T	P	Tot		CA	ES	Tot
1	CN24O01	Energy Efficient Building	OEC	3	0	0	3	**3**	40	60	100
2	CN24O02	Economics and Finance management in Construction	OEC	3	0	0	3	**3**	40	60	100
3	CN24O03	Stress management	OEC	3	0	0	3	**3**	40	60	100
4	CU24O01	Principles of Multimedia	OEC	3	0	0	3	**3**	40	60	100
5	CU24O02	Software Defined Radio	OEC	3	0	0	3	**3**	40	60	100
6	CU24O03	MEMS & NEMS	OEC	3	0	0	3	**3**	40	60	100
7	CU24O04	Introduction to cognitive Radio Network	OEC	3	0	0	3	**3**	40	60	100
8	ET24O01	Embedded Systems	OEC	3	0	0	3	**3**	40	60	100
9	ET24O02	Embedded Control	OEC	3	0	0	3	**3**	40	60	100
10	ET24O03	Embedded Automation	OEC	3	0	0	3	**3**	40	60	100
11	PE24O01	Switching Concepts and Power Semiconductor Devices	OEC	3	0	0	3	**3**	40	60	100
12	PE24O02	Smart Grid Technology	OEC	3	0	0	3	**3**	40	60	100
13	PE24O03	Renewable Energy Technology	OEC	3	0	0	3	**3**	40	60	100
14	PE24O04	Energy Management and Conservation	OEC	3	0	0	3	**3**	40	60	100
15	ST24O01	Principles of Sustainable development	OEC	3	0	0	3	**3**	40	60	100
16	ST24O02	Failure Analysis of Structures	OEC	3	0	0	3	**3**	40	60	100
17	ST24O03	Smart materials and Smart Structures	OEC	3	0	0	3	**3**	40	60	100
18	CC24O01	Digital Manufacturing	OEC	3	0	0	3	3	40	60	100
19	CC24O02	Design for Manufacturing and Assembly	OEC	3	0	0	3	3	40	60	100
20	CC24O03	Smart Materials and Structures	OEC	3	0	0	3	3	40	60	100
21	IS24O01	Industrial Safety Engineering	OEC	3	0	0	3	3	40	60	100
22	IS24O02	Fire Engineering and Protection	OEC	3	0	0	3	3	40	60	100
23	IS24O03	Food and Bio-safety	OEC	3	0	0	3	3	40	60	100

Summary						
Name of the Programme: M.Tech. - Information Technology						
CATEGORY	**I**	**II**	**III**	**IV**	**TOTAL CREDITS**	**%**
FC	3	-	-	-	**3**	**3.94**
EEC	-	2	6	12	**20**	**26.31**
RMC	3	-	-	-	**3**	**3.94**
PCC	10	16	6	-	**32**	**42.10**
PEC	6	6	3	-	**15**	**19.73**
OEC	-	-	3	-	**3**	**3.94**
AC	-	-	✓	-	**-**	**-**
Total	**25**	**24**	**18**	**12**	**76**	**100**

MA24T16	OPERATIONS RESEARCH	Category	L	T	P	C
		FC	3	0	0	3

(Common to M. E- CSE, M. E- BDA and M.Tech.- IT)

PREREQUISITE:

For Effective learning and applying resource management technique students must have a foundational understanding of optimization technique like linear programming and integer programming, basic knowledge of network programming, Queuing model.

OBJECTIVES:

- To determine the most effective way to allocate the best value of linear programming such as profit or loss based on decision variables.
- To analyze the most effective way to minimize the total transportation cost and to find the optimal way to assign a set of tasks.
- To determine the optimal quantity of inventory to hold the balancing between excess and shortage and improve optimal efficiency and reduce waste.
- Todevelop the ability to analyze the basic components and behavior of queuing systems
- To facilitate learners about the PERT/CPM models to identify shortest path, Network design, Project Scheduling.

UNIT-I	LINEAR PROGRAMMING	9

Formation of LPP – Graphical method – Simplex method – Big M Method – Dual simplex method.

UNIT-II	TRANSPORTATION AND ASSIGNMENT PROBLEMS	9

Transportation Models (Minimizing and Maximizing Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by North West Corner Rule, Least cost and Vogel's approximation methods –Optimum solution by MODI Method –Assignment Models (Minimizing and Maximizing Problems) – Hungarian method - Balanced and Unbalanced Problems.

UNIT-III	INVENTORY MODELS	9

Types of Inventory - Deterministic inventory models: Purchasing problem with no shortage and with shortages - Production problem with and without shortages - Purchase problem with price breaks - Probabilistic inventory model (excluding proof).

UNIT-IV	QUEUING MODELS	9

Characteristics of Queuing Models – Kendall's notations - Little's formula - (M/M/1): $(\infty/FIFO)$ Single Server with infinite capacity – (M/M/C) :$(\infty/FIFO)$ Multi Server with infinite capacity - (M/M/1) : $(N/FIFO)$ Single Server with finite capacity - (M/M/C) : $(N/FIFO)$ Multi server with finite capacity .

UNIT-V	PERT/CPM	9

Network Construction-Critical Path Method – Computation of earliest start time, latest start time, Total, free and independent float time-PERT Analysis – Computation of optimistic, most likely Pessimistic and expected time.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Apply the concepts of linear programming approach during the uncertain situations.	Apply

CO2	Analyze the transportation method and Assignment method to minimize costs	Analyze
CO3	Evaluate the inventory model using EOQ and EBQ with and without shortage.	Apply
CO4	Analyze and interpret the key features of various queuing systems	Analyze
CO5	Apply and Evaluate the concepts of network model	Analyze

TEXT BOOKS:

1. TahaH.A, "OperationResearch", Pearson Education, Noida , 9th Edition,2013
2. Vohra N D, "Quantitative Techniques in Management", Tata McGraw Hill, New Delhi, 6th Edition, 2021.

REFERENCES:

1. P.K.GuptaandManMohan, "Problemsin Operations Research", S.Chand and Co, New Delhi, 12th Edition,2014
2. Wayne. L. Winston, "Operationsresearchapplicationsandalgorithms", Thomson learning, United States, 4th Edition,2016.
3. Kalavathy S, "Operations Research", Vikas Publishing House, Ahmedabad, 6th Edition, 2019.
4. HiraandGupta, "ProblemsinOperationsResearch",S.Chandand Co, New Delhi, 2ndEdition, 2012.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	-	2	1
CO2	3	-	-	2	1
CO3	3	-	-	2	1
CO4	3	-	-	2	1
CO5	3	-	-	2	1
Avg.	**3**	**-**	**-**	**2**	**1**

1-low, 2-medium, 3-high

IT24T11	ADVANCED DATA STRUCTURES	Category	L	T	P	C
		PCC	3	0	0	3

PREREQUISITE:

Basic Data Structures, Arrays and Linked Lists, Stacks and Queues, Trees, Hash Tables, Heaps, Mathematics, Discrete Mathematics, Graph Theory, Probability and Statistics, Algorithm Analysis, Sorting and Searching Algorithms, Problem-Solving Techniques, Divide and Conquer, Greedy Algorithms, Dynamic Programming, Proficiency in a Programming Language, Dynamic Memory Management.

OBJECTIVES:

The student should be able to

- Improve problem-solving and critical thinking
- Design an Algorithm and Analysis the algorithm
- Develop skills to apply appropriate data structures in problem solving
- Understand the necessary mathematical abstraction to solve problems
- Understand importance of data structures in context of writing efficient programs.

UNIT - I	HASHING	(9)

General Idea – Hash Function – Separate Chaining – Hash Tables without linked lists: Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Hash Tables in the Standard Library – Universal Hashing – Extendible Hashing.

UNIT - II	SKIP LISTS AND PRIORITY QUEUES (HEAPS)	(9)

Skip Lists: Need for Randomizing Data Structures and Algorithms – Search and Update Operations on Skip Lists – Probabilistic Analysis of Skip Lists – Deterministic Skip Lists – Heap: Model – Simple implementations – Binary Heap : Structure Property – Heap Order Property – Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations.

UNIT - III	TREES	(9)

AVL Trees – Red Black Trees : Properties of red-black trees, Rotations, Insertion, Deletion – 2-3 Trees : 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree – B-Trees – Splay Tree.

UNIT - IV	TEXT PROCESSING	(9)

Text Processing: Sting Operations – Brute-Force Pattern Matching – The Boyer-Moore Algorithm – The Knuth-Morris Pratt Algorithm – Standard Tries – Compressed Tries – Suffix Tries – The Huffman Coding Algorithm – The Longest Common Subsequence Problem (LCS) – Applying Dynamic Programming to the LCS Problem.

UNIT - V	COMPUTATIONAL GEOMETRY	(9)

Computational Geometry: One Dimensional Range Searching – Two Dimensional Range Searching – Constructing a Priority Search Tree – Searching a Priority Search Tree – Priority Range Trees – Quad trees – k-d Trees.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Implement the hashing techniques and its types.	Understand
CO2	Explain the concept of skip list and Heaps.	Understand
CO3	Demonstrate the algorithms for different trees and its operations.	Understand
CO4	Design algorithms for text processing applications.	Apply

CO5	Build algorithms for computational geometry problems.	Apply

REFERENCES:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition, Pearson Education, 2014.
2. Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 4th Edition, The MIT Press, 2022.
3. M T Goodrich, Roberto Tamassia, Algorithm Design and Applications,1st edition, John Wiley, 2014.
4. Alfred V. Aho and John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	1	3
CO2	3	-	2	1	3
CO3	3	-	2	1	3
CO4	3	-	2	1	3
CO5	3	-	2	1	3
Avg.	**3**	**-**	**2**	**1**	**3**

1-low, 2-medium, 3-high

IT24T12	RESEARCH METHODOLOGY AND IPR	Category	L	T	P	C
		RMC	3	0	0	3

PREREQUISITE:

A basic knowledge of the scientific method, types of research, and the design of studies, including data collection, sampling techniques, and basic statistics. Ethical considerations such as informed consent, plagiarism, and confidentiality are crucial. For IPR, familiarity with patents, copyrights, trademarks, and their legal frameworks is essential to protect innovations and ensure compliance.

OBJECTIVES:

- To understand the objectives and motivations driving research.
- To understand the need, guidelines, and process for conducting a literature review.
- To explore the international framework for intellectual property protection, including cooperation and procedures.
- To understand the scope and implications of patent rights.
- To explore the recent developments in IPR.

UNIT – I	RESEARCH METHODOLOGY	[9]

Objectives and motivation of research - Types of Research - Research Approaches - Significance of Research - Research Methods verses Methodology - Research and Scientific Method - Importance of Research Methodology - Research Process - Criteria of Good Research - Problems Encountered by Researchers in India - Benefits to the Society in general. Defining the Research Problem: Definition of Research problem - Problem formulation - Necessity of defining the Problem - Technique Involved in Defining a Problem.

UNIT – II	LITERATURE SURVEY	[9]

Importance of Literature survey - Sources of Information - Assessment of Quality of Journals and Articles - Information through Internet - Literature Review: Need of Review - Guidelines for Review - Record of Research Review.

UNIT – III	PROCESS AND DEVELOPMENT	[9]

Nature of Intellectual Property: Patents – Designs - Trade and Copyright - Process of Patenting and Development: technological research - Innovation - Patenting - Development. International Scenario: International cooperation on Intellectual Property - Procedure for grants of patents - patenting under PCT.

UNIT – IV	PATENT RIGHTS	[9]

Patent Rights: Scope of Patent Rights - Licensing and Transfer of Technology - Patent information and Databases - Geographical Indications.

UNIT – V	NEW DEVELOPMENTS IN IPR	[9]

New Developments in IPR: Administration of Patent System - New developments in IPR - IPR of Biological Systems - Computer Software etc., - Traditional knowledge Case Studies - IPR and IITs

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Analyze the concept of research problem.	Analyze
CO2	Develop and analyze literature study	Create
CO3	Gain insight into how IP laws support technological	Understanding

	advancements and commercialization.	
CO4	Gain knowledge in product licensing.	Understanding
CO5	Identify intellectual property rights.	Applying

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students" 2014.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"2014.
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"2005

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	**3**	**2**	**-**	**3**	**2**
CO2	**3**	**2**	**-**	**3**	**2**
CO3	**3**	**2**	**-**	**3**	**2**
CO4	**3**	**2**	**-**	**3**	**2**
CO5	**3**	**2**	**-**	**3**	**2**
Avg.	**3**	**2**	**-**	**3**	**2**

1-low, 2-medium, 3-high

IT24T13	SOFTWARE ENGINEERING METHODOLOGIES	Category	L	T	P	C
		PCC	3	0	0	3

PREREQUISITE:

Prerequisites for Software Engineering Methodologies include basic programming skills, knowledge of the software development life cycle

OBJECTIVES:

- To explore and analyze various software engineering methodologies, focusing on generic and prescriptive process models.
- To comprehensively examine the processes of requirements engineering.
- To analyze and compare various object-oriented methodologies and modeling techniques.
- To develop a structured approach for identifying use cases and conducting object analysis, focusing on class design.
- To explore software testing fundamentals and quality assurance practices, emphasizing test case design, methodologies.

UNIT - I	INTRODUCTION	(9)

Software Engineering - Software Process - Generic process model – Prescriptive Process models - Agile development-Agile Process- Extreme Programming - Other Agile process models: Adaptive process models ,Scrum, Dynamic - Systems Development Method .

UNIT - II	REQUIREMENT ANALYSIS	(9)

Functional and Non-Functional Requirements - User Requirements - System Requirements - Interface Specifications - Software RequirementsDocument - Requirements Engineering Processes - Feasibility Studies- Elicitation and Analysis - Validations - Management - System Models – Context - Behavioral - Data - Object - Structured.

UNIT - III	OBJECT ORIENTED METHODOLOGIES	(9)

Rumbaugh Methodology - Booch Methodology - Jacobson Methodology - Patterns - Frameworks - Unified Approach - Unified Modeling Language - Use Case - Class Diagram - Interactive Diagram - Package Diagram - Collaboration Diagram-State Diagram - Activity Diagram.

UNIT - IV	OBJECT ORIENTED ANALYSIS AND DESIGN	(9)

Identifying Use Cases - Object Analysis – Classification - Identifying Object Relationships - Attributes and Methods - Design Axioms - Designing Classes - Access Layer - Object Storage –V iew Layer .

UNIT - V	SOFTWARE TESTING AND SOFTWARE QUALITYASSURANCE	(9)

Software Testing Fundamentals - Test Case Design - White Box - Black Box - Testing for Specialized Environments, Architectures and Applications - Software Testing Strategies - Approach – Issues – Testing - Unit - Integration - Validation - System - Art of Debugging.

Software Quality Concepts - Quality Assurance - Software Technical Reviews - Formal Approach to Software Quality Assurance - Reliability - Quality Standards - Software Quality Assurance Plan - Software Maintenance - Software Configuration Management -SCM Standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the Concepts of software development process	Understand
CO2	Analyze the system requirements and system specification	Understand

CO3	Discuss about the different methodologies used in software systems	Analyzing
CO4	Understand the various software design methodologies	Evaluating
CO5	Investigate the software testing and Quality Assurance for developing Software systems	Creating

REFERENCES:

1. Roger S Pressman, "Software Engineering – A Practitioner's Approach", 7th edition, McGraw Hill Education, 2014.
2. Ian Sommerville, "Software engineering", Seventh Edition, Pearson Education Asia.
3. Wiegers, Karl, Joy Beatty, "Software requirements", Pearson Education, 2013.
4. Pankaj Jalote, - Software Engineering, A Precise Approachl, Wiley India, 2010.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	2	1
CO2	2	-	2	2	1
CO3	2	-	2	2	1
CO4	2	-	2	2	1
CO5	2	-	2	2	1
Avg.	**2**	**-**	**2**	**2**	**1**

1-low, 2-medium, 3-high

IT24P11	ADVANCED DATA STRUCTURES LABORATORY	Category	L	T	P	C
		PCC	0	0	3	2

PREREQUISITE:

Data Structures, Design, Analysis of Algorithms and Basic Programming skills.

OBJECTIVES:

- Learn about complex data structures
- Analyze and evaluate time and space complexity for various data structures.
- Develop problem-solving skills for applying data structures to real-world challenges.
- Enhance coding and implementation skills, including debugging and testing.
- Gain familiarity with real-world applications of advanced data structures.

List of Exercise/Experiments:

Implementation of

1. Depth-First Search (DFS) and Breadth-First Search (BFS).
2. Dijkstra's Algorithm for shortest paths in weighted graphs.
3. Floyd-Warshall Algorithm for all-pairs shortest paths.
4. Minimum Spanning Tree using Prim's algorithms.
5. Randomized quick sort algorithm
6. Hash functions and associated algorithms
7. Splay trees and its functions
8. Find the solution for the knapsack problem using the greedy method.
9. Operations on Fibonacci heaps
10. Operations on binary heaps
11. Operations on B-Trees
12. N Queen's problem using Back Tracking algorithm
13. 0-1 knapsack problem using dynamic programming
14. Single source shortest path for a given graph.
15. Find minimum cost spanning tree using Kruskal's algorithm

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Implement List ADTs and their operations.	Apply
CO2	Develop programs for sorting, hash functions	Apply
CO3	Apply Greedy, divide and conquer algorithms	Apply
CO4	Apply dynamic programming concept in real time problems	Apply
CO5	Analyze and Apply various advanced data structures algorithms in real time applications	Apply

REFERENCES:

1. Thomas H. Cormen, Charles E"Introduction to Algorithms" 3rd Edition, MIT Press, 2009

2. Steven S. Skiena "The Algorithm Design Manual" 2nd Edition, Springer , 2008.

Mapping of COs with POs and PSOs					
COs/ POs	**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	2	-	1	2	-
CO2	2	-	1	2	-
CO3	2	-	1	2	-
CO4	2	-	1	2	-
CO5	2	-	1	2	-
Avg.	**2**	**-**	**1**	**2**	**-**
1-low, 2-medium, 3-high					

IT24P12	XML AND WEB SERVICES LABORATORY	Category	L	T	P	C
		PCC	0	0	3	2

PREREQUISITE:

A Basic knowledge in programming languages such as Java, Python, or C#. Familiarity with Integrated Development Environments (IDEs) like Eclipse, IntelliJ, or Visual Studio.

OBJECTIVES:

- To understand the structure and elements of HTML to create interactive and visually structured web pages.
- To understand the functionality of ASP/JSP objects like Response, Request, Application, Session, and Server.
- To understand the role of servlets in Java-based web applications.
- Develop expertise in XML for data exchange and integration with databases.
- To Develop online applications integrating database access for managing data dynamically.

List of Exercise/Experiments:

1. Creation of HTML pages with frames links, tables and other tags
2. Usage of internal and external CSS along with HTML pages
3. Client side Programming
   i) JavaScript for displaying date and comparing two dates

   ii) Form Validation including text field, radio buttons, check boxes, list box and other controls.
4. Usage of ASP/JSP objects Response, Request, Application, Session ,Server, ADO etc
   i) Writingonlineapplicationssuchasshopping,railway/air/busticketreservationsystem with set of ASP/JSP pages
   ii) Using sessions and cookies asp art of the web application
5. Writing Servlet Program using HTTP Servlet
6. Any online application with database access
7. Creation of XML document for a specific domain
8. Writing DTD or XML schema for the domain specific XML document
9. Parsing an XML document using DOM and SAX Parsers
10. Connect a Xml web page to any database engine.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Develop web pages using markup languages and design by Cascading Style Sheets	Applying
CO2	Build dynamic pages and perform validation using javascript	Creating
CO3	Develop online applications using ASP/JSP and perform session management	Applying
CO4	Design a XML document and parse these document using DOM / SAX parsers	Creating

CO5	Extend web applications using open source software	Understanding

REFERENCES:

1. Schmelzer, XML and Web Services Unleashed, Pearson India, January 2008.
2. Claudia Zentner , Dieter Koenig , Doug Davis , Glen Daniels , Building Web Services with Java: Making Sense of XML, SOAP, WSDL, and UDDI, Sams Publishing, June 2004.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	**2**	**-**	**2**	**1**	**-**
CO2	**2**	**-**	**2**	**1**	**-**
CO3	**2**	**-**	**2**	**1**	**-**
CO4	**2**	**-**	**2**	**1**	**-**
CO5	**2**	**-**	**2**	**1**	**-**
Avg.	**2**	**-**	**2**	**1**	**-**

1-low, 2-medium, 3-high

IT24T21	AI and ML LEARNING TECHNIQUES	Category	L	T	P	C
		PCC	3	0	0	3

PREREQUISITE:

A solid foundation in mathematics, including linear algebra, calculus, probability, and statistics, as these are fundamental to understanding algorithms and models. Proficiency in programming languages like Python and familiarity with libraries such as NumPy, Pandas, TensorFlow, and Scikit-learn are essential for implementation. Basic knowledge of machine learning concepts, such as supervised and unsupervised learning, as well as algorithms like linear regression and clustering, is crucial.

OBJECTIVES:

- Grasp the fundamental concepts of calculus, including derivatives and integrals, and their relevance to optimization in machine learning.
- To understand the principles and process of supervised learning, distinguishing it from unsupervised learning.
- To identify how Principal Component Analysis aids in data visualization and reduces the complexity of high-dimensional datasets.
- To explore multi-layer perceptrons (MLPs) and their role in more complex learning tasks.
- Develop an understanding of the challenges and considerations of implementing ethical AI systems.

UNIT - I	FOUNDATIONS OF AI AND MACHINE LEARNING	(9)

Introduction to AI and ML - Historical perspective and evolution - Key applications in various domains - Basic linear algebra: Vectors, matrices - Probability theory: Bayes' theorem- Basic calculus: Derivatives and integrals.

UNIT - II	SUPERVISED LEARNING TECHNIQUES	(9)

Introduction to Supervised Learning - Supervised vs. unsupervised learning - Basic terminology: Training, testing, validation - Linear regression - Logistic regression - k-Nearest Neighbors (k-NN) - Decision Trees and Random Forests - Support Vector Machines (SVM).

UNIT - III	UNSUPERVISED LEARNING TECHNIQUES	(9)

Clustering - k-Means clustering - Hierarchical clustering - Dimensionality Reduction - Principal Component Analysis (PCA) - Applications of PCA in data visualization.

UNIT - IV	NEURAL NETWORKS AND DEEP LEARNING	(9)

Basic concepts of neural networks - Perceptron and multi-layer perceptrons - Introduction to CNNs - Convolution and pooling operations - Data preprocessing and feature engineering - Model selection and hyperparameter tuning - Cross-validation.

UNIT - V	ADVANCED TOPICS AND ETHICAL CONSIDERATIONS	(9)

Model Deployment and Monitoring - Saving and loading models - Model deployment basics - Ethics and Fairness in AI - Ethical implications of AI - Bias in machine learning algorithms.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the Fundamentals of AI and ML	Understand
CO2	Implement Supervised Learning Techniques	Evaluate
CO3	Implement Unsupervised Learning Techniques	Evaluate
CO4	Gain knowledge in complex task solving using Multi layer perceptron.	Apply
CO5	Analyze ethical issues, biases, and fairness in AI and ML	Analyze

REFERENCES:

1. Stuart Russell and Peter Norvig , Artificial Intelligence: A Modern Approach" ,2010
2. Christopher Bishop , “Pattern Recognition and Machine Learning", 2016
3. Marc Peter Deisenroth, Mathematics for Machine Learning", 2020
4. Goodfellow, Yoshua Bengio, and Aaron Courville , "Deep Learning", 2016

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	1	2	1
CO2	2	-	1	2	1
CO3	2	-	1	2	1
CO4	2	-	1	2	1
CO5	2	-	1	2	1
Avg.	**2**	**-**	**1**	**2**	**1**

1-low, 2-medium, 3-high

IT24T22	ADVANCED ALGORITHM	Category	L	T	P	C
		PCC	3	0	0	3

PREREQUISITE:

Prerequisite for Advanced Algorithm includes Dynamic Programming methods, graph traversal techniques, brute-force and algorithms, NP-hard and NP-complete problems, probabilistic and randomized algorithms.

OBJECTIVES:

- To apply core algorithmic strategies to solve complex problems.
- To analyze and implement network flow algorithms for maximum flow problems.
- To implement efficient string-matching techniques for pattern matching.
- To design and evaluate approximation algorithms for optimization challenges.
- To use probabilistic and randomized methods for solving non-deterministic problems.

UNIT - I	OVERVIEW	(9)

Overview of Divide and Conquer - Greedy and Dynamic Programming strategies - Basic search and traversal techniques for graphs – Backtracking - Branch and Bound.

UNIT - II	FLOWS IN NETWORK	(9)

Basic Concepts – Maxflow mincut theorem – Ford and Fulkerson augmenting path Method – integral flow theorem – maximum capacity augmentation - Edmond Karp method – Dinic's method and its analysis - Strassen's algorithm.

UNIT - III	STRING MATCHING ALGORITHM	(9)

Introduction to string-matching problem - Naïve or Brute force algorithm - String matching with finite automata - Rabin Karp algorithm - Knuth Morris Pratt Algorithm – BoyerMoore algorithms - Longest Common Substring/Subsequence - Shortest Common Superstring - Bipartite Matching - complexity analysis.

UNIT - IV	APPROXIMATION ALGORITHMS	(9)

Introduction - Combinatorial Optimization - approximation factor - PTAS, FPTAS - Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem - Analysis of the expected time complexity of the algorithms - Theory of NP- Hard and NP-Complete Problems.

UNIT - V	PROBABILISTIC AND RANDOMIZED ALGORITHMS	(9)

Numerical probabilistic algorithms - Las Vegas and Monte Carlo algorithms – Randomized algorithm - Game-theoretic techniques - Circuit Satisfiability Problem - Approximation Algorithms - Randomized Algorithms - Multithreaded Algorithms - Parallel Algorithms - Amortized Analysis and Its Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the basic concepts related to algorithms	Understand
CO2	Discuss about the various maximum flow algorithms	Understand
CO3	Analyze the complexity of different algorithms	Analyzing
CO4	Determine the appropriate algorithm for solving a particular set of problems.	Evaluating
CO5	Develop more sophisticated algorithms using these techniques	Creating

REFERENCES:

1. Aho, Hopcroft and Ullman "The Design and Analysis of Computer Algorithms".

2. Fundamentals of Algorithmics: G.Brassard And P.Bratley.
3. Horowitz Ellis, Sahani Sartaz, R. Sanguthevar " Fundamentals of ComputerAlgorithms".
4. T Cormen, C Leisersonand R Rivest “Introduction to Algorithms”, PHI

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	**2**	**-**	**2**	**2**	**-**
CO2	**2**	**-**	**2**	**2**	**-**
CO3	**2**	**-**	**2**	**2**	**-**
CO4	**2**	**-**	**2**	**2**	**-**
CO5	**2**	**-**	**2**	**2**	**-**
Avg.	**2**	**-**	**2**	**2**	**-**

1-low, 2-medium, 3-high

IT24T23	SOFT COMPUTING	Category	L	T	P	C
		PCC	3	0	0	3

PREREQUISITE:

A basic mathematics, particularly in areas like linear algebra, probability, and calculus, as these are essential for understanding algorithms in soft computing. Familiarity with traditional computing methods and algorithms is also important, as soft computing often contrasts with classical techniques. Additionally knowledge in artificial intelligence (AI), neural networks, and optimization methods, such as genetic algorithms and fuzzy logic, is crucial, as these are core components of soft computing.

OBJECTIVES:

- To understand the evolution of computing and the transition from conventional AI to computational intelligence.
- To study fuzzy rules and fuzzy reasoning for decision-making in uncertain environments.
- To explore feedforward networks and their role in supervised learning tasks.
- To explain the principles and basic concepts of Genetic Algorithms (GA).
- To apply genetic algorithms and soft computing techniques in solving real-world problems using MATLAB/Python.

UNIT - I	INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS	(9)

Evolution of Computing: Soft Computing Constituents – From Conventional AI to Computational Intelligence: Machine Learning Basics.

UNIT - II	FUZZY LOGIC	(9)

Fuzzy Sets– Operations on Fuzzy Sets – Fuzzy Relations – Membership – Functions: Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT - III	NEURAL NETWORKS	(9)

Machine Learning Using Neural Network – Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks: Reinforcement Learning – Unsupervised Learning Neural – Networks – Adaptive Resonance architectures – Advances in Neural networks.

UNIT - IV	GENETICAL ALGORITHM	(9)

Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning : Machine Learning Approach to Knowledge acquisition.

UNIT - V	MATLAB/PYTHON LIB	(9)

Introduction to Matlab / Python – Arrays and array operations – Functions and Files – Study of neural network toolbox and fuzzy logic toolbox – Simple implementation of Artificial Neural Network and Fuzzy Logic – Recent Trends in deep learning– various classifiers – Neural networks and genetic algorithm – Implementation of recently proposed soft computing techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Identify and describe soft computing techniques and their roles in building intelligent machines.	Evaluate
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.	Apply
CO3	Design and implement feedforward neural networks (FFNs) for supervised learning tasks.	Evaluate

CO4	Build genetic algorithms to combinatorial optimization problems .	Create
CO5	Explain Matlab / Python Libraries.	Understand

REFERENCES:

1. Jyh Shing Roger Jang, Chuen Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, 2nd Edition ,Prentice Hall of India.
2. George J, Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, 4 th Edition Prentice Hall.
3. Prof. Prasun Chakrabarti Kuntal Barua ,Fundamentals of Soft Computing,BpB publication, January 2017.
4. Samir Roy ,Soft Computing: Neuro-Fuzzy and Genetic Algorithms,Pearson publication, January 2013.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	1	-
CO2	3	-	2	1	-
CO3	3	-	2	1	-
CO4	3	-	2	1	-
CO5	3	-	2	1	-
Avg.	**3**	**-**	**2**	**1**	**-**

1-low, 2-medium, 3-high

IT24T24	FULL STACK WEB APPLICATION DEVELOPMENT	Category	L	T	P	C
		PCC	3	0	0	3

PREREQUISITE:

Students should have a foundational understanding of web development concepts, including the distinction between **server-side** and **client-side** web applications. Familiarity with basic programming principles such as variables, data types, operators, and functions is essential. Exposure to **Object-Oriented Programming (OOP)** concepts (e.g., classes, inheritance, interfaces, and generics) is beneficial, as these are integral to TypeScript.

OBJECTIVES:

- To understand the basic concepts of typescript languages.
- To understand the Angular framework and its role in building dynamic and interactive single-page applications.
- To develop modular applications using Node.js modules.
- To implement RESTful services using Express.js routing and middleware.
- To understanding of MongoDB, its structure, and the concept of documents, collections, and databases.

UNIT - I	FUNDAMENTALS & TYPESCRIPT LANGUAGE	(9)

Server-Side Web Applications - Client-Side Web Applications - Single Page Application - About TypeScript - Creating TypeScript Projects - TypeScript Data Types –Variables- Expression and Operators - Functions - OOP in Typescript – Interfaces - Generics. Modules – Enums –Decorators – Enums – Iterators - Generators.

UNIT - II	ANGULAR	(9)

About Angular. Angular CLI - Creating an Angular Project – Components: Components Interaction - Dynamic Components - Angular Elements - Angular Forms - Template Driven Forms - Property, Style, Class and Event Binding - Two way Bindings - Reactive Forms - Form Group - Form Controls - About Angular Router: Router Configuration - Router State - Navigation Pages - Router Link - Query Parameters - URL matching - Matching Strategie – Services -Dependency Injection – Http Client - Read Data from the Server - CRUD Operations - Http Header Operations - Intercepting requests and responses.

UNIT - III	NODE.Js	(9)

Node.jsConfiguring - Node.js environment - Node Package Manager NPM – Modules - Asynchronous Programming - Call Stack and Event Loop - Callback functions - Callback errors - Abstracting callbacks - Chaining callbacks - File System - Synchronous vs. asynchronous I/O - Path and directory operations - File Handle - File Synchronous API - File Asynchronous API - File Callback API - Timers. - Scheduling Timers - Timers Promises API - Node.js Events - Event Emitter - Event Target and Event API – Buffers: Buffers and TypedArrays - Buffers and iteration - Using buffers for binary data - Flowing vs. non-flowing streams. JSON.

UNIT - IV	EXPRESS.Js	(9)

Express.js: How Express.js Works - Configuring Express.js - App Settings - Defining Routes - Starting the App - Express.js Application Structure – Configuration – Settings – Middleware - body-parser - cookie-parser - express-session - response-time - Template Engine Jade EJS. Parameters – Routing – router - route(path) - Router Class - Request Object - Response Object - Error Handling - RESTful.

UNIT - V	MONGODB	(9)

Introduction to MongoDB – Documents – Collections - Sub collections – Database - Data Types – Dates – Arrays - Embedded Documents - CRUD Operations - Batch Insert - Insert Validation - Querying The Documents - Cursors. Indexing - Unique Indexes - Sparse Indexes - Special Index and Collection Types - Full-Text Indexes - Geospatial Indexing - Aggregation framework.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Develop basic programming skills using Javascript	Evaluate
CO2	Implement a front-end web application using Angular	Apply
CO3	Create modules to organise the server	Create
CO4	Build RESTful APIs with Node, Express and MongoDB with confidence	Evaluate
CO5	Gain knowledge in Storing complex, relational data in MongoDB using Mongoose	Understand

REFERENCES:

1. Adam Freeman, Essential TypeScript, Apress, 2019
2. Mark Clow, Angular Projects, Apress, 2018
3. Alex R. Young, Marc Harter,Node.js in Practice, Manning Publication, 2014
4. Pro Express.js, Azat Mardan, Apress, 2015
5. MongoDB in Action, Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, Manning Publication, Second edition, 2016

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	1	2	-
CO2	2	-	1	2	-
CO3	2	-	1	2	-
CO4	2	-	1	2	-
CO5	2	-	1	2	-
Avg.	**2**	**-**	**1**	**2**	**-**

1-low, 2-medium, 3-high

IT24P21	AI and ML LEARNING TECHNIQUES LABORATORY	Category	L	T	P	C
		PCC	0	0	3	2

PREREQUISITE:

Mathematics and Statistics, Linear Algebra, Calculus, Probability and Statistics, Programming Skills, Libraries and Frameworks, Code Debugging and Optimization, Basic Machine Learning Concepts, Supervised Learning, Unsupervised Learning, Model Evaluation, Data Preprocessing and Feature Engineering , Data Cleaning, Feature Scaling and Transformation, Feature Selection, Artificial Intelligence Fundamentals, concepts of Neural Networks.

OBJECTIVES:

The student should be able to

- Use AI and ML Tools and Frameworks
- Have Hands-On Experience with AI & ML Algorithms
- Prepare data set for analysis
- Know where AI and Ml techniques used
- Know Advanced Machine Learning Techniques

List of Exercise/Experiments:

1. Perform data manipulation using NumPy and Pandas and, data visualization using matplotlib.
2. Implement Naive Bayes classification and predict the class label for a given data.
3. Implement linear models to approximate the given data
4. Implement multi-layer perceptron algorithm for the specified data.
5. Implement K-NN algorithm for the specified data.
6. Implement SVM algorithm for the given data.
7. Implement the concept of decision tree with suitable dataset.
8. Implement K-means clustering algorithm for the given data and visualize and interpret the result.
9. Implement genetic operators and Q-learning for the given data.
10. Build a supervised model / unsupervised model using appropriate dataset in cloud framework

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate probabilistic based learning and supervised learning algorithms for the given data.	Understand
CO2	Explain how multi layer perceptron algorithm is working for given data.	Understand
CO3	Develop K-NN and SVM algorithm for given data.	Apply
CO4	Summarize where decision trees and K-means clustering algorithm are used.	Understand
CO5	Build a model in cloud framework.	Apply

REFERENCES:

1. Russell/Norvig , Artificial Intelligence: A Modern Approach,Pearson Education,may 2022.
2. vinod chandra s.s, Anand hareendran S., Artificial intelligence and machine learning, PHI learning, March 2014.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	2	1
CO2	3	-	2	2	1
CO3	3	-	2	2	1
CO4	3	-	2	2	1
CO5	3	-	2	2	1
Avg.	**3**	**-**	**2**	**2**	**1**

1-low, 2-medium, 3-high

IT24P22	ADVANCED ALGORITHMS LABORATORY	Category	L	T	P	C
		PCC	0	0	3	1

PREREQUISITE

The students should have the Knowledge on basic algorithmic concepts, including searching and sorting algorithms, and their time and space complexities and should Familiar with basic graph concepts including types of graphs (directed, undirected, weighted, unweighted), graph traversal methods, and properties.

OBJECTIVES:

- To implement Graph Algorithms.
- To Explore Optimization and Heuristic Algorithms
- To Implement various searching algorithms (e.g., binary search, linear search) and evaluate their performance in different scenarios.
- To Implement a variety of sorting algorithms (e.g., quicksort, mergesort, heapsort) and analyze their efficiency and suitability for different data sets.
- To Write a menu-driven program to implement and test DFS and BFS for graph traversal, understanding their use cases and performance characteristics.

List of Exercise/Experiments:

1. Implement the Bellman-Ford algorithm to find the shortest paths from a single source to all vertices in a graph with potentially negative edge weights. Test your implementation with graphs that contain negative weight cycles.
2. Implement Dijkstra's algorithm to find the shortest paths from a single source to all other vertices in a graph with non-negative edge weights. Compare its performance with Bellman-Ford on different types of graphs.
3. Implement Prim's algorithm to find the minimum spanning tree of a weighted, undirected graph. Visualize the resulting minimum spanning tree and compare it with the output of Kruskal's algorithm if implemented.
4. Implement Warshall's algorithm to compute the transitive closure of a directed graph. Verify the results by comparing with the adjacency matrix of the original graph.
5. Implement the Monte Carlo algorithm to estimate the value of π or solve an optimization problem (e.g., finding the approximate solution to a large-scale optimization problem). Analyze the accuracy and performance of your implementation.
6. Develop a menu-driven program that allows users to choose from various searching algorithms (e.g., binary search, interpolation search) and apply them to search in different types of data structures (arrays, linked lists).
7. Implement and compare various sorting algorithms (e.g., quicksort, mergesort, heapsort) for different datasets. Measure their performance and analyze the results based on time complexity and space complexity.
8. Implement a solver for linear modular equations of the form $ax \equiv b \pmod{m}$. Test your implementation with various equations and modulus values, and verify correctness using different input scenarios.
9. Create a menu-driven program to perform Depth-First Search (DFS) and Breadth-First Search (BFS) on a graph. Allow users to input the graph, choose the traversal algorithm, and visualize the traversal order.
10. Implement the Euclidean algorithm to compute the greatest common divisor (GCD) of two integers. Extend the implementation to handle multiple integers and verify its correctness with different test cases.
11. Implement algorithms such as Johnson's algorithm for finding all pairs shortest paths or the Edmonds-Karp algorithm for solving the maximum flow problem.

12. Implement and experiment with advanced data structures such as AVL trees, Red-Black trees, or B-trees, and evaluate their performance in various scenarios.
13. Implement advanced string matching algorithms like the Knuth-Morris-Pratt (KMP) algorithm or the Boyer-Moore algorithm and compare their performance with naive string matching approaches

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate and Implement the bellman algorithm	Understand
CO2	Apply linear modulo operation and design the algorithm	Apply
CO3	Construct Dijkstra algorithm	Create
CO4	Design and develop various sorting algorithms	Create
CO5	Illustrate searching algorithms	Understand

REFERENCES:

1. https://www.khanacademy.org/computing/computer-science/algorithms

2. https://www.coursera.org/specializations/algorithms

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	2	1
CO2	2	-	2	2	1
CO3	2	-	2	2	1
CO4	2	-	2	2	1
CO5	2	-	2	2	1
Avg.	**2**	**-**	**2**	**2**	**1**

1-low, 2-medium, 3-high

IT24P23	MINI PROJECT WITH SEMINAR	Category	L	T	P	C
		PCC	3	0	0	3

PREREQUISITE:

Students should start by conducting thorough research on their chosen topic, reviewing recent journals and conference papers. They must select their topic with guidance from faculty to ensure relevance. Additionally, students need to develop strong presentation skills to clearly and effectively communicate their findings, using appropriate visual aids.

OBJECTIVES:

- To identify your core knowledge in research, search various projects.
- To identify needs for the chosen topic.
- Incorporate your recently acquired knowledge into the projects.
- Writing technical papers in scientific journal style and format and creating video pitches.
- Showcase it at various events and gain feedback to improvise your project.

Guidelines:

1. Students will engage in mutual discussions with faculty to select a specific area within personal finance management for their project.
2. Throughout the project duration, students will deliver weekly seminars on their chosen topic, sharing progress updates, insights gained from research, and challenges encountered.
3. One week before the final presentation, students will submit a comprehensive technical report to the corresponding faculty member.
4. The report should be between 30 to 50 pages in length and encompass project objectives, methodology, implementation details, results, and future recommendations.
5. References to recent journals, conference proceedings, and other scholarly sources must be cited appropriately to support the project findings.
6. The final presentation will serve as a culmination of the project, where students will showcase the developed personal budgeting application and present key findings from their research.
7. A Q&A session will follow the final presentation, allowing faculty and peers to engage with the student presenters, ask questions, and provide feedback.
8. The students should have published their project paper in journals or conference.
9. The student has to submit a technical report having 30 - 50 pages to the corresponding faculty one week before the final presentation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Utilize various technical resources available from multiple fields	Apply
CO2	Analyze the importance of intonation, word and sentence stress for improving communicative	Analyze

CO3	Identify and overcome problem sounds.	Apply
CO4	Illustrate their technical knowledge to enhance the leadership skills	Understand
CO5	Build report and present oral demonstrations	Create

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	**3**	**3**	**1**	**3**	**2**
CO2	**3**	**3**	**1**	**3**	**2**
CO3	**3**	**3**	**1**	**3**	**2**
CO4	**3**	**3**	**1**	**3**	**2**
CO5	**3**	**3**	**1**	**3**	**2**
Avg.	**3**	**3**	**1**	**3**	**2**

1-low, 2-medium, 3-high

IT24E01	ADVANCED COMPUTER ARCHITECTURE (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

Prerequisite for Advanced Computer Architecture includes Basic Computer Architecture, Performance Metrics, Memory Concepts, Parallelism and Multithreading, Multicore and GPU Basics.

OBJECTIVES:

- To understand and evaluate computer design principles and performance metrics.
- To analyze memory hierarchy and optimization techniques for improved performance.
- To identify and address issues in multiprocessor architectures, including cache coherence and synchronization.
- To explore multicore architectures and their applications in modern computing environments.
- To examine vector, SIMD, and GPU architectures for parallel computing and multimedia processing.

UNIT - I	FUNDAMENTALS OF COMPUTER DESIGN	(9)

Fundamentals of Computer Design - Measuring and Reporting Performance - Instruction Level Parallelism and its Exploitation - Concepts and Challenges - Exposing ILP - Advanced Branch Prediction - Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP - Instruction Delivery and Speculation - Limitations of ILP – Multithreading

UNIT - II	MEMORY HIERARCHY DESIGN	(9)

Introduction - Optimizations of Cache Performance - Memory Technology and Optimizations - Protection: Virtual Memory and Virtual Machines - Design of Memory Hierarchies - Case Studies.

UNIT - III	MULTIPROCESSOR ISSUES	(9)

Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures-Cache Coherence Issues - Performance Issues - Synchronization - Models of Memory Consistency-Case Study- Interconnection Networks - Buses, Crossbar and Multi-stage Interconnection Networks

UNIT - IV	MULTICORE ARCHITECTURES	(9)

Homogeneous and Heterogeneous Multi-core Architectures - Intel Multicore Architectures - SUN CMP architecture - IBM Cell Architecture. Introduction to Warehouse-Scale computers – Architectures- Physical Infrastructure and Costs- Cloud Computing-Case Study- Google Warehouse-Scale Computer.

UNIT - V	VECTOR, SIMD AND GPU ARCHITECTURES TLE	(9)

Introduction-Vector Architecture - SIMD Extensions for Multimedia - Graphics Processing Units - Case Studies - GPGPU Computing - Detecting and Enhancing Loop Level Parallelism-Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the basic concepts of computer architecture	Understand
CO2	Discuss the various techniques used for optimizing the cache performance	Understand
CO3	Analyze the issues related to multiprocessing	Analyzing
CO4	Elaborate the salient features of different multicore architectures	Evaluating
CO5	Illustrate the concept of Vector and GPU architectures	Creating

REFERENCES:

1. Darryl Gove, Multicore Application Programming: For Windows, Linux, and Oracle Solarisl, Pearson, 2011

2. John L Hennessey and David A Patterson "Computer Architecture – A quantitative approach" Morgan Kaufmann Elsevier 5th Edition 2012
3.David B. Kirk, Wen-mei W. Hwu, -Programming Massively Parallel Processorsl, Morgan Kauffman, 2010
4. William Stallings "Computer Organization and Architecture – Designing for Performance" Pearson Education 8th Edition 2010

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	2	1	-
CO2	1	-	2	1	-
CO3	1	-	2	1	-
CO4	1	-	2	1	-
CO5	1	-	2	1	-
Avg.	**1**	**-**	**2**	**1**	**-**

1-low, 2-medium, 3-high

IT24E02	AD-HOC AND SENSOR NETWORKS (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE

A foundational understanding of computer networks is essential, including concepts such as network topologies, routing protocols, and wireless communication principles. Familiarity with wireless technologies like Wi-Fi, Bluetooth, and cellular networks will help grasp the decentralized nature of ad-hoc networks. Basic knowledge of energy constraints and resource management in computing systems is valuable, particularly for understanding sensor networks.

OBJECTIVES:

- To understand the basics of Ad-hoc & Sensor Networks.
- To learn various fundamental and emerging protocols of all layers.
- To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
- To understand the nature and applications of Ad-hoc and sensor networks.
- To understand various security practices and protocols of Ad-hoc and Sensor Networks.

UNIT - I	AD HOC NETWORKS –INTRODUCTION AND ROUTING PROTOCOLS	(9)

Elements of Ad-hoc Wireless Networks – Issues in Ad-hoc wireless networks – Example commercial applications of Ad- hoc networking – Ad- hoc wireless Internet – Classifications of Routing Protocols – Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – On–Demand Routing protocols – Ad-hoc On–Demand Distance Vector Routing (AODV).

UNIT - II	SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES	(9)

Issues – Classifications of routing protocols – Hierarchical and Power aware – Multicast routing – Classifications –Tree based – Mesh based – Ad Hoc Transport Layer Issues – TCP Over Ad Hoc – Feedback based – TCP with explicit link – TCP BuS – Ad Hoc TCP and Split TCP.

UNIT - III	WSN NETWORKING AND PROTOCOLS	(9)

Physical Layer and MAC Protocols– Network layer protocol – Transport layer protocol – energy efficiency in WSNs – Data aggregation and management – Security in WSNs – Case Study: Smart Cities and Healthcare.

UNIT - IV	SENSOR NETWORK SECURITY	(9)

Network Security Requirements –Issues and Challenges in Security Provisioning – Network Security Attacks – Layer wise attacks in wireless sensor networks – possible solutions for jamming – tampering – black hole attack –flooding attack –Key Distribution and Management – Secure Routing – SPINS

UNIT - V	MESH NETWORKS	(9)

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Analyze the function design issues and classification of MAC protocols that have been proposed for ad hoc networks	Analyze

CO2	Summarize the different types of routing protocols and transport layer issues in ad-hoc networks	Understand
CO3	Compile the principles, architecture and MAC protocol of wireless sensor networks (WSNs)	Create
CO4	Discuss the localization types and various routing issues in wireless sensor networks	Create
CO5	Rephrase the architecture, MAC enhancement, routing and capacity models of mesh networks	Understand

REFERENCES:

1. Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2011
2. C.Siva Ram Murthy and B.Smanoj, Ad Hoc Wireless Networks – Architectures and Protocols, Pearson Education, 2011.
3. C.K.Toh," Ad Hoc Mobile Wireless Networks", 3rd Edition, Pearson Education, 2011
4. Thomas Krag and SebastinBuettrich," Wireless Mesh Networking, O'Reilly Publishers", 2007

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	1	2	-
CO2	1	-	1	2	-
CO3	1	-	1	2	-
CO4	1	-	1	2	-
CO5	1	-	1	2	-
Avg.	**1**	**-**	**1**	**2**	**-**

1-low, 2-medium, 3-high

IT24E03	COMPUTER VISION (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

A solid foundation in mathematics is essential, particularly in linear algebra (e.g., matrices, transformations), calculus (e.g., optimization), and probability and statistics (e.g., distributions, Bayesian inference). Familiarity with programming languages such as Python, along with libraries like OpenCV, TensorFlow, or PyTorch, is crucial for implementing computer vision algorithms. Basic knowledge of image processing concepts, such as filtering, edge detection, and color spaces, is also important.

OBJECTIVES:

- To understand the fundamental image processing techniques such as filtering, thresholding, and edge detection.
- To explore distance functions, skeletonization, and shape recognition using deformable models and active contours.
- To develop skills in object location and feature collation using spatial matching techniques and GHT.
- To understand 3D vision methods, including projection schemes, shape-from-X techniques, and surface representations.
- To apply image processing and computer vision techniques to real-world applications, including face detection, face recognition, and surveillance systems.

UNIT - I	IMAGE PROCESSING FOUNDATIONS	(9)

Review of image processing techniques – classical filtering operations – Thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT - II	SHAPES AND REGIONS	(9)

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT - III	HOUGH TRANSFORM	(9)

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT - IV	3D VISION AND MOTION	(9)

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT - V	APPLICATIONS	(9)

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Gain the ability to enhance and preprocess images using various filtering techniques to remove noise and emphasize features.	Understanding

CO2	Develop skills in shape recognition by integrating deformable models .	Applying
CO3	Apply spatial matching and GHT to solve real-world challenges.	Applying
CO4	Summarize the 3D vision methods, including the principles .	Understanding
CO5	Assimilate image processing and computer vision solutions into practical applications.	Creating

REFERENCES:

1. D. L. Baggio et al., ―Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.
2. E. R. Davies, ―Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012.
3. Jan Erik Solem, ―Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.
4. Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	**2**	**-**	**1**	**1**	**-**
CO2	**2**	**-**	**1**	**1**	**-**
CO3	**2**	**-**	**1**	**1**	**-**
CO4	**2**	**-**	**1**	**1**	**-**
CO5	**2**	**-**	**1**	**1**	**-**
Avg.	**2**	**-**	**1**	**1**	**-**

1-low, 2-medium, 3-high

IT24E04	DATA SCIENCE (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

A solid understanding of calculus, linear algebra, and basic statistics is crucial. Proficiency in Python is essential, particularly familiarity with libraries like NumPy and Pandas. To know the concepts of databases, SQL for data storage solutions is important for effective data collection and management.

OBJECTIVES:

- To understand the terminology and foundational concepts of data science, including the data science process and toolkit.
- To explore the sources of data and understand the techniques for data collection, including working with APIs.
- To understand the fundamental terminology and concepts in data analysis.
- To develop expertise in Pandas for data indexing, selection, and handling missing data effectively.
- To apply the methods used in modern data science applications.

UNIT - I	INTRODUCTION TO CORE CONCEPTS AND TECHNOLOGIES	(9)

Introduction – Terminology – Data science process – Data science toolkit – Types of data – Exploratory Data Analysis Example applications.

UNIT - II	DATA COLLECTION AND MANAGEMENT	(9)

Introduction – Sources of Data – Data collection and APIs – Exploring and fixing data – Data storage and management –Using Multiple Data Sources

UNIT - III	DATA ANALYSIS	(9)

Introduction – Terminology and concepts – Introduction to statistics – Central tendencies and distributions – Variance –Distribution properties and arithmetic – Samples/CLT– Basic machine learning algorithms – Linear regression – SVM –Naive Bayes.

UNIT - IV	PYTHON LIBRARIES FOR DATA WRANGLING	(9)

Basics of Numpy Arrays – Aggregations – Computations on Arrays – Comparisons, Masks, Boolean logic – Fancy Indexing – Structured Arrays – Data Manipulation with Pandas – Data Indexing and Selection – Operating on Data – Missing Data.

UNIT - V	DATA VISUALISATION AND APPLICATIONS	(9)

Introduction – Types of data visualization – Data for visualization – Data types – Data encodings – Retinal variables –Mapping variables to encodings – Visual Encodings- Visualization with Seaborne. Applications: Technologies for Visualization – Bokeh (Python) Recent trends in various Data Collection and Analysis Techniques — Application Development Methods of Used in Data Science.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Discuss the key concepts in data science- including their real-world applications and the toolkit used by data scientists	Creating
CO2	Build data collection and management scripts using MongoDB	Applying
CO3	Analyze the concept of Data Analysis	Analyzing
CO4	Develop Python programming language to manipulate and clean datasets using various libraries.	Applying
CO5	Identify Data Visual encoding Techniques and applications usage of Data Science	Applying

REFERENCES:

1. Luca Massaron John Paul Mueller, "Python Data Science Handbook", 2nd Edition, Wiley 2019.
2. Cathy O'Neil and Rachel Schutt. "Doing Data Science", Straight Talk From The Frontline, First Edition, O'Reilly, 2013.
3. Foster Provost, Tom Fawcet, "Data Science for Buisness", 1st Edition, O'Reilly Publishers, 2013
4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Oppurunities in Huge Data Streams with Advanced Analytics", 1st Edition, John Wiley & Sons, 2012

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	2	-
CO2	2	-	2	2	-
CO3	2	-	2	2	-
CO4	2	-	2	2	-
CO5	2	-	2	2	-
Avg.	**2**	**-**	**2**	**2**	**-**

1-low, 2-medium, 3-high

IT24E05	SCIENTIFIC COMPUTING (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

A solid foundation in calculus, linear algebra, and basic programming concepts is essential. Familiarity with statistical methods, particularly in understanding randomness and random number generation, is also important. Additionally, exposure to mathematical software or programming languages like Python, MATLAB, or R will be beneficial for simulation and numerical methods.

OBJECTIVES:

- Understand the principles of modeling and general systems theory.
- Comprehend the role of computational methods in addressing scientific problems.
- To understand optimization techniques, including problem formulation, solution methods, and key concepts like existence, uniqueness, and convexity.
- To explore methods for solving equations and systems, including graphical and iterative techniques, matrix inversion, interpolation methods, and regression analysis.
- To study numerical methods for differentiation and integration, including Runge-Kutta and various integration techniques.

UNIT - I	INTRODUCTION TO SYSTEM MODELING	(9)

Modelling and general systems theory – Concepts of simulation – Types of simulation – Experimental design consideration – Comparison and selection of simulation languages – Development of simulation models using any one of the languages for some problems – stochastic simulation – Randomness and random numbers – Random number generators – software for generating random numbers.

UNIT - II	APPROXIMATIONS IN SCIENTIFIC COMPUTING	(9)

Overview of Scientific Computing – Importance of Approximations - General Strategy – Approximations in Scientific Computation – Mathematical Software – Mathematical Software Libraries – Scientific Computing Environments – Extended Arithmetic Packages.

UNIT - III	OPTIMIZATION	(9)

Optimization Problems – Existence and Uniqueness – Convexity – Optimization in One Dimension – Multidimensional Unconstrained Optimization – Constrained Optimization – Linear Programming

UNIT - IV	ROOTS OF EQUATION LINEAR ALGEBRAIC EQUATION AND INTERPOLATION	(9)

Graphical Method – Iterative Methods – Newton Raphson Method – Break Even Analysis – Gauss Elimination – Solution Of Linear Systems By Gaussian – Gauss Jordan – Jacobi And Gauss Seidel Methods – Matrix Inversion – Gauss – Jordan Method – Least Square Regression – Newton's Divided – Difference Interpolating Polynomials – Lagrange's polynomials – Newton's Forward and Backward Difference Formula – Stirling's and Bessel's Central Difference Formula

UNIT - V	NUMERICAL ORDINARY AND PARTIAL DIFFERENTIATION AND INTEGRATION	(9)

Numerical Differentiation: Runge – Kutta Methods – Boundary – Value and Eigen value Problems – Partial Differential Equation – Elliptic Equation – Parabolic Equations – Numerical Integration: Trapezoidal and Simpson's Rules – Two and Three Point Gaussian Quadrature Formula – Double Integral Using Trapezoidal and Simpson's Rule.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	To understand system modeling and simulation concepts, focusing	Analyzing

	on types, experimental design, and random number generation.	
CO2	To recognize the significance of approximations in scientific computing and familiarize with relevant mathematical software and computing environments.	Understanding
CO3	To grasp essential optimization concepts, including problem formulation, existence, convexity, and methods for constrained and unconstrained optimization.	Creating
CO4	Categorize the various methods to find out the roots of the equation	Analyzing
CO5	Compare the partial difference equation along with integration	Evaluating

REFERENCES:

1. Steven C, Chapra Raymond P Canale, Numerical Methods for Engineering, 8th Edition, McGraw-Hill 2021
2. George F. Pinder, Numerical Methods for Solving Partial Differential Equations: A Comprehensive Introduction for Scientists and Engineers, 1st Edition, Wiley 2019.
3. Norbert Schorghofer, Lessons in Scientific Computing, 1st Edition, CRC Press, 2018.
4. Jerry Banks and John Carson, Discrete Event System Simulation, 5th Edition, Pearson Education India, 2013.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	2	-
CO2	2	-	2	2	-
CO3	2	-	2	2	-
CO4	2	-	2	2	-
CO5	2	-	2	2	-
Avg.	**2**	-	**2**	**2**	-

1-low, 2-medium, 3-high

IT24E06	DIGITAL IMAGE PROCESSING (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

Understanding of linear algebra and calculus, particularly concepts related to matrices, transformations, and functions. Knowledge of signal processing fundamentals, including continuous and discrete signals, Fourier analysis, and filtering techniques. To know how imaging systems work, including sensors, optics, and the capture of images.

OBJECTIVES:

- Grasp the basic principles of digital image processing, including image representation, visual perception, and pixel relationships.
- Learn techniques for image enhancement through spatial and frequency domain methods, focusing on transformations, filtering, and histogram processing.
- Explore methods for image restoration, including various noise models and filtering techniques such as Wiener and geometric mean filters.
- Develop skills in spatial feature extraction and segmentation techniques, including edge detection, region-based methods, and clustering.
- Understand the importance of image compression techniques and recognition methods, including coding standards like JPEG and MPEG, as well as feature-based recognition strategies.

UNIT - I	INTRODUCTION TO DIGITAL IMAGING	(9)

Introduction to Digital Image Processing – Elements of Digital Image Processing System - Visual perception and properties of human eye - Image Representation - A Simple Image Model - Basic Relationship Between Pixels – Image Geometry.

UNIT - II	IMAGE OPTIMIZATION	(9)

Spatial Domain: Gray Level Transformations – Histogram Processing – Basics of Spatial Filtering – Smoothing and Sharpening– Frequency Domain: DFT (Discrete Fourier Transform) – FFT (Fast FourierTransform) – DCT (Discrete Cosine Transform)- Smoothing and Sharpening frequency domain filters – Gaussian Filters – Homomorphism Filtering –Multi Spectral Image Enhancement– Color Image Enhancement.

UNIT - III	IMAGE RESTORATION	(9)

Image Restoration Model – Properties – Noise Models - Inverse and Wiener Filtering-Finite Impulse Response (FIR) Wiener Filtering-Geometric Mean Filter - Constrained Least Squares Filtering- Image Reconstruction from Projections.

UNIT - IV	IMAGE ANALYSIS AND SEGMENTATION	(9)

Spatial Feature Extraction- Edge Detection- Boundary Extraction- Scale-Invariant Feature Transform (SIFT) - Thresholding - Region Based Segmentation – Region Growing – Region Splitting and Merging - Region Segmentation Using Clustering and Superpixels- Morphological Watersheds - Motion in Segmentation.

UNIT - V	IMAGE COMPRESSION AND RECOGNITION	(9)

Need for Data Compression – Huffman – Run Length Encoding – Shift Codes – Arithmetic Coding – JPEG Standard – MPEG Standard – Boundary Representation – Boundary Description – Regional Descriptors – Topological Feature – Recognition based on Matching- Application of Image Processing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explain digital image processing fundamentals- sampling and quantization concepts for 2D images	Understanding
CO2	Build image enhancement techniques	Applying
CO3	Develop new techniques in the areas of image enhancement-restoration	Creating
CO4	Explain key concepts in image analysis and apply various image segmentation techniques	Understanding
CO5	Recommend various image processing techniques for real time applications	Evaluating

REFERENCES:

1. Rafael C. Gonzalez, Richard Eugene Woods, Digital Image Processing, 4th Edition, Pearson Education 2018
2. Anil K. Jain, Fundamentals of Digital Image Processing, 1st Edition, Pearson Education 2015
3. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, 2nd Edition, McGraw Hill 2020
4. Alasdair McAndrew, A Computational Introduction to Digital Image Processing, 2nd Edition, Taylor & Francis Group, CRC Press, 2016

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	2	2	1
CO2	1	-	2	2	1
CO3	1	-	2	2	1
CO4	1	-	2	2	1
CO5	1	-	2	2	1
Avg.	**1**	**-**	**2**	**2**	**1**

1-low, 2-medium, 3-high

IT24E07	XML AND WEB SERVICES (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

A foundational knowledge of programming languages such as Java, Python, or C# is essential, as these are commonly used to implement and interact with web services. A basic understanding of web technologies, including HTTP, HTML, and CSS, is crucial for comprehending how web services operate over the internet. Additionally, familiarity with data formats like XML and JSON is important for understanding how data is structured and exchanged between systems.

OBJECTIVES:

- To understand the fundamentals of XML and its benefits.
- To understand the business motivations for using web services Understand the business motivations for using web services
- Gain an understanding of Simple Object Access Protocol, its structure, and how it supports messaging between clients and servers.
- Explore the role of XML in vertical industries and how web services for mobile devices enable businesses to engage with customers on mobile platforms.
- To understand how to manage, store, and organize digital content effectively in modern content management systems.

UNIT–I	XML TECHNOLOGY FAMILY	[9]

XML – benefits – Advantages of XML over HTML – EDI (Electronic Data Interchange) – Databases – XML based standards – DTD (Document Type Declaration) – XML Schemas – XML Files – XML processing – DOM (Document Object Model) – SAX (simple API for XML) -– Presentation technologies – XSL (XML Style sheet Language) – XFORMS – XHTML – Voice XML

UNIT–II	ARCHITECTING WEB SERVICES	[9]

Business motivations for web services – B2B (Business to Business) – B2C (Business to Customer) – Technical motivations – Limitations of CORBA and DCOM – Service Oriented Architecture (SOA) – Architecting web services – Implementation view – Web services technology stack – Logical view – Composition of web services – Deployment view from application server to peer to peer – Process view – Life in the runtime

UNIT–III	WEB SERVICES: SOAP & WSDL	[9]

Web Services SOAP: – Structure of SOAP – SOAP Namespaces – SOAP Headers – SOAP Body –SOAP Messaging Modes – SOAP Faults – SOAP over HTTP. WSDL: Structure of WSDL – WSDL Declarations – WSDL Abstract Interface – Messaging Exchange patterns – WSDL Implementation.

UNIT–IV	IMPLEMENTING XML IN E-BUSINESS	[9]

B2B – B2C Applications – Different types of B2B interaction – Components of e- business XML systems – ebXML– Rosetta Net Applied XML in vertical industry – Web services for mobile devices

UNIT–V	XML AND CONTENT MANAGEMENT	[9]

Semantic Web – Role of Meta data in web content – Resource Description Framework – RDF schema – Architecture of semantic web – Content management workflow.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Discuss the basics of XML Technology	Understanding
CO2	Outline the basic concepts of Web Services	Understanding
CO3	Develop web services using SOAP and WSDL technologies.	Creating
CO4	Illustrate the use of XML Line-business	Understanding
CO5	Importance of usage of XML and content management	Evaluating

REFERENCES:

1. Ron schmelzer et al, XML and Web Services, Pearson Education, 3rd Edition, 2012
2. Richard Monson-Haefel, "J2EE Web Services", 8th Edition, Person Education, 2012.
3. H.M.Deitel, P.J.Deitel, T.R.Nieto, T.M.Lin, XML How to Program, Pearson Education,2012
4. Frank P, Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2011

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	2	1	-
CO2	1	-	2	1	-
CO3	1	-	2	1	-
CO4	1	-	2	1	-
CO5	1	-	2	1	-
Avg.	**1**	**-**	**2**	**1**	**-**

1-low, 2-medium, 3-high

IT24E08	DISTRIBUTED SYSTEMS (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

The students shall have the Knowledge of networking concepts such as the OSI model, TCP/IP protocols, IP addressing, routing, and basic network security and Proficiency in at least one programming language, such as Java, C++, or Python, particularly for implementing algorithms and handling network communication and also have the knowledge on fundamental data structures like arrays, linked lists, stacks, queues, trees, and graphs, and how they are used in algorithms.

OBJECTIVES:

- To gain a comprehensive understanding of various system models, including architectural and fundamental models, and understands networking concepts and inter process communication.
- To examine the operating system layer, focusing on protection, processes, threads, and the architecture of operating systems in distributed environments.
- To study synchronization techniques in distributed systems, including clock synchronization, logical clocks, global states, and distributed debugging.
- To gain insights into the concepts of replication, distributed shared memory, and web services as they relate to distributed transaction processing.
- To analyze mutual exclusion problems and algorithms, including lockout-free mutual exclusion, and understand the lower bound on the number of registers in asynchronous shared memory models.

UNIT - I	BASIC CONCEPTS	(9)

Definition of a distributed systems- Examples- Resource sharing and the Web- Challenges- System models- Architectural and fundamental models- Networking Inter process communication- External data representation and marshalling- Client-server and Group communication.

UNIT - II	DISTRIBUTED OBJECTS AND PROCESS	(9)

Distributed objects and remote invocation- Communication between distributed objects- Remote procedure call- Events and notifications - The operating system layer- Protection- Processes and Threads- Communication and invocation- OS Architecture. Security techniques- Cryptographic algorithms- Access control- Digital signatures- Cryptography pragmatics- Needham-Schroeder- Kerberos- Securing electronics transaction- IEEE 802.11 WiFi.

UNIT - III	OPERATING SYSTEM ISSUES	(9)

Distributed file systems - Name services- Domain name system- Directory and discovery services- Peer to peer systems- Napster file sharing system- Peer to peer middleware routing overlays – Clocks- Events and process states Clock Synchronization - Logical clocks Global states - Distributed debugging - Distributed mutual exclusion - Elections - Multicast communication.

UNIT - IV	DISTRIBUTED TRANSACTION PROCESSING	(9)

Transactions - Nested transactions - Locks - Optimistic concurrency control - Timestamp ordering - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery - Overview of replication, Distributed shared memory and Web services

UNIT - V	DISTRIBUTED ALGORITHMS	(9)

Synchronous network model - Algorithms: leader election- maximal independent set -Asynchronous system model: I/O automata- operations on automata- fairness - Asynchronous shared memory model - Mutual exclusion: model- the problem- stronger conditions- lockout-free mutual exclusion algorithms- lower bound on the number of registers - Asynchronous network model - Asynchronous network algorithms: leader election in a ring and an arbitrary network.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Have knowledge on basics of distributed systems.	Understand
CO2	Know about distributed objects and process.	Understand
CO3	Ability to understand Operating System issues.	Understand
CO4	Gain Knowledge on Transactions Processing.	Understand
CO5	Ability to design distributed systems for basic level applications.	Understand

REFERENCES:

1.George Coulouris, Jean Dollimore, and Tim Kindberg, " Distributed Systems Concepts and Design", 5th ed., Pearson Education, 2011

2.Andrew S. Tanenbaum, Maartenvan Steen, "Distributed Systems Principles and Paradigms", 2nd ed., Pearson Education, 2006

3.Andrew S. Tanenbaum, Maarten Van Steen ,"Distributed Systems, Principles and Paradigms", , 2nd Edition, PHI,2018

4.Ajay D. Kshemakalyani and Mukesh Singhal ,"Distributed Computing, Principles, Algorithms and Systems", Cambridge, 2010.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	2	1	-
CO2	1	-	2	1	-
CO3	1	-	2	1	-
CO4	1	-	2	1	-
CO5	1	-	2	1	-
Avg.	**1**	**-**	**2**	**1**	**-**

1-low, 2-medium, 3-high

IT24E09	MULTIMEDIA COMMUNICATON (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

Basic knowledge in computer hardware, software and networking along with programming skills in HTML, CSS and Javascript.

OBJECTIVES:

- To Learn about create, manage, and deliver multimedia content across various platforms.
- To Enhance Understanding of Text, Image Formats and Compression Standards.
- To Gain Proficiency in Audio and Video Compression Formats and Codecs.
- To Learn about Popular Video Compression Standards.
- To Study About Synchronization and Multimedia Operating Systems.

UNIT - I	INTRODUCTION	(9)

Introduction about Multimedia Information Representation – Multimedia Networks - Multimedia Applications – Application and Network Terminology – Network QoS and Application QoS - Digitization Principles – Text. Image, Audio and Video.

UNIT - II	TEXT AND IMAGE COMPRESSION	(9)

Compression Principles - Text Compression Techniques - Run length, Huffman, LZW - Document Image compression Techniques - T2 and T3 coding - Image Compression Techniques - GIF, TIFF and JPEG

UNIT - III	AUDIO AND VIDEO COMPRESSION	(9)

Audio Compression – Principles, DPCM, ADPCM - Adaptive and Linear predictive coding - Code-Excited LPC - Perceptual coding - Video Compression Principles - MPEG and Dolby Coders Video Compression

UNIT - IV	VIDEO COMPRESSION STANDARDS	(9)

Introduction about Video Compression – Different Standards - H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 - Reversible VLCs - MPEG 7 Standardization Process of Multimedia Content Description - MPEG 21 multimedia framework.

UNIT - V	SYNCHRONIZATION	(9)

Need for Synchronization - Presentation Requirements, Reference Model for Synchronization - Introduction to SMIL - Multimedia Operating Systems - Resource Management, Process - Resource Management Techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Comprehension of Basic Multimedia Concepts	Remembering
CO2	Familiarity with Text, Image Compression Techniques	Remembering
CO3	Gain the Skill in Implementation of audio and video Compression Techniques	Remembering
CO4	Gain the Knowledge of Video Compression Standards	Remembering
CO5	Acquire Knowledge in Synchronization and its Various Techniques	Remembering

REFERENCES:

1. Fred Halsall's "Multimedia Communications: Applications, Networks, Protocols, and Standards" Pearson Education, 2001

2. K. R Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic “Multimedia Communication Systems”, Pearson Education, 2004.
3. Ze-Nian Li and Mark S. Drew"Fundamentals of Multimedia"Pearson, 2014
4. Raifsteinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications and Applications”, Pearson Education, 2002.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	**1**	**-**	**2**	**1**	**-**
CO2	**1**	**-**	**2**	**1**	**-**
CO3	**1**	**-**	**2**	**1**	**-**
CO4	**1**	**-**	**2**	**1**	**-**
CO5	**1**	**-**	**2**	**1**	**-**
Avg.	**1**	**-**	**2**	**1**	**-**

1-low, 2-medium, 3-high

IT24E10	INFORMATION RETRIEVAL TECHNIQUES (PROFESSIONAL ELECTIVES – I and II)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

A basic knowledge in data structures and algorithms, as these are critical for efficiently storing, indexing, and retrieving information. Familiarity with databases and query languages like SQL is important for understanding how data is organized and accessed. Basic knowledge of search engines, web technologies, and HTML will help in grasping how content is retrieved from the web.

OBJECTIVES:

- To understand the basic concepts and practical issues related to information retrieval (IR) systems.
- To explain structural queries and query operations, and how they contribute to improving retrieval performance.
- To analyze document preprocessing techniques, including clustering and text compression.
- To understand the data models and query languages used in multimedia information retrieval.
- To focusing on search engines and how they index and rank content.

UNIT - I	INTRODUCTION	(9)

Basic Concepts — Practical Issues - Retrieval Process –Open Source IR Systems – Modeling – Classic Information Retrieval – Set Theoretic- Algebraic and Probabilistic Models – Structured Text Retrieval Models – Retrieval Evaluation.

UNIT - II	QUERYING	(9)

Languages – Key Word based Querying- Queries in IR Systems – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis – Text and Multimedia languages

UNIT - III	TEXT OPERATIONS AND USER INTERFACE	(9)

Document Preprocessing – Clustering – Text Compression – Indexing and Searching – Inverted files – User Interface and Visualization – Human Computer Interaction – Access Process – Starting Points – Query Specification – Context – User relevance Judgment – Interface for Search

UNIT - IV	MULTIMEDIA INFORMATION RETRIEVAL	(9)

Data Models – Query Languages – Spatial Access Models – Generic Approach – One Dimensional Time Series – Two Dimensional Color Images – Feature Extraction

UNIT - V	APPLICATIONS	(9)

Searching the Web – Structure of the Web – Characterizing the Web- IR and web search – Search Engines- Web Crawling and Indexing — Online IR systems – Online Public Access Catalogs – Digital Libraries – Architectural Issues – Document Models – Representations and Access – Prototypes and Standards

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explain the basics of the information retrieval technique	Evaluating
CO2	Discuss the retrieval process by using the query method	Creating
CO3	Examine the text operation process along with the user interface	Analyzing
CO4	Discuss the various multimedia information retrieval techniques	Understanding
CO5	Design an efficient search engine and analyze the Web content structure	Applying

REFERENCES:

1. Ricardo Baeza,Yate,BerthierRibeiro,Neto, Modern Information Retrieval, Addison Wesley, 2011
2. Daniel lurafsky and James H Martin, Speech and Language Processing, Pearson Education, International Edition,2014.
3. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", ACM Press Books, Second Edition, 2016.
4. G G Chowdhury, Introduction to Modern Information Retrieval, Neal Schuman Publishers, Third edition, 2010.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	1	2	-
CO2	2	-	1	2	-
CO3	2	-	1	2	-
CO4	2	-	1	2	-
CO5	2	-	1	2	-
Avg.	**2**	**-**	**1**	**2**	**-**

1-low, 2-medium, 3-high

IT24E11	DATA WAREHOUSING AND DATA MINING (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE

This course helps the students to understand the overall architecture of a data warehouse and methods for data gathering and data pre-processing using OLAP tools. The different data mining models and techniques will be discussed in this course. Data mining and data warehousing applications in bioinformatics will also be explored.

OBJECTIVES:

- To understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions
- To impart knowledge of the fundamental concepts that provide the foundation of data mining
- To learn about the data mining tasks and pre-processing activities.
- Apply the techniques of clustering, classification and visualization to real world data
- Develop a data mining application for data analysis using various tools.

UNIT - I	DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING (OLAP)	(9)

Basic Concepts of Data Warehousing – Data warehousing Components – Data warehouse Architecture – Data Warehouse Schemas for Decision Support – Online Analytical Processing (OLAP) – Characteristics of OLAP - OLAP and Multidimensional Data Analysis – Typical OLAP Operations – OLAP and OTAP - Data Warehousing to Data Mining

UNIT - II	INTRODUCTION TO DATA MINING	(9)

Data Mining – Knowledge discovery Process - Issues and Applications - Data Mining Techniques - Data Objects and Attribute Types – Statistical Descriptions of Data - Data Visualization - Measuring Data Similarity and Dissimilarity - Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization

UNIT - III	DATA MINING – FREQUENT PATTERN ANALYSIS	(9)

Basic Concepts of Mining Frequent Patterns, Associations, and Correlations - Frequent Item set Mining Methods - Advanced Pattern Mining - Pattern Mining in Multilevel, Multidimensional Space - Constraint-Based Frequent Pattern Mining – Classification using Frequent Patterns

UNIT - IV	CLASSIFICATION AND CLUSTERING	(9)

Classification: Decision Tree Induction – Bayesian Classification – Rule Based Classification –Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Model Evaluation and Selection - Techniques to Improve Classification Accuracy

Clustering Techniques: Cluster Analysis – Partitioning Methods – Hierarchical methods – Density Based Methods – Grid Based Methods – Model Based Clustering Methods – Advanced Cluster analysis - Outlier Detection.

UNIT - V	TRENDS AND APPLICATIONS IN DATA MINING	(9)

Mining Object – Spatial, Multimedia, Text and Web Data - Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web - Data mining tools - DB Miner – WEKA - Applications: Data Mining for Intrusion Detection and Prevention - Financial Data Analysis

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the basic concepts of data warehousing and Online Analytical Processing	Understand
CO2	Discuss about the various Data Mining Techniques	Understand
CO3	Examine the Suitable Frequent Patterns for mining applications	Evaluating
CO4	Analyze the various data classification and Clustering techniques	Analyzing
CO5	Outline the recent tools and applications used for data mining	Understand

REFERENCES:

1. Jiawei Han and Micheline Kamber" Data Mining Concepts and Techniques" 3rd Edition Elsevier Reprinted 2011
2. Alex Berson and Stephen J Smith" Data Warehousing Data Mining & OLAP" Tata McGraw – Hill Edition 13th Reprint 2010
3. Andrew H. Johnston, "Practical Machine Learning: A Beginner's Guide to Data Mining with WEKA", July 2018.
4. Paulraj Ponniah, "Data Warehousing Fundamentals Comprehensive Guide for IT Professionals, Wiley, 2010

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	**2**	**-**	**1**	**1**	**-**
CO2	**2**	**-**	**1**	**1**	**-**
CO3	**2**	**-**	**1**	**1**	**-**
CO4	**2**	**-**	**1**	**1**	**-**
CO5	**2**	**-**	**1**	**1**	**-**
Avg.	**2**	**-**	**1**	**1**	**-**

1-low, 2-medium, 3-high

IT24E12	NETWORK MANAGEMENT SYSTEM (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

- Basic understanding of TCP/IP protocol suite are required.
- Basic computer networks and data systems
- Be familiar with Linux environment and basic commands
- Students must have Basic Scripting/Programming concepts

OBJECTIVES:

- To understand the principles of network management, different standards and protocols used in managing complex networks.
- To understand the Automation of network management operations and making use of readily available network management systems.
- Explain the concepts and terminology associated with SNMP.
- Describe network management as a typical distributed application.
- To gain knowledge in using tools and models for measuring the network performance.

UNIT - I	DATA COMMUNICATION AND NETWORK MANAGEMENT OVERVIEW	(9)

Networking basics – LANs and WANs – Network hardware components – Server-based networks – Peer-to-peer networks – Server based vs peer-to-peer networks – Specialized servers – Combination networks – Network packets – Addressing packets – Multiplexing – Protocols – The OSI reference model – Internet Protocol Stack.

UNIT - II	MAC MANAGEMENT	(9)

MAC Layer in Networking–Role and functions of the MAC layer– MAC addressing – MAC protocols – CSMA/ CD – Collision detection mechanism – CSMA/ CA – Hidden node problems – MAC layer security – Performance and optimization – Emerging trends in MAC management.

UNIT - III	TCP/ IP NETWORKING	(9)

OSI vs TCP/ IP Model – IPV_4 addressing and subnetting– IPV_6 Addressing and Configuring – VLSM – Address resolution protocol – DHCP – ICMP – Error reporting – TCP – UDP – Routing protocols.

UNIT - IV	SNMP MANAGEMENT	(9)

SNMPv1: SNMP network management concepts –SNMP management information – standard MIB – SNMP protocol specification – SNMP Group – SNMPv2 – Protocol operations –SNMPv2 Management Information Base–Conformance Statements–SNMPv2 Management Information Base–Conformance Statements.

UNIT - V	SWITCHING AND ROUTING	(9)

Traffic modeling and simulation – Self-similar and heavy tailed models – Buffering – Blocking – Fast Forwarding Internet traffic: Self-similarity – Ethernet traffic – World-Wide – Web traffic – IP Switching – IP multicast – Multicast routing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Apply the knowledge in fundamental concepts and basic taxonomy and terminology used in computer networks	Apply
CO2	Discover about IEEE 802-11 LAN system architecture and MAC	Analyze

	management concepts	
CO3	Identify the necessity of TCP/ IP networking	Apply
CO4	Understand the historical development and versions of SNMP (SNMPv1, SNMPv2	Understand
CO5	Summarize about various tools and models used for measure the network performance	Understand

REFERENCES:

1. Mani Subramanian, "Network Management Principles and Practice",Second Edition, Pearson Education, 2010.
2. William Stallings, "SNMP, SNMPN2, SNMPV3, RMON 1 AND 2", Third Edition, Pearson Education,2009.
3. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.
4. Morris, "Network management", 1st Edition, Pearson Education, 2008.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	1	-	2	2	1
CO2	1	-	2	2	1
CO3	1	-	2	2	1
CO4	1	-	2	2	1
CO5	1	-	2	2	1
Avg.	**1**	**-**	**2**	**2**	**1**

1-low, 2-medium, 3-high

IT24E13	OBJECT ORIENTED PROGRAMMING IN PYTHON (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

Basic knowledge of Python - syntax, writing and invoking functions, creating variables, reading inputs, and generating outputs from the Python console, Familiarity with using a text editor or IDE, Knowledge on how to execute a Python program, Python keywords, Knowing how to raise exceptions in Python., reading and Writing Files, Understanding of Modules and Libraries.

OBJECTIVES:

- Understand the basics of Oops.
- Design a program for constructors, Destructors, arrays.
- Implement inheritance concepts in Python.
- Understand the concept of file streams.
- Develop the program for exceptional handling using Python.

UNIT - I	INTRODUCTION	(9)

Need for object oriented programming - Procedural Languages vs. Object oriented approach Characteristics Object oriented programming – Python Programming Basics: Basic Program Construction - Operators - Control Statements - Manipulators - Type conversion. Function Prototyping- call by reference, return by reference - Inline function- Default arguments - Function overloading.

UNIT - II	OBJECTS AND CLASSES	(9)

Objects and Classes Simple Class - Constructors: Parameterized Constructors - Multiple Constructors in Class - Constructors with Default Arguments - Dynamic Initialization of Objects - Copy and Dynamic Constructors - Destructors - Structures and Classes - Arrays and Strings.

UNIT - III	OPERATOR OVERLOADING AND INHERITANCE	(9)

Operator Overloading and Inheritance Need of operator overloading- Overloading Unary Operators Overloading binary Operators - Overloading Special Operators - Data Conversion Inheritance: Derived Class and Base Class - Derived Class Constructors - Overriding Member Functions -Class Hierarchies - Public and Private Inheritance - Levels of Inheritance - Multiple Inheritance.

UNIT - IV	POLYMORPHISM AND FILE STREAMS	(9)

Polymorphism and File Streams Virtual Function - Friend Function - Static Function - Assignment and Copy Initialization - Memory Management: new and delete Pointers to Objects, this Pointer- Streams - String I/O - Character I/O - Object I/O - I/O with Multiple Objects - File Pointers - Disk I/O with Member Functions - Error Handling in File I/O.

UNIT - V	TEMPLATES AND EXCEPTION HANDLING	(9)

Templates: Introduction - Function Templates - Overloading Function Templates - user defined template arguments - Class Templates - Exception Handling - Syntax, multiple exceptions, exceptions with arguments.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Know the syntax on control statements and type conversions in Python.	Remember

CO2	Explain the Constructors and its types.	Understand
CO3	Demonstrate the concept of Operator over loading and inheritance.	Understand
CO4	Summarize the concept of Polymorphism and File streams.	Understand
CO5	Apply Exception handling in Python.	Apply

REFERENCES:

1. Steven F.Lott, Dusty Phillips, Python Object Oriented Programming, 4th Edition, Packet, 2021.
2. Dusty Phillips, Python 3 Object Oriented Programming, 2nd Edition, Packet, 2015.
3. Mark Lutz, Learning Python, Fifth Edition, O'Reilly, 2015.
4. Steven F.Lott, Mastering Object Oriented Python, 1st Edition, Packet, 2014.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	1	2	2	1
CO2	3	1	2	2	1
CO3	3	1	2	2	1
CO4	3	1	2	2	1
CO5	3	1	2	2	1
Avg.	**3**	**1**	**2**	**2**	**1**

1-low, 2-medium, 3-high

IT24E14	QUANTUM COMPUTING (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

To know about linear algebra, quantum mechanics, classical computing fundamentals, probability theory, and programming skills in languages like Python or Qiskit.

OBJECTIVES:

- To explore fundamental concepts of quantum theory, including quantum bits and state transformations.
- To analyze quantum circuits and algorithms, focusing on universal quantum gates, measurement.
- To investigate key quantum algorithms, including Deutsch's, Grover's, and Shor's, along with concepts of quantum parallelism and complexity classes.
- To examine classical cryptography and the principles of quantum information, including state distinction.
- To explore quantum error correction and fault-tolerant quantum computation through the Shor code and stabilizer codes.

UNIT - I	FOUNDATION	(9)

Basic Concepts of Quantum theory - Quantum Bits – The Leap from Classical to Quantum – Quantum state spaces – Single Qubit Systems – Multiple Qubit Systems – Quantum state transformations - Quantum mechanics - Application: super dense coding - Models for computation - The analysis of computational problems.

UNIT - II	QUANTUM COMPUTATION	(9)

Quantum Circuits - Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms - Quantum Counting - Speeding up the solution of NP - complete problems - Quantum Search for an unstructured database.

UNIT - III	QUANTUM ALGORITHMS	(9)

Deutsch's Algorithm - The Deutsch–Jozsa Algorithm - Simon's Periodicity Algorithm - Grover's Search Algorithm - Shor's Factoring Algorithm – Quantum Parallelism – Quantum Fourier Transform – Machine models and Complexity Classes.

UNIT - IV	QUANTUM INFORMATION THEORY	(9)

Classical Cryptography - Distinguishing quantum states and the accessible information - Data compression - Classical information over noisy quantum channels - Quantum information over noisy quantum channels - Entanglement as a physical resource.

UNIT - V	QUANTUM ERROR CORRECTION	(9)

Introduction - Short code - Theory of Quantum Error-Correction - Constructing Quantum Codes - Stabilizer codes - Fault Tolerant Quantum Computation - Entropy and information Shannon Entropy - Basic properties of Entropy - Von Neumann - Strong Sub Additivity.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the Basics of Quantum computing and its applications.	Understanding
CO2	Describe about the Quantum Computations and its operations	Understanding

CO3	Analyze the various quantum algorithms for solving the problems	Analyzing
CO4	Apply quantum information theory in various case studies	Evaluating
CO5	Discuss about the different quantum error correction techniques.	Creating

REFERENCES:

1. "Quantum Computation and Quantum Information" by Michael Nielsen and Isaac Chuang,October 2000.
2. "Quantum Computing: A Gentle Introduction" by Eleanor Rieffel and Wolfgang Polak, 2011.
3. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists,2008.
4. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press,Cambridge, 2020.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	1	3	2	-
CO2	3	1	3	2	-
CO3	3	1	3	2	-
CO4	3	1	3	2	-
CO5	3	1	3	2	-
Avg.	**3**	**1**	**3**	**2**	**-**

1-low, 2-medium, 3-high

IT24E15	BLOCKCHAIN TECHNOLOGY AND APPLICATIONS (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

Familiarity with databases and networking protocols, including peer-to-peer networks, will help in understanding how decentralized systems operate. A basic understanding of cryptographic techniques, such as public-key encryption and digital signatures, is crucial as blockchain technology relies heavily on these for ensuring data integrity and security. Additionally, knowledge of smart contracts, consensus algorithms (such as Proof of Work and Proof of Stake), and decentralized applications (dApps) will be beneficial for exploring blockchain-based solutions.

OBJECTIVES:

- To understand the fundamental concepts of blockchain technology, including its history, features, and terminologies.
- To discuss the various cryptographic algorithms such as SHA-1, RC4, Blowfish, and how they contribute to data encryption and system security.
- To analyze Bitcoin's role and public perception in the global financial ecosystem.
- To examine other consensus algorithms such as Proof of Burn, Delegated Proof of Stake (DPoS), and Practical Byzantine Fault Tolerance.
- To explore the tools used in Ethereum and their applications in various industries.

UNIT - I	BLOCKCHAIN FOUNDATION	(9)

Blockchain: Introduction - History- Features - Blockchain Terminologies -Different Version of Blockchain- Types Of Blockchain - Benefits- Peer-To-Peer - Decentralization: Role in Blockchain- Components of Blockchain- Centralized, Decentralized and Distributed Systems.

UNIT - II	CRYPTOGRAPHY IN BLOCKCHAIN	(9)

Cryptography: Introduction- Cryptography in Blockchain- Public and Private key Cryptography- Types of Cryptography- Cryptography and Network Security Principles- Data Encryption- Encryption algorithms- SHA-1 Hash- RC4 Encryption Algorithm- Hash Functions in System Security- Blowfish Algorithm –Data Integrity in Cryptography: Digital Signature.

UNIT - III	BITCOIN AND CRYPTOCURRENCY	(9)

Cryptocurrency- creation of cryptocurrency- Initial coin offering(ICO)- Bitcoin Peer-to-Peer Network- Proof-of-Stake Mining Cryptocurrencies- Tracking Bitcoin: Unspent Transaction Outputs(UTXO - Bitcoin in Public perception.

UNIT - IV	BITCOIN CONSENSUS	(9)

Consensus Algorithms in Blockchain- Proof of Work (PoW)- Proof of Burn Consensus Algorithm- Proof of Stake (PoS)- Byzantine Generals Problem- Cryptographic Consensus Mechanisms- Delegated Proof Of Stake - practical Byzantine Fault Tolerance(pBFT)- Paxos and Raft Algorithm.

UNIT - V	HYPERLEDGER,ETHEREUM AND BLOCKCHAIN APPLICATIONS	(9)

Hyperledger: Understanding Hyperledger- Hyperledger fabric, Tools and its Applications-Ethereum: Basics of Ethereum - Networks- Clients- Smart Contract in Ethereum -Tools used in Ethereum. Blockchain Applications: Smart Contract, Supply chain Industry, Digital fiat Currency, Cross border money Transfer, Insurance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Acquire knowledge in blockchain technology	Understanding
CO2	explain how these cryptographic algorithms are used in blockchain and cryptocurrency systems	Understanding
CO3	Analyze Bitcoin's market behavior, including factors that drive its price fluctuations, investor interest	Analyzing
CO4	Gain insights into Practical Byzantine Fault Tolerance (PBFT), its role in achieving consensus in a decentralized environment	Evaluating
CO5	Analyze the practical implications of Ethereum tools in real-world industries,	Analyzing

REFERENCES:

1. Amit Dua, Blockchain Technology and Applications : A systematic and Practical approach, Kindle Edition, August 2022
2. Asharaf S, Sivadas Neelima , Adarsh S. , Franklin John , Blockchain Technology: Algorithms and Applications, Wiley publisher, December 2023
3. Blockchain Technologies Applications And Cryptocurrencies [Paperback] Dr. P.S. Ramesh,Prof. Gaikwad Anil Pandurang,Ravi Teja Bhamidipati,Dr. K. Sridharan, Kindle Edition, February 2022.
4. Peter Lipovyanov, Blockchain for Business 2019: A user-friendly introduction to blockchain technology and its business applications, Packt Publishing Limited, January 2019.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	3	1
CO2	3	-	2	3	1
CO3	3	-	2	3	1
CO4	3	-	2	3	1
CO5	3	-	2	3	1
Avg.	**3**	**-**	**2**	**3**	**1**

1-low, 2-medium, 3-high

IT24E16	DIGITAL FORENSICS (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

The students should familiar with basic programming concepts in languages such as Python, Java, or C++, which can aid in scripting and automation tasks within digital forensics and have knowledge on malware, phishing, social engineering, and the basic measures to protect against these threats.

OBJECTIVES:

- To identify and classify various types of cybercrimes and understand the procedures for handling electronic evidence, including the collection, searching, and storage of digital media.
- To learn investigation methods for collecting digital evidence, with a focus on hacking, child pornography, cyber talking, and other cyber offenses, as well as understanding the legal considerations under Indian and international law.
- To learn how to validate data acquisitions and handle complex scenarios such as RAID configurations and remote network data acquisition.
- To explore advanced techniques for recovering and analyzing digital evidence, such as retrieving deleted data, handling damaged SIM cards, and recovering multimedia evidence from various devices.
- To understand the methodologies for validating forensic software, addressing data-hiding techniques, and conducting specialized investigations such as email crime and remote acquisitions.

UNIT - I	INTRODUCTION TO DIGITAL FORENSICS	(9)

Cyber Crime and computer crime: Introduction to Digital Forensics- Definition and types of cybercrimes- electronic evidence and handling- electronic media- collection- searching and storage of electronic media- introduction to internet crimes- hacking and cracking- credit card and ATM frauds- web technology- cryptography- emerging digital crimes and modules.

UNIT - II	DIGITAL CRIME AND INVESTIGATION	(9)

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.Cr.P.C and Indian Evidence Act - Cyber crimes under the Information Technology Act,2000 - Cyber crimes under International Law - Hacking Child Pornography, Cyber Stalking, Denial of service Attack, Virus Dissemination, Software Piracy, Internet Relay Chat (IRC) Crime, Credit Card Fraud, Net Extortion, Phishing etc - Cyber Terrorism Violation of Privacy on Internet - Data Protection and Privacy – Indian Court cases

UNIT - III	DATA ACQUISITION	(9)

Data acquisition- understanding storage formats and digital evidence- determining the best acquisition method- acquisition tools- validating data acquisitions- performing RAID data acquisitions- remote network acquisition tools- other forensics acquisitions tools.

UNIT - IV	PROCESSING CRIMES	(9)

Processing crimes and incident scenes- securing a computer incident or crime- seizing digital evidence at scene- storing digital evidence-.Processing of digital evidence- digital images- damaged SIM and data recovery- multimedia evidence- retrieving deleted data: desktops- laptops and mobiles- retrieving data from slack space- renamed file- ghosting- compressed files.

UNIT - V	COMPUTER FORENSICS TOOLS	(9)

Current computer forensics tools- Types of Computer Forensics Tools- Tasks Performed by Computer Forensics Tools -software- hardware tools- validating and testing forensic software- addressing data-hiding techniques- performing remote acquisitions- E-Mail investigations- investigating email crime and violations- understanding E-Mail servers- specialized E-Mail forensics tool.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Have knowledge on digital forensics.	Understand
CO2	Know about digital crime and investigations	Understand
CO3	Examine digital evidences such as the data acquisition, identification analysis.	Analyze
CO4	Investigate, identify and extract digital evidence	Apply
CO5	Know about computer forensics tools	Understand

REFERENCES:

1. Bill Nelson, Amelia Phillips & Christopher Steuart ,"Guide to Computer Forensics and Investigations", Cengage Learning, 6th Edition,2018.
2. Linda Volonino, Reynaldo Anzaldua, and Jana Godwin, "Computer Forensics: Principles and Practices" , Pearson,2017.
3. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2020
4. Altheide .C & Carvey .H,"Digital Forensics with Open Source Tools", Syngress, 2018.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	1	2	2	-
CO2	2	1	2	2	-
CO3	2	1	2	2	-
CO4	2	1	2	2	-
CO5	2	1	2	2	-
Avg.	**2**	**1**	**2**	**2**	**-**

1-low, 2-medium, 3-high

IT24E17	SOCIAL NETWORK ANALYSIS (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

PREREQUISITE:

The students should be familiar with Data Structure and Algorithms, Python Programming .

OBJECTIVES:

- To gain a solid foundation in the principles of Social Network Analysis
- To learn how different types of network models and visualization techniques in Social Network Analysis.
- To grasp the concept of communities within social networks
- To explore the mechanisms and models that explain how social networks evolve over time,
- To learn how to apply SNA techniques to analyze and solve practical problems across different domains

UNIT - I	INTRODUCTION	(9)

Introduction to Web – Limitations of Current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks – Network Analysis – Development of Social Network Analysis – Key Concepts and measures in Network Analysis – Blogs and Online Communities – Web based Networks.

UNIT - II	MODELING AND VISUALIZATION	(9)

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation – Centrality - Clustering - Node Edge Diagrams - Visualizing Social Networks with Matrix - Node Link Diagrams – Hybrid Representations - Modeling and Aggregating Social Network Data - Random Walks and their Applications - Use of Hadoop and Map Reduce.

UNIT - III	MINING COMMUNITIES	(9)

Aggregating and reasoning with Social Network Data - Advanced Representations – Extracting Evolution of Web Community from a Series of Web Archive – Detecting Communities in Social Networks – Evaluating Communities – Core Methods for Community Detection and Mining – Applications of Community Mining Algorithms – Node Classification in Social Networks.

UNIT - IV	EVOLUTION	(9)

Evolution in Social Networks – Framework – Tracing Smoothly Evolving Communities – Model and Algorithm for Social Influence Analysis – Social Similarity and Influence – Influence Maximization in Virtual Marketing – Algorithms and Systems for Expert Location in Social Networks – Expert Location without Graph Constraints - Expert Location with Score Propagation – Expert Team Formation- Link Prediction in Social Networks – Feature based Link Prediction.

UNIT - V	APPLICATIONS	(9)

A Learning Based Approach for Real Time Emotion Classification of Tweets – A New Linguistic Approach to Assess the Opinion of Users in Social Network Environment – Scientific and Technical Emergence Forecasting – Social Network Analysis for Biometric Template Protection.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Work on the internal components of social networks	Remembering
CO2	Apply the different types of network models and visualization	Analyzing

	techniques in social network analysis	
CO3	Mine the behavior of the users in asocial network	Remembering
CO4	Predict the possible next outcome of the social networks	Remembering
CO5	Apply social network in real time applications	Analyzing

REFERENCES:

1. Guandong Xu, Yanchun Zhang "Web Mining and Social Networking – Techniques and Applications", Springer, 1st Edition, 2012.
2. Borko Furht, " Handbook of Social Network Technologies and Applications", Springer, 1st Edition, 2011.
3. Przemyslaw Kazienko, Nitesh Chawla, " Applications of Social Media and Social Network Analysis", Sringer , 2015.
4. Charu C, Aggarwal, " Social Network Data Analytics", Springer, 2014.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	2	2
CO2	2	-	2	2	2
CO3	2	-	2	2	2
CO4	2	-	2	2	2
CO5	2	-	2	2	2
Avg.	**2**	-	**2**	**2**	**2**

1-low, 2-medium, 3-high

IT24E18	BIG DATA AND ANALYTICS (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	3	0	0	3

(Common to All Branches)

PREREQUISITE:

The student should be familiar with database management systems and SQL which is essential for storing and querying large data sets. Also, they should have the understanding of basic statistics and data analysis techniques. This is useful for working with large datasets, performing data exploration, and deriving meaningful insights. Requires any basic programming knowledge for learning Hadoop.

OBJECTIVES:

- To gain in-depth knowledge of all the concepts related to bigdata.
- Analyze appropriate NoSQL database techniques for storing and processing large volumes of structure and unstructured data.
- Learn to use various techniques for analysis of bigdata.
- Explore the tools and algorithms like Hadoop, Map Reduce and NO SQL used in big data analytics.
- Able to evaluate the techniques and theories to large-scale data science problems using various databases with analytics and visualizations.

UNIT - I	FUNDAMENTALS OF BIG DATA AND ANALYTICS	(9)

Introduction to Big Data - Big Data Characteristics – Different Types of Big Data - Traditional Versus Big Data Approach – Big data Analytics Lifecycle – Enterprise Technologies and Big Data Business Intelligence - Big Data Challenges .

Big Data Analytics: Classification of Analytics – Challenges – Importance of Big Data Analytics - Data Science - Data Scientist - Terminologies used in Big Data Environments - Top Analytics Tools.

UNIT - II	STORING AND PROCESSING BIG DATA	(9)

Big data Storage Concepts: Clusters – File Systems – Distributed File Systems – NoSQL – Sharding – Replication – CAP Theorem – ACID – BASE.

Big data Processing Concepts: Parallel Data Processing – Hadoop – Processing Workloads – Processing in Batch mode - Processing in Realtime mode – On-Disk Storage Devices.

UNIT - III	BIG DATA ANALYSIS & ANALYTICS TECHNIQUES	(9)

Analysis Techniques: Quantitative Analysis - Qualitative Analysis – Statistical Analysis – Semantic Analysis – Visual Analysis – Case Study: Correlation – Regression – Time Series Plot – Clustering – Classification.

Analytics Techniques: Predictive Analytics - Descriptive Analytics - Survival Analysis - Social Network Analytics.

UNIT - IV	MONGODB, HADOOP AND MAPREDUCE PROGRAMMING	(9)

MongoDB: Why Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.

Hadoop: Apache Hadoop & Hadoop Ecosystem, Moving Data in and out of Hadoop - Data Serialization MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.

UNIT - V	HDFS, HIVE AND HIVEQL, HBASE	(9)

HDFS-Overview - Installation and Shell, Java API - Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data - Sorting And Aggregating - Map Reduce Scripts, Joins & Sub queries - HBase concepts, Advanced Usage - Schema Design - Advance Indexing, PIG, Zookeeper - Build Applications with Zookeeper.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand Big Data and its analytics in the real world	Understand
CO2	Discuss the storage and processing techniques for big data	Understand
CO3	Analyze web contents and Social Networks to provide analytics with relevant visualization tools.	Analyzing
CO4	Demonstrate the Map Reduce programming model to process the big data along with Hadoop tools.	Evaluating
CO5	Illustrate the concepts of HDFS, HIVE AND HIVEQL, HBASE	Creating

REFERENCES:

1. Michael Minelli Michelle Chambers and AmbigaDhiraj "Big Data Big Analytics: Emerging Business and Analytic trends for todaysBusiness"First Editionwiley, 2013.
2. Paul Buhler, Wajid khattak, Thomas Erl, "Big Data Fundamentals: Concepts, Drivers & Techniques", Second Edition, Prentiee Hall, 2016.
3. Seema Acharya, SubhashiniChellappan, "Big Data and Analytics", Wiley Publications, First Edition, 2015.
4. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, "Hadoop For Dummies", Wiley Publications, 2014.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	1	2	1	-
CO2	2	1	2	1	-
CO3	2	1	2	1	-
CO4	2	1	2	1	-
CO5	2	1	2	1	-
Avg.	**2**	**1**	**2**	**1**	-

1-low, 2-medium, 3-high

IT24E19	ONTOLOGY AND SEMANTIC WEB (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	1	0	3	1

PREREQUISITE:

A basic understanding of logic, specifically propositional and predicate logic, is important, as it underpins the principles of knowledge representation and reasoning. Familiarity with markup languages like XML and HTML, as well as an understanding of web development technologies such as HTTP, REST, and web services, will be helpful. Additionally, an introductory knowledge of databases and query languages, particularly SQL, will provide a strong basis for understanding RDF and SPARQL in the context of the Semantic Web.

OBJECTIVES:

- To understand the definition and purpose of ontologies and their real-world applications.
- To explore the RDF Primer and SPARQL Query Language Specifications.
- To understand the concept of Semantic Web Services and explore OWL-S and other service ontologies.
- To identify the challenges of ontology alignment and the techniques for ontology matching and merging.
- To analyze semantic web applications in various domains.

UNIT - I	INTRODUCTION TO ONTOLOGIES AND KNOWLEDGE REPRESENTATION	(9)

Definition and purpose of ontologies - Real-world applications - Ontology development -lifecycle - Methodologies for ontology design - Tools for ontology engineering - Basics of knowledge representation - Description Logic (DL)

UNIT - II	SEMANTIC WEB FUNDAMENTALS	(9)

Vision and goals of the Semantic Web - Differences between the traditional web and the Semantic Web - Resource Description Framework (RDF) - SPARQL query language - RDF Primer and SPARQL Query Language Specifications

UNIT - III	ONTOLOGY LANGUAGES AND SEMANTIC WEB SERVICES	(9)

Overview of OWL - OWL syntax and semantics - Using OWL for ontology modeling -Introduction to Semantic Web Services - OWL-S and other service ontologies

UNIT - IV	ONTOLOGY ALIGNMENT, INTEGRATION, AND LINKED DATA	(9)

Challenges of ontology alignment - Techniques for ontology matching and merging - Principles of Linked Data- Publishing and consuming Linked Data

UNIT - V	SEMANTIC WEB APPLICATIONS AND ADVANCED TOPICS	(9)

Case studies of Semantic Web applications - Trends and future directions - Ontology learning and automatic ontology generation - Semantic search and query expansion - Machine learning for the Semantic Web

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Define and explain the purpose and significance of ontologies in information systems	Understand

CO2	Acquire the skills to use the Resource Description Framework (RDF) to represent structured data on the Semantic Web	Understand
CO3	Describe services using OWL-S and other service ontologies.	Understand
CO4	Use tools and methodologies to align and integrate different ontologies effectively.	Apply
CO5	Analyze and evaluate case studies of Semantic Web applications to understand their architecture and impact.	Analyze

REFERENCES:

1. Dean Allemang and James Hendler , “Semantic Web for the Working Ontologist",2020.
2. Asunción Gómez-Pérez, Mariano Fernández-López, and Oscar Corcho , "Ontology Engineering" , 2018.
3. Toby Segaran, Colin Evans, and Jamie Taylor , “Programming the Semantic Web", 2011

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	2	-
CO2	3	-	2	2	-
CO3	3	-	2	2	-
CO4	3	-	2	2	-
CO5	3	-	2	2	-
Avg.	**3**	**-**	**2**	**2**	**-**

1-low, 2-medium, 3-high

IT24E20	AR/VR/XR DEVELOPMENT (PROFESSIONAL ELECTIVES – III and IV)	Category	L	T	P	C
		PEC	1	0	3	1

PREREQUISITE:

The students must knowledge in programming languages such as C, C++, Swift, Python, Java, and JavaScript. Skill at using game engines such Unreal Engine and Unity. Familiarity with programming tools such as Git. The ability to use animation and design tools such as 3DS Max, Blender, and Maya.

OBJECTIVES:

- Provide a foundational understanding of augmented, virtual, and extended reality technologies
- Introduce fundamental modeling tools and techniques in Blender.
- Master subdivision modeling and sculpting for high-detail 3D creation.
- Understand the fundamental principles of keyframe animation for dynamic movement.
- Discover how to create basic interactions and user interfaces for immersive experiences.

UNIT - I	INTRODUCTION TO AR/VR/XR	(9)

Overview of AR, VR, and XR technologies - Applications and use cases - Introduction to Blender and related tools - Definition and concepts of AR, VR, and XR - Historical evolution and current trends - Comparison of AR/VR/XR technologies - Potential applications and use cases - Discussing real-world examples of AR/VR/XR applications

UNIT - II	GETTING STARTED WITH BLENDER	(9)

Overview of Blender interface and workspace - Basic navigation and manipulation of 3D objects Introduction to modeling tools and techniques - Understanding Blender's workflow for asset - Basic modeling techniques - UV unwrapping and texturing - advanced modeling tools and modifiers Animation and Rigging - Keyframe animation - Rigging characters and objects - Animation - Principles And techniques

UNIT - III	ADVANCED MODELING IN BLENDER	(9)

Advanced modeling techniques (e.g., subdivision modeling, sculpting) - UV unwrapping and texturing fundamentals - Introduction to Blender's material editor - Exploring Blender's modifier stack for non-destructive modeling

UNIT - IV	ANIMATION AND RIGGING	(9)

Keyframe animation principles - Rigging basics: bones, armatures, and constraints - Weight painting and skinning - Introduction to Blender's animation tools and timeline - **Integrating Blender with Unity and Unreal Engine :** Overview of game engines (Unity and Unreal Engine) - Exporting Blender assets for use in Unity and Unreal Engine - Basics of scene setup and importing assets - Introduction to scripting and interactivity

UNIT - V	TESTING AND DEBUGGING STRATEGIES	(9)

Principles of scene composition and layout - Lighting techniques for AR/VR/XR environments Material and texture optimization for real-time rendering - Implementing basic interactions and user Interfaces - Techniques for optimizing assets and scenes for real-time performance - Building and deploying AR/VR/XR applications for different platforms - Testing and debugging strategies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the Basics of Quantum computing and its applications.	Understand

CO2	Describe about the Quantum Computations and its operations	Understand
CO3	Analyze the various quantum algorithms for solving the problems	Analyzing
CO4	Apply quantum information theory in various case studies	Evaluating
CO5	Discuss about the different quantum error correction techniques.	Creating

REFERENCES:

1. The Essential Guide to Game Audio: The Theory and Practice of Sound for Games" by Steve Horowitz and Scott R. Looney, March 2014.
2. Jonathan Linowes "Unity Virtual Reality Projects: Learn Virtual Reality by Developing More Than 10 Engaging Projects with Unity", 2019.
3. Tomas Akenine-Möller, Eric Haines, and Naty Hoffman "Real-Time Rendering" August 2019.
4. Robert Scoble and Shel Israel,"The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything" , kindle Edition, December 2016.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	3	2	1
CO2	2	-	3	2	1
CO3	2	-	3	2	1
CO4	2	-	3	2	1
CO5	2	-	3	2	1
Avg.	**2**	**-**	**3**	**2**	**1**

1-low, 2-medium, 3-high