MUTHAYAMMAL ENGINEERING COLLEGE

An Autonomous Institution

(Approved by AICTE | Accredited by NBA & NAAC | Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code : **AD**

Programme Name : **B.TECH- ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

Regulation : **R-2023**

MUTHAYAMMAL ENGINEERING COLLEGE

(Approved by AICTE | Accredited by NBA & NAAC | Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Institution Vision & Mission

Institution Vision

- To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards.

Institution Mission

- To prepare the students with high professional skills and ethical values.
- To impart knowledge through best practices.
- To instill a spirit of innovation through Training, Research and Development.
- To undertake continuous assessment and remedial measures.
- To achieve academic excellence through intellectual, emotional and social stimulation.

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Department Vision & Mission

Department Vision

- To create an inspirational learning centre where proficient and future-ready scientist in the field of Artificial Intelligence and Data Science.

Department Mission

- To impart high-quality education and capitalist oriented learning through Artificial Intelligence and Data Science.
- To contribute towards advanced AI technologies that provides increased and better performance.
- To benefit the society through our contribution towards advancements in AI and Data Science

Program Educational Objectives

PEO1 : Graduates will be able to Practice as an IT Professional in Multinational Companies

PEO2 : Graduates will be able to Gain necessary skills and to pursue higher education for career growth

PEO3 : Graduates will be able to Exhibit the leadership skills and ethical values in the day to day life.

Program Specific Outcomes

PSO1 : Graduates should be able to design and analyze the Artificial Intelligence algorithms towards Contemporary technology

PSO2 : Graduates should be able to apply probability and statistical solutions for real time problems towards data science

PSO3 : Graduates should be able to create an intelligent system by understanding modern coding tools, data analytics and digital business.

Program Outcomes

PO1 : **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2 : **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.

PO3 : **Design/Development solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 : **Conduct investigations of complex problems:** Use research-based knowledge and **research methods including design of experiments, analysis and interpretation of data, and synthesis** of the information to provide valid conclusions.

PO5 : **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 : **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 : **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8 : **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 : **Project management and finance:** Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 : **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

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Estd. 2000

B.Tech – Artificial Intelligence and Data Science
Grouping of Courses

I. Humanities and Social Sciences Courses (HS)

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
1.	23HSS01	Business English	HS	2	2	0	0	2
2.	23HSS02	English Communicative Skills Laboratory	HS	2	0	0	2	1
3.	23HSS03	Life Skill and Work Place Psychology	HS	2	2	0	0	2
4.	23HSS04	Technical English For Engineers	HS	2	2	0	0	2
5.	23HSS05	Communicative English for Engineers	HS	2	2	0	0	2
6.	23HSS06	Basics of Japanese Language	HS	2	2	0	0	2
7.	23HSS07	Basics of French Language	HS	2	2	0	0	2
8.	23HSS18	Professional Ethics and Human Values	HS	3	3	0	0	3

II. Basic Sciences (BS)

1.	23BSS01	Engineering Physics	BS	3	3	0	0	3
2.	23BSS02	Physics and Chemistry Laboratory	BS	2	0	0	2	1
3.	23BSS03	Bio and Nanomaterials Sciences	BS	3	3	0	0	3
4.	23BSS04	Material Sciences	BS	3	3	0	0	3
5.	23BSS05	Physics for Mechanical Engineers	BS	3	3	0	0	3
6.	23BSS11	Engineering Chemistry	BS	3	3	0	0	3
7.	23BSS12	Environmental Science and Engineering	BS	3	3	0	0	3
8.	23BSS13	Organic Chemistry	BS	3	3	0	0	3
9.	23BSS14	Physical Chemistry	BS	3	3	0	0	3
10.	23BSS15	Applied Chemistry	BS	3	3	0	0	3
11.	23BSS16	Organic Chemistry Laboratory	BS	2	0	0	2	1
12.	23BSS17	Physical Chemistry Laboratory	BS	2	0	0	2	1
13.	23BSS21	Algebra and Calculus	BS	4	3	1	0	4
14.	23BSS22	Differential Equations and Vector Analysis	BS	4	3	1	0	4
15.	23BSS23	Transform and Partial Differential Equations	BS	4	3	1	0	4
16.	23BSS24	Discrete Mathematics	BS	4	3	1	0	4

17.	23BSS25	Statistical and Queuing Model	BS	4	3	1	0	4
18.	23BSS26	Numerical Methods	BS	4	3	1	0	4
19.	23BSS27	Probability and Random Processes	BS	4	3	1	0	4
20.	23BSS28	Statistic and Numerical Methods	BS	4	3	1	0	4

III. General Engineering Science (GES)

1.	23GES01	Programming for Problem Solving Using C	GES	3	3	0	0	3
2.	23GES02	Programming for Problem Solving Technique	GES	3	3	0	0	3
3.	23GES03	Programming in C Laboratory	GES	2	0	0	2	1
4.	23GES04	Programming in C and Python Laboratory	GES	2	0	0	2	1
5.	23GES05	Electrical and Electronic Sciences	GES	3	3	0	0	3
6.	23GES06	Mechanical and Building Sciences	GES	3	3	0	0	3
7.	23GES07	Computer Aided Drafting Laboratory	GES	2	0	0	2	1
8.	23GES08	Python Programming	GES	3	3	0	0	3
9.	23GES09	Programming in Python Laboratory	GES	2	0	0	2	1
10.	23GES10	Soft Skills Laboratory	GES	2	0	0	2	1
11.	23GES11	Electronic Devices	GES	3	3	0	0	3
12.	23GES12	Electronic Simulation Laboratory	GES	2	0	0	2	1
13.	23GES13	Electric Circuits	GES	3	2	1	0	3
14.	23GES14	Electric Circuits Laboratory	GES	2	0	0	2	1
15.	23GES15	Manufacturing Process	GES	3	3	0	0	3
16.	23GES16	Manufacturing Process Laboratory	GES	2	0	0	2	1
17.	23GES17	Mechanical and Building Sciences Laboratory	GES	2	0	0	2	1
18.	23GES18	Construction Materials	GES	3	3	0	0	3
19.	23GES19	Concepts in Product Design	GES	3	3	0	0	3
20.	23GES20	Renewable Energy Sources	GES	3	3	0	0	3
21.	23GES21	Electrical Drives and Control	GES	3	3	0	0	3
22.	23GES22	Electrical Drives and Control Laboratory	GES	2	0	0	2	1
23.	23GES23	Analog and Digital communication	GES	3	3	0	0	3
24.	23GES24	Digital Principles and System Design	GES	3	3	0	0	3
25.	23GES25	Digital Principles and System Design Laboratory	GES	2	0	0	2	1
26.	23GES26	Engineering Drawing	GES	5	1	0	4	3
27.	23GES27	Engineering Geology	GES	3	3	0	0	3
28.	23GES28	Engineering Mechanics	GES	4	3	1	0	4
29.	23GES29	Wireless Communication	GES	4	3	1	0	4

30.	23GES30	Electronics and Microprocessor	GES	3	3	0	0	3
31.	23GES31	Electronics and Microprocessor Laboratory	GES	2	0	0	2	1
32.	23GES32	Data Structures using Python	GES	3	3	0	0	3

IV. Professional Core (PC)

1.	23ADC01	Data Structures and Algorithm using C	PC	3	3	0	0	3
2.	23ADC02	Data Structures using C Laboratory	PC	2	0	0	2	1
3.	23ADC03	Digital System Design	PC	3	3	0	0	3
4.	23ADC04	Digital System Design Lab	PC	2	0	0	2	1
5.	23ADC05	Object Oriented Programming	PC	3	3	0	0	3
6.	23ADC06	Object Oriented Programming using Java	PC	3	3	0	0	3
7.	23ADC07	Operating System	PC	2	0	0	2	1
8.	23ADC08	Operating System Lab	PC	3	3	0	0	3
9.	23ADC09	Design and Analysis of Algorithms	PC	2	0	0	2	1
10.	23ADC10	Database Design and Management	PC	3	3	0	0	3
11.	23ADC11	Database Design and Management Laboratory	PC	3	3	0	0	3
12.	23ADC12	Introduction to Artificial Intelligence	PC	2	0	0	2	1
13.	23ADC13	Introduction to Artificial Intelligence Laboratory	PC	3	3	0	0	3
14.	23ADC14	Data Analytics	PC	2	0	0	2	1
15.	23ADC15	Data Analytics Laboratory	PC	3	3	0	0	3
16.	23ADC16	Cognitive Systems	PC	2	0	0	2	1
17.	23ADC17	Optimization Techniques	PC	3	3	0	0	3
18.	23ADC18	Data Exploration and Visualization	PC	3	3	0	0	3
19.	23ADC19	Machine Learning	PC	3	3	0	0	3
20.	23ADC20	Machine Learning Laboratory	PC	3	3	0	0	3
21.	23ADC21	Business Analytics	PC	2	0	0	2	1
22.	23ADC22	Internet Programming and Web Technologies	PC	3	3	0	0	3
23.	23ADC23	Internet Programming and Web Technologies Laboratory	PC	3	3	0	0	3
24.	23ADC24	Artificial Intelligence II	PC	2	0	0	2	1
25.	23ADC25	Artificial Intelligence - II Laboratory	PC	3	3	0	0	3
26.	23ADC26	Data and Information Security	PC	2	0	0	2	1
27.	23ADC27	Deep Learning	PC	3	3	0	0	3
28.	23ADC28	Deep Learning Laboratory	PC	3	3	0	0	3
29.	23ADC29	AI and Robotics	PC	2	0	0	2	1
30.	23ADC30	Computer Vision	PC	3	3	0	0	3
31.	23ADC31	Software Engineering	PC	4	0	0	4	2
32.	23ADC32	Fundamentals of Data Science And Analytics	PC	3	0	0	3	3
33.	23ADC33	Computer Organization and Architecture	PC	3	0	0	3	3

34.	23ADC34	Theory of Computation and Compiler Design	PC	3	0	0	3	3
35.	23ADC35	Parallel and Distributed Computing	PC	3	0	0	3	3
36.	23ADC36	Security and Privacy in Cloud	PC	3	0	0	3	3
37.	23ADC37	Software Testing and Automation	PC	3	0	0	3	3
38.	23ADC38	Computer Networks	PC	3	0	0	3	3
39.	23ADC39	Stream Processing	PC	3	0	0	3	3
40.	23ADC40	Modern Cryptography	PC	3	0	0	3	3
41.	23ADC41	Game Theory	PC	3	0	0	3	3
42.	23ADC42	Image and video analytics	PC	3	0	0	3	3
43.	23ADC43	App Development	PC	3	0	0	3	3
44.	23ADC44	3D Printing and Design	PC	3	0	0	3	3
45.	23ADC45	Design Project	PC	3	0	0	3	3
46.	23ADC46	Data Modeling and Business Intelligence	PC	3	3	0	0	3
47.	23ADC47	Data Modeling and Business Intelligence Laboratory	PC	2	0	0	2	1
48.	23ADC48	Natural Language Processing	PC	3	3	0	0	3
49.	23ADC49	Natural Language Processing Laboratory	PC	2	0	0	2	1
50.	23ADC50	AWS Academy Cloud Foundation	PC	3	3	0	0	3
51.	23ADC51	Foundation of Data Science	PC	3	3	0	0	3
52.	23ADC52	Data Science using Python Laboratory	PC	2	0	0	2	1
53.	23ADC53	Game Design Prototyping and Development	PC	3	3	0	0	3
54.	23ADC54	DEVOPS	PC	3	3	0	0	3

V. Professional Elective (PE)

1.	23ADE01	Software Development Processes	PE	3	3	0	0	3
2.	23ADE02	Microprocessors and Microcontrollers	PE	3	3	0	0	3
3.	23ADE03	Engineering Predictive Analytics	PE	3	3	0	0	3
4.	23ADE04	Agile Methodologies	PE	3	3	0	0	3
5.	23ADE05	Parallel Computing	PE	3	3	0	0	3
6.	23ADE06	Software Architecture	PE	3	3	0	0	3
7.	23ADE07	Internet of Things	PE	3	3	0	0	3
8.	23ADE08	Health care Analytics	PE	3	3	0	0	3
9.	23ADE09	Distributed Systems	PE	3	3	0	0	3
10.	23ADE10	Mobile Applications Development	PE	3	3	0	0	3
11.	23ADE11	Software Testing and Quality Assurance	PE	3	3	0	0	3
12.	23ADE12	Cloud Computing	PE	3	3	0	0	3
13.	23ADE13	Embedded Systems and Programming	PE	3	3	0	0	3
14.	23ADE14	Operations and Supply Chain Management	PE	3	3	0	0	3
15.	23ADE15	Speech Processing and Analytics	PE	3	3	0	0	3
16.	23ADE16	Social Network Analytics	PE	3	3	0	0	3

17.	23ADE17	Cyber Security	PE	3	3	0	0	3
18.	23ADE18	Web Services and API Design	PE	3	3	0	0	3
19.	23ADE19	Nonlinear Optimization	PE	3	3	0	0	3
20.	23ADE20	Ethics of AI	PE	3	3	0	0	3
21.	23ADE21	Engineering Economics	PE	3	3	0	0	3
22.	23ADE22	Python for Data Science	PE	3	3	0	0	3
23.	23ADE23	Python Laboratory	PE	2	0	0	2	1
24.	23ADE24	Data Warehousing and Mining	PE	3	3	0	0	3
25.	23ADE25	Cognitive Science and Analytics	PE	3	3	0	0	3
26.	23ADE26	Big Data Analytics	PE	3	3	0	0	3
27.	23ADE27	Big Data Analytics Laboratory	PE	2	0	0	2	1
28.	23ADE28	Block Chain and Cryptography	PE	3	3	0	0	3
29.	23ADE29	Principles of Management	PE	3	3	0	0	3
30.	23ADE30	IOT System And Analytics	PE	3	3	0	0	3
31.	23ADE31	IOT System And Analytics Laboratory	PE	2	0	0	2	1
32.	23ADE32	Bio-inspired Optimization Techniques	PE	3	3	0	0	3
33.	23ADE33	Information Extraction and Retrieval	PE	3	3	0	0	3
34.	23ADE34	Data Security and Privacy	PE	3	3	0	0	3
35.	23ADE35	Adhoc and Sensor Networks	PE	3	3	0	0	3
36.	23ADE36	Digital Image Processing	PE	3	3	0	0	3
37.	23ADE37	MERN Stack Development	PE	3	3	0	0	3
38.	23ADE38	MERN Stack Development Laboratory	PE	2	0	0	2	1
39.	23ADE39	Sales fore CRM and Platform	PE	3	3	0	0	3
40.	23ADE40	Sales fore CRM and Platform Laboratory	PE	2	0	0	2	1

VI. Open Elective (OE)

1.	23ADP07	NPTEL- Introduction to Industry 4.0 and Industrial Internet of Things	EC	-	-	-	-	-
2.	23ADP08	NPTEL- Introduction to Machine Learning	EC	-	-	-	-	-
3.	23ADP09	NPTEL- The Joy of Computing using Python	EC	-	-	-	-	-
4.	23ADP10	NPTEL-Data Analytics with Python	EC	-	-	-	-	-
5.	23ADP11	NPTEL- Indian Constitution	EC	-	-	-	-	-
6.	23ADP12	NPTEL- Value Education	EC	-	-	-	-	-
7.	23ADP13	NPTEL- Disaster Management	EC	-	-	-	-	-
8.	23ADP14	NPTEL- Pedagogy Studies	EC	-	-	-	-	-
9.	23ADP15	NPTEL- Stress Management by Yoga	EC	-	-	-	-	-

VII. Employability Enhancement Courses (EEC)

1.	23ADP01	Project work-Phase I	EC	6	0	0	6	3
2.	23ADP02	Project work-Phase II	EC	15	0	0	15	12
3.	23ADP03	Comprehension	EC	4	0	0	4	2

4.	23ADP04	Technical Seminar	EC	4	0	4	0	2
5.	23ADP05	Entrepreneurship Development	EC	3	3	0	0	3
6.	23ADP06	Professional Practices	EC	6	0	0	6	3

Chairman
Board of Studies
Department of Computer Science and Engineering
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B.Tech - Artificial Intelligence and Data Science
Curriculum | UG - R2023
Semester -I

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23HSS01	Technical and Communicative English I	HS	2	0	2	3	3
2.	23BSS21	Algebra and Calculus	BS	3	0	0	4	4
3.	23BSS01	Engineering Physics	BS	3	0	0	3	3
4.	23GES01	Programming for Problem Solving Using C	GES	3	0	0	3	3
5.	23GES06	Electrical and Electronics Sciences	GES	3	0	0	3	3
6.	23HSS08	Heritage of Tamils	HS	1	0	0	1	1
Practical								
7.	23BSS02	Physics Laboratory	BS	0	0	2	2	2
8.	23GES03	Programming in C Laboratory	GES	0	0	1	1	2
							Total Credit	**20**

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Semester -II

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23HSS02	Technical and Communicative English II	HS	3	0	3	3	3
2.	23BSS22	Advanced Calculus and Complex Analysis	BS	3	1	0	4	4
3.	23BSS11	Engineering Chemistry	BS	3	0	0	3	3
4.	23GES08	Python Programming	GES	3	0	0	3	3
5.	23GES04	Computer Peripherals and Programming Essentials	GES	3	0	0	3	1
6.	23HSS09	Tamils and Technology	HS	1	0	0	1	1
Practical								
7.	23BSS12	Chemistry Laboratory	BS	0	0	2	2	2
8.	23GES09	Soft Skill -1 Python Programming Laboratory	GES	0	0	2	1	2
							Total Credit	**20**

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Semester -III

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23BSS30	Discrete Mathematics	BS	3	1	0	4	4
2.	23ADC10	Database Management System	PC	3	0	0	3	3
3.	23ADC05	Object Oriented Programming using JAVA	PC	3	0	0	3	3
4.	23ADC01	Data Structures and Algorithm using C	PC	3	0	0	3	3
5.	23ADC33	Computer Organization and Architecture	PC	3	0	0	3	3
6.	23ADC12	Introduction to Artificial Intelligence	PC	3	0	0	3	3
Practical								
7.	23ADC11	Database Management System Laboratory	PC	0	0	2	1	2
8.	23ADC06	Object Oriented Programming using JAVA Laboratory	PC	0	0	2	1	2
9.	23ADC02	Data Structures using C Laboratory	PC	0	0	2	1	2
10.		Mini Project - Front End						
							Total Credit	**23**

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Semester -IV

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23BSS27	Probability and Statistics	BS	3	1	0	4	4
2.	23ADC07	Operating System	PC	3	0	0	3	3
3.	23ADE37	PE-I MERN Stack Development	PC	3	0	0	3	3
4.	23ADC19	Machine Learning	PC	3	0	0	3	3
5.	23ADC51	Foundation of Data Science	PC	3	0	0	3	3
6.	23ADC31	Software Engineering	PC	3	0	0	3	3
Practical								
7.	23ADE38	MERN stack development Laboratory	PC	0	0	2	1	2
8.	23ADC20	Internship I Machine Learning Laboratory	PC	0	0	2	1	2
9.	23ADC52	Data Science using Python Laboratory	PC	0	0	2	1	2
10.		Quantitative Aptitude					1	
							Total Credit	**23**

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Semester -V

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23ADC38	Computer Networks	PC	3	0	0	3	3
2.	23ADC18	Data Exploration and Visualization	PC	3	0	0	3	3
3.	23ADE26	PE-II Big Data Analytics	PC	3	0	0	3	3
4.	23ADC27	Deep Learning	PC	3	0	0	3	3
5.	23ADE39	PE-III Sales fore CRM and Platform	PC	3	0	0	3	3
6.	OE	Elective I (NPTEL) (Introduction To Block Chain)	PE	3	0	0	3	3
Practical								
7.	23ADE27	Big Data Analytics Laboratory	PC	0	0	2	1	2
8.	23ADC28	Deep Learning Laboratory	PC	0	0	2	1	2
9.	23ADE40	Internship II Sales fore CRM and Platform Laboratory		0	0	2	1	2
							Total Credit	**21**

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Semester -VI

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23ADC48	Natural Language Processing	PC	3	0	0	3	3
2.	23ADC46	Data Modeling and Business Intelligence	PC	3	0	0	3	3
3.	23ADC50	AWS Academy Cloud Foundation	PC	3	0	0	3	3
4.	23ADC42	Image and Video Analytics	PC	3	0	0	3	3
5.	23ADE07	PE IV (NPTEL) (IOT)	PE	3	0	0	3	3
6.	23MEC11	OE –II Industrial Automation and Robotics	OE	3	0	0	3	3
Practical								
7.	23ADC47	Data Modeling and Business Intelligence Laboratory	PC	0	0	2	1	2
8.	23ADC49	Natural Language Processing Laboratory	PC	0	0	2	1	2
9.		Soft skills		0	0	2	1	2
10.	23ADC45	Design Project	EE	0	0	2	1	2
							Total Credit	**22**

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B.Tech - Artificial Intelligence and Data Science
Curriculum | UG - R2023
Semester -VII

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23ADC53	Game Design Prototyping and Development	PC	3	0	0	3	3
2.	23ADC54	DEVOPS	PC	3	0	0	3	3
3.	23ADC29	AI and Robotics	PC	3	0	0	3	3
4.	PE 23ADE17	Elective-V(NPTEL) (Cyber Security)	PE	3	0	0	3	3
5.	PE23 ADE20	Elective-VI (Ethics of AI)	PE	3	0	0	3	3
6.	OE	OE- III	OE	3	0	0	3	3
Practical								
7.	23ADP01	Project Work I	EE	0	0	6	3	6
8.	23ADP17	Internship III		0	0	2	1	2
							Total Credit	**21**

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Curriculum | UG - R2023

Semester -VIII

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23ADP02	Project Work II	EE	0	0	12	12	12
							Total Credit	**12**

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Summary of Course Component

Sl.No.	Course Area	Semesters								Total Credits	% of Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	4	4							8	5.00
2.	BS	9	9	4	4					26	16.25
3.	GES	7	7							14	10
4.	PC			18	18	15	16	6		73	44.37
5.	PE					6	3	6		15	9.37
6.	OE							3	12	15	9.37
7.	EEC						3	6		9	5.62
8.	MC										
9.	NPTEL										
Total		**20**	**20**	**22**	**22**	**21**	**22**	**21**	**12**	**161**	**100.00**

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23ADC01	DATA STRUCTURES AND ALGORITHM USING C	L	T	P	C
		3	0	3	3

Course Objective:

- To understand the basic concepts of data structures and files
- To develop concepts about stacks, queues, lists, trees and graphs
- To choose and implement the appropriate data structure for a specific application
- To solve different applications using various data structures and file organization
- To understand concepts about searching and sorting techniques

Course Outcomes:

23ADC01.CO1 Apply and implement linear data structure

23ADC01.CO2 Apply different nonlinear data structures.

23ADC01.CO3 Implement variants of different tree data structure.

23ADC01.CO4 Analyze and implement variants of graph data structure using hashing.

23ADC01.CO5 Analyze searching, sorting and file technique

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC01.CO1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
23ADC01.CO2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
23ADC01.CO3	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X
23ADC01.CO4	X	X	X	X	X	X	X	-	-	X	X	X	X	X	X
23ADC01.CO5	X	X	X	X	X	X	X	-	-	X	X	X	X	X	X

Unit-I INTRODUCTION **9**

Data Structure Operations: insertion, deletion, traversal etc.; Abstract Data Types (ADTs) : List ADT – Array-based implementation Linked list implementation - Singly linked lists - Circularly linked lists - Doubly-linked lists – Applications of lists – Polynomial Manipulation.

Unit-II LINEAR DATA STRUCTURES **9**

Stack ADT – Operations – Applications – Evaluating arithmetic expressions - Conversion of Infix to postfix expression – Queue ADT Operations – Circular Queue – Double ended queue – Applications of queues.

Unit-III NON LINEAR DATA STRUCTURES **9**

Trees : Traversals – Binary Trees – Expression trees – Applications of trees – Binary search trees - AVL Trees – B-Tree – Heap – Applications of heap -Tries

Unit-IV GRAPHS **9**

Graphs : Representation of graph – Graph traversals – Breadth-first traversal – Depth-first traversal – Minimum Spanning Trees: Prim's algorithm, Kruskal's algorithm – Shortest path algorithms: Dijkstra's algorithm, Floyd Warshall algorithm - Applications of Graphs: Topological Sort

Unit-V SEARCHING, SORTING, HASHING TECHNIQUES AND FILES **9**

Searching : Linear Search – Binary Search, Sorting : Bubble sort – Selection sort – Insertion sort – Merge sort, Hashing : Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing . Files And Their Organization : File Storage Concepts - Sequential Access Method (SAM) - Indexed Sequential Access Method (ISAM) - Direct Access Method (DAM)

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Mark Allen Weiss	Data Structures and Algorithm Analysis in C++	Pearson Education	2014

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	D.S. Malik	Data Structures Using C++	Cengage	2012
2	Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum,	Data Structures using C and C++	Prentice Hall of India/ Pearson Education	2006
3	Sartaj Sahni	Data Structures, Algorithm and Application in C++	Universities Press	2005
4	Michael T.Goodrich, R.Tamassia and Mount	Data structures and Algorithms in C++	Wiley	2016

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23ADC02	DATA STRUCTURES USING C LABORATORY	L	T	P	C
		3	0	3	3

Course Objective:

- To write a C Program
- To Learn the knowledge about linked list
- To Execute the programs in Stack, Queue
- To Provide the knowledge about various searching and sorting techniques

Course Outcomes:

23ADC02.CO1	Classify various operations on singly and doubly linked list
23ADC02.CO2	Illustrate stack programs using C
23ADC02.CO3	Apply the concept of queue using an array
23ADC02.CO4	Develop binary search tree and B-tree
23ADC02.CO5	Build various sorting techniques

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC02.CO1	X	X	X	X	X	X	X		X	X	X	X	X	X	X
23ADC02.CO2	X	X	X	X	X	X	X		X	X	X	X	X	X	X
23ADC02.CO3	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X
23ADC02.CO4	X	X	X	X	X	X	X	-	-	X	X	X	X	X	X
23ADC02.CO5	X	X	X	X	X	X	X	-	-	X	X	X	X	X	X

Sl.No.	List of Experiments
1	Write a C program that uses functions to perform the following: a) Create a singly linked list of integers. b) Delete a given integer from the above linked list. c) Display the contents of the above list after deletion
2	Write a template based C program that uses functions to perform the following: a) Create a doubly linked list of elements. b) Delete a given element from the above doubly linked list. c) Display the contents of the above list after deletion.
3	Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent, Implement the stack using an array.
4	Write a C program to implement a double ended queue ADT using an array, using a doubly linked list.
5	Write a C program that uses functions to perform the following: a) Create a binary search tree of characters. b) Traverse the above Binary search tree recursively in preorder, in order and post order
6	Write a C program that uses function templates to perform the following: a) Search for a key element in a list of elements using linear search. b) Search for a key element in a list of sorted elements using binary search.
7	Write a C program that implements Insertion sort algorithm to arrange a list of integers in ascending order
8	Write a template based C program that implements selection sort algorithm to arrange a list of elements in descending order.
9	Write a template based C program that implements Quick sort algorithm to arrange a list of elements in ascending order.
10	Write a C program that implements Heap sort algorithm for sorting a list of integers in ascending order
11	Write a C program that implements Merge sort algorithm for sorting a list of integers in ascending order

Total Periods: 45

23ADC03	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	3	3

Course Objective:

- To introduce Boolean algebra and Logic Gates
- To understand the design of combinational circuits
- To impart knowledge on sequential circuits
- To gain knowledge on state table and excitation table
- To introduce the concept of Verilog HDL and programmable logic devices.

Course Outcomes:

23ADC03.CO1 Apply Boolean algebra to simplify the logical expressions

23ADC03.CO2 Construct combinational logic circuits using logic Gates

23ADC03.CO3 Construct sequential logic circuits using Flip flops

23ADC03.CO4 Build an Hazard free combinational circuits

23ADC03.CO5 Explain the concept of Verilog HDL Programming

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC03.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC03.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC03.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC03.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC03.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I BASIC CONCEPTS OF DIGITAL SYSTEMS AND LOGIC FAMILIES 9

Review of Number systems, Number Representation, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method, Logic Gates, Digital Logic Families- TTL, ECL, CMOS.

Unit-II COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates, Design of combinational circuits : Adder, Subtractor, Parallel adder Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, De-Multiplexer - Function realization using Multiplexer, Decoder - Code converters

Unit-III SEQUENTIAL CIRCUITS 9

Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Characteristic table and equation – Application table – Asynchronous and synchronous counters - Shift registers - Types – Universal shift registers – Ring counter – Johnson Counters- Serial adder / Subtractor.

Unit-IV SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Mealy and Moore models – State diagram - State table – State minimization – State assignment - Excitation table - Design of Synchronous sequential circuits: Counters and Sequence generators- Circuit implementation - Asynchronous sequential circuits - Hazards and Races, Hazard free combinational circuits.

Unit-V MEMORY AND Verilog HDL PROGRAMMING 9

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA – Verilog HDL Programming: Data flow modeling, Behavioral modeling, Structural modeling– Test benches-Simulation and implementation of combinational and sequential circuits.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Educatio	2013
2	Donald D.Givone,	Digital Principles and Design	Tata Mc-Graw Hill Publishing company limited, New Delhi	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Thomas L. Floyd	Digital Fundamentals	Pearson Education	2011
2.	Charles H. Roth Jr,	Fundamentals of Logic Design	Jaico Publishing House	2003
3.	Leach D, Malvino A P &Saha	Digital Principles and Applications	Tata McGraw-Hill Publishing Company	2014
4.	John F. Wakerly,	Digital Design Principles and Practices	Pearson Educatio	2007
5.	John.M Yarbrough	Digital Logic Applications and Design	Thomson – E26Vikas Publishing House	2002
6.	Charles H.Roth Jr.	Digital System Design using VHDL	Thomson Learning	2008

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23ADC04	DIGITAL SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To introduce the design procedure of combinational circuits
- To introduce the design procedure of sequential circuits
- To understand synchronous and asynchronous sequential circuits
- To impart knowledge on programmable logic devices and Verilog HDL

Course Outcomes:

23ADC04.CO1 Construct combinational circuits using logic Gates

23ADC04.CO2 Construct sequential circuits using logic Gates

23ADC04.CO3 Apply Verilog HDL programming to implement combinational and sequential circuits

23ADC04.CO4 Develop binary search tree and B-tree

23ADC04.CO5 Build various sorting techniques

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC04.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC04.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC04.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC04.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC04.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Sl.No.	List of Experiments
1	Implementation of Adder and Subtractor
2	Design and implementation of Parity Generator and Checker
3	Implementation of 4-Bit Magnitude Comparator
4	Design and implementation of Multiplexer and De-multiplexer
5	Design and implementation of Encoders and Decoders
6	Design and implementation of Synchronous / Asynchronous Counters
7	Design and implementation of Shift registers
8	Design and implementation of combinational circuits using Verilog HDL
9	Design and implementation of combinational circuits using Verilog HDL
10	Design and implementation of sequential circuit using Verilog HDL
11	Design and implementation of sequence generator

Total Periods: 45

23ADC05	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	3	3

Course Objective:

- To Understand Object Oriented Programming concepts and basic characteristics of Java
- To Illustrate the principles of packages, inheritance and interfaces
- To Describe exceptions and use I/O streams
- To Develop a java application with threads and generics classes
- To Build simple Graphical User Interfaces

Course Outcomes:

23ADC05.CO1	Understand Java programs using OOP principles
23ADC05.CO2	Apply Java programs with the concepts inheritance and interfaces
23ADC05.CO3	Construct Java applications using exceptions and I/O streams
23ADC05.CO4	Develop Java applications with threads and generics classes
23ADC05.CO5	Implement Develop interactive Java programs using swings

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC05.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC05.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC05.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC05.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC05.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

Unit-II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists – Strings.

Unit-III EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

Unit-IV MULTITHREADING AND GENERIC PROGRAMMING 9

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, and thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations

Unit-V EVENT DRIVEN PROGRAMMING **9**

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling- event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows – Menus – Dialog Boxes.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Herbert Schildt	Java The complete reference , 8th Edition	McGra wHill Education	2011
2	Cay S. Horstmann, Gary cornell	Core Java Volume–I Fundamentals, 9th Edition	Prentice Hall	2013

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Paul Deitel, Harvey Deitel,	Java SE 8for programmers", 3rd Edition	Pearson, Education	2015
2.	Steven Holzner,	Java 2 Black book	Dream tech press	2011
3.	Timothy Budd	Understanding Object-oriented programming with Java	Pearson Education	2000
4.	Robert Lafore	Object-orientedprogramming in Microsoft C++	Pearson Education	2009
5.	Vaskaran Sarcar	Interactive Object-Oriented Programming in Java: Learn and Test Your Programming Skills	Apress	2016

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23ADC06	OBJECT ORIENTED PROGRAMMING USING JAVA LABORATORY	L	T	P	C
		3	0	0	3

Course Objective:

- Understand the basic Object Oriented Programming concepts.
- To write programs for solving real world problems using java collection frame work
- To write multithreaded programs.
- To introduce java compiler and eclipse platform

Course Outcomes:

23ADC06.CO1	Able to write programs using abstract classes.
23ADC06.CO2	Able to write multithreaded programs.
23ADC06.CO3	Able to write GUI programs using swing controls in Java.
23ADC06.CO4	Able to write multithreaded programs
23ADC06.CO5	To hands on experience with java programming.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC06.CO1	-	-	X	-	-	X	-	-	-	-	-	X	-	X	-
23ADC06.CO2	-	X	-	-	x	X	-	-	-	X	x	-	X	x	-
23ADC06.CO3	-	-	X	-	-	X	-	-	X	-	-	X	-	-	X
23ADC06.CO4	X	X	-	X	-	-	X	-	-	X	-	-	X	-	-
23ADC06.CO5	X	-	-	-	-	X	X	-	-	X	-	X	X	-	-

Sl.No.	List of Experiments
1	Pass by value, Pass by reference and Pass by address
2	Constructors & Destructors, Copy Constructor
3	Friend Function & Friend Class.
4	Inheritance.
5	Polymorphism & Function Overloading
6	Virtual Functions.
7	Overload Unary & Binary Operators Both as Member Function & Non Member Function
8	Class Templates & Function Templates.
9	Exception Handling Mechanism..
10	Standard Template Library concept.

Total Periods: 45

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23ADC07	OPERATING SYSTEM	L	T	P	C
		3	0	3	3

Course Objective:

- To Understand the Fundamental Concepts of Operating Systems
- To Analysis Threads and Scheduling Algorithm.
- To Summarize on Memory management that includes deadlock detection algorithms.
- To Examine the mechanisms involved in Storage management.
- To Illustrate different OS and compare their features

Course Outcomes:

23ADC07.CO1 Recall the basic architectural components involved in design an operating system.

23ADC07.CO2 Recognize the various scheduling algorithms for different types of operating system.

23ADC07.CO3 Develop resource management techniques and handling Deadlock issues.

23ADC07.CO4 Investigate to change the disk structure and access the files.

23ADC07.CO5 Integrate the different operating systems.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC07.CO1	-	-	x	-	-	x	-	-	-	-	-	x	-	x	-
23ADC07.CO2	-	x	-	-	x	x	-	-	-	x	x	-	x	x	-
23ADC07.CO3	-	-	x	-	-	x	-	-	x	-	-	x	-	-	x
23ADC07.CO4	x	x	-	x	-	-	x	-	-	x	-	-	x	-	-
23ADC07.CO5	x	-	-	-	-	x	x	-	-	x	-	x	x	-	-

Unit-I OPERATING SYSTEMS OVERVIEW 9

Operating system functions, Operating system structure, operating systems Operations, protection and security, Computing Environments, Open- Source Operating Systems System Structures: Operating System Services, User and Operating System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot. Processes: Process concept, process Scheduling, Operations on processes, Inter process Communication, Examples of IPC systems

Unit-II THREADS AND SCHEDULING ALGORTIHMS 9

Multicore Programming, Multithreading Models, Thread Libraries, Threading Issues. Process Synchronization: The critical-section problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches. CPU Scheduling: Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation

Unit-III MEMORY MANAGEMENT 9

Swapping, contiguous memory allocation, segmentation, paging, structure of the page table. Virtual memory: demand paging, page- replacement, Allocation of frames, Thrashing, Memory Mapped Files, Allocating Kernel Memory Deadlocks: System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock

Unit-IV STORAGE AND FILE MANAGEMENT 9

Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation. File system Interface: The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection. File system Implementation: File-system

structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.

Unit-V CASE STUDY – LINUX SYSTEM 9

Linux System- Basic Concepts; System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen, VMware on Linux Host and Adding Guest OS.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	rham Silberchatz, Peter B. Galvin, Greg Gagne	Operating System Concepts	Wiley,9th Edition	2014
2	William. Stallings	Operating Systems – internals and Design Principles	Pearson,7th Edition	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Andrew S Tanenbaum	Modern Operating Systems	PHI, Second Edition	2009
2.	Damhamdhere	OperatingSystems:A Concept-BasedApproach	TataMc-grawHill Publishing 3rd Edition	2012
3.	Charles Crowley	OperatingSystem:A Design-Oriented Approach	TataMc-grawHill Publishing 1ST edition	2009
4.	EviNemeth,Garth Snyder,TrentR. Hein,BenWhaley, DanMackin	UNIXandLinuxSystem AdministrationHandbook	PrenticeHallofIndia,4th Edition	2010
5.	HarveyM.Deitel	OperatingSystems	PearsonEducation, 3rdEdition.	2007

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23ADC08	OPERATING SYSTEM LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To Remember programs in Linux environment using system call.
- To Understand the scheduling algorithms
- To Apply page replacement algorithms
- To Analyze file allocation methods.

Course Outcomes:

23ADC08.CO1	Enumerate to develop application programs using system calls in Unix.
23ADC08.CO2	Estimate interprosses communication between two processes.
23ADC08.CO3	Develop and solve synchronization problems.
23ADC08.CO4	Analyze to simulate operating system concepts such as scheduling, deadlock management, file management, and memory management.
23ADC08.CO5	Integrate to develop application programs using system calls in Unix.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC08.CO1	-	-	X	-	-	X	-	-	-	-	-	X	-	X	-
23ADC08.CO2	-	X	-	-	x	X	-	-	-	X	x	-	X	x	-
23ADC08.CO3	-	-	X	-	-	X	-	-	X	-	-	X	-	-	X
23ADC08.CO4	X	X	-	X	-	-	X	-	-	X	-	-	X	-	-
23ADC08.CO5	X	-	-	-	-	X	X	-	-	X	-	X	X	-	-

Sl.No.	List of Experiments
1	Write C programs to simulate the following CPU scheduling algorithms: Round Robin b) SJF
2	Write C programs to simulate the following CPU scheduling algorithms: FCFS b) Priority
3	Write a C program to copy the contents of one file to another using system calls.
4	Write a C program to simulate Bankers Algorithm for Dead Lock Avoidance
5	Write a C program to simulate Bankers Algorithm for Dead Lock Prevention
6	Write C programs to simulate the following page replacement algorithms: FIFO b) LRU c) LFU
7	Write C programs to simulate the following techniques of memory management :a) Paging b) Segmentation
8	Write a C program to implement the ls | sort command. (Use unnamed Pipe)
9	Write a C program to solve the Dining- Philosopher problem using semaphores...
10	Write C programs to simulate the following File organization techniques: a)Single level directory b) Two level c) Hierarchical
11	Write C programs to simulate the following File allocation methods: 21a)Contiguous b)Linked c)Indexed

Total Periods: 45

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23ADC09	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objective:

- To Introduce various Mathematical techniques for representation and manipulation of the data in the real world.
- To Expose students to a variety of technique for designing and analyzing algorithms
- To Summarize the choice of Data Structures and algorithms by designing the performance of programs
- To Formulate the time order analysis for an algorithm to prove the correctness of an algorithm
- To understand the differences between tractable and intractable problems.

Course Outcomes:

23ADC09.CO1 Identify algorithm design methodology to solve problems.

23ADC09.CO2 Analyze the algorithm efficiency by means of mathematical Notations

23ADC09.CO3 Empathize the limitation of Computations

23ADC09.CO4 Design algorithms for network flows

23ADC09.CO5 Differentiate algorithm design techniques of P and NP classes of problems

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
23ADC09.CO1	x	x	x	x	x	x	x	-	x	-	x	x	x	x	x
23ADC09.CO2	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x
23ADC09.CO3	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x
23ADC09.CO4	x	x	x	x	x	x	x	-	-	x	x	x	x	x	x
23ADC09.CO5	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x

Unit-I INTRODUCTION 9

Introduction-Algorithm definition, Algorithm Specification, Performance Analysis-Space complexity, Time complexity, Randomized Algorithms. Divide and conquer- General method, applications - Binary search, Merge sort, Quick sort, Strassen's Matrix Multiplication

Unit-II BACKTRACKING 9

Disjoint set operations, union and find algorithms, AND/OR graphs, Connected Components and Spanning trees, Bi-connected components, Backtracking-General method, applications-The 8-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

Unit-III GREEDY METHOD 9

Greedy method- General method, applications- Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Single source shortest path problem.

Unit-IV DYNAMIC PROGRAMMING 9

Dynamic Programming- General Method, applications- Chained matrix multiplication, All pairs shortest path problem, Optimal binary search trees, 0/1 knapsack problem, Reliability design, Traveling sales person problem.

Unit-V BRANCH AND BOUND & NP-HARD, NP-COMPLETE PROBLEMS 9

Branch and Bound- General Method, applications-0/1 Knapsack problem, LC Branch and Bound solution, FIFO Branch and Bound solution, Traveling sales person problem.NP-Hard and NP-Complete problems- Basic concepts, Non-deterministic algorithms, NP - Hard and NP- Complete classes, Cook's theorem.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ellis Horowitz, Sartaj Sahni and S. Rajasekharan	Fundamentals of Computer Algorithms, 2nd Edition	Universities Press	2008
2	P. H. Dave	Design and Analysis of Algorithms	H.B.Dave,2nd edition,Pearson Education	2013

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. T. Goodrich and R. Tomassia	Algorithm Design: Foundations, Analysis and Internet examples	John Wiley and sons	2006
2.	S. Sridhar	Design and Analysis of Algorithms	Oxford Univ. Press	2014
3.	Aho, Ullman and Hopcroft	Design and Analysis of algorithms	Pearson Education	2014
4.	R. Neapolitan and K. Naimipour	Foundations of Algorithms	4th edition,Jones and Bartlett Student edition	2011
5.	T. H. Cormen, C. E.Leiserson, R.L. Rivest and C. Stein	Introduction to Algorithms	PHI,3rd Edition	2009

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23ADC10	Database Design And Management	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce database development life cycle and conceptual modeling
- To learn SQL for data definition, manipulation and querying a database
- To learn relational database design using conceptual mapping and normalization
- To learn transaction concepts and serializability of schedules
- To learn data model and querying in object-relational and No-SQL databases

Course Outcomes:

23ADC10.CO1	Understand to draw the E-R diagram for the given Relation and use the Data model in Database Design
23ADC10.CO2	Apply the Normalization in optimize storage space
23ADC10.CO3	Design the Hashing Techniques and B+ Tree
23ADC10.CO4	Analysis the Concept of Transaction with Concurrency Control and Timestamp in Database
23ADC10.CO5	Evaluate SQL queries on Data Retrieval

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC10.CO1	X	X	X	-	-	-	-	-	X	-	X	X	X	X	-
23ADC10.CO2	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X
23ADC10.CO3	X	X	X	X	X	-	-	X		X	X	X	X	-	X
23ADC10.CO4	X	X	X	X	-	-	-	X	-	X	X	X	X	X	X
23ADC10.CO5	X	X	X	X	-	X	-	X	-	-	X	X	X	X	X

Unit-I CONCEPTUAL DATA MODELING 9

Database environment – Database system development lifecycle – Requirements collection – Database design -- Entity-Relationship model – Enhanced-ER model – UML class diagrams

Unit-II BACKTRACKING 9

Relational model concepts -- Integrity constraints -- SQL Data manipulation – SQL Data definition – Views -- SQL programming.

Unit-III RELATIONAL DATABASE DESIGN AND NORMALIZATION 9

ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).

Unit-IV TRANSACTION MANAGEMENT 9

Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two-phase locking techniques.

Unit-V OBJECT RELATIONAL AND NO-SQL DATABASES 9

Mapping EER to ODB schema – Object identifier – reference types – rowtypes – UDTs – Subtypesand supertypes– user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Thomas M. Connolly, Carolyn E. Begg	Database Systems – A PracticalApproach to Design, Implementation, and Management	Sixth Edition, Global Edition, Pearson Education	2015
2	Ramez Elmasri, Shamkant B.Navathe	Fundamental of Database Systems	7th Edition Pearson Education	2014

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Toby Teorey, Sam Lightstone	Database Modeling Anddesign - LogicalDesign	Fifth Edition, MorganKaufmann Publishers	2011
2.	Carlos Coronel, Steven Morris	Design, Implementation ,and Management	Ninth Edition, Cengage learning	2012
3.	Abraham Silberschatz, Henry F Korth, S Sudharshan	Database System Concepts	6thEdition,Tata Mc Graw Hill	2011.
4.	Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom	Database Systems:The Complete Book,	2nd edition, Pearson	2015
5.	S Sumathi, S Esakkirajan	Fundamentals of Relational Database Management Systems,(Studies in Computational Intelligence),	Springer-Verlag	2007
6.	Raghu Ramakrishnan	Database Management Systems	4th Edition,Tata Mc Graw Hill	2010

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23ADC11	Database Design And Management- Laboratory	L	T	P	C
		3	0	3	3

Course Objective:

- To understand the database development life cycle
- To learn database design using conceptual modeling, Normalization
- To implement database using Data definition, Querying using SQL manipulation and SQLprogramming
- To implement database applications using IDE/RAD tools
- To learn querying Object-relational databases

Course Outcomes:

23ADC11.CO1 Execute query using SQL DML/DDL Commands.

23ADC11.CO2 Implement programs using PL/SQL including stored procedures, cursors, packages etc

23ADC11.CO3 Construct real time database application using current techniques.

23ADC11.CO4 Analyses the DB tool in various real time application.

23ADC11.CO5 Develop the VB as front end and SQL as back end.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC11.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	X	X
23ADC11.CO2	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X
23ADC11.CO3	X	X	X	X	X	-	-	X		X	X	X	X	X	X
23ADC11.CO4	X	X	X	X	-	X	-	X	-	X	X	X	X	X	X
23ADC11.CO5	X	X	X	X	X	X	-	X	-	-	X	X	X	X	X

Sl.No.	List of Experiments
1.	Database Development Life cycle: Problem definition and Requirement analysisScope and Constraints
2.	Database design using Conceptual modeling (ER-EER) – top-down approach Mapping conceptual to relational database and validate using Normalization
3.	Implement the database using SQL Data definition with constraints, Views
4.	Query the database using SQL Manipulation
5.	Querying/Managing the database using SQL Programming
6.	Stored Procedures/Functions
7.	Constraints and security using Triggers
8.	Database design using Normalization – bottom-up approach
9.	Develop database applications using IDE/RAD tools (Eg., NetBeans,VisualStudio)
10.	Database design using EER-to-ODB mapping / UML class diagrams
11.	Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition

Total Periods: 45

23ADC12	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	3	3

Course Objective:

- To Understand the basic concepts of intelligent agents
- To Develop general-purpose problem solving agents, logical reasoning agents, and agentsthat reason under uncertainty
- To Employ AI techniques to solve some of today's real world problems
- To Emphasis the Logical Agents
- To Elaborate Knowledge Representation and Planning

Course Outcomes:

23ADC12.CO1	Explain autonomous agents that make effective decisions in fully informed, partiallyobservable, and adversarialsettings
23ADC12.CO2	Choose appropriate algorithms for solving given AI problems
23ADC12.CO3	Implement a design in terms of Gamming
23ADC12.CO4	Design and implement logical reasoning agents
23ADC12.CO5	Design and implement agents that can reason under uncertainty

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC12.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC12.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC12.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC12.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC12.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I INTELLIGENT AGENTS 9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents Problem solving agents – search algorithms – uninformed search strategies

Unit-II PROBLEM SOLVING 9

Heuristic search strategies – heuristic functions Local search and optimization problems – local search in continuous space – search with non- deterministic actions – search in partially observable environments – online search agents and unknown environments

Unit-III GAME PLAYING AND CSP 9

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP

Unit-IV LOGICAL AGENTS 9

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining -- resolution

Unit-V KNOWLEDGE REPRESENTATION AND PLANNING 9

Ontological engineering – categories and objects – events – mental objects and modal logic – reasoning systems for categories – reasoning with default information Classical planning – algorithms for classical planning – heuristics for planning – hierarchical planning -non-deterministic domains – time, schedule, and resources –

analysis

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Stuart Russel and Peter Norvig	Artificial Intelligence: A Modern Approach	Fourth Edition, Pearson Education	2020

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dan W. Patterson	Introduction to AI and ES	Pearson Education	2007
2.	Kevin Night, Elaine Rich, and Nair B	Artificial Intelligence	McGraw Hill	2008
3.	Patrick H. Winston	Artificial Intelligence	Third edition, Pearson Edition	2006
4.	Deepak Khemani	(http://nptel.ac.in/)	Tata McGraw Hill Education	2013

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23ADC13	Introduction To Artificial Intelligence Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To design and implement different techniques to develop simple autonomous agents that makeeffective decisions in fully informed, and partially observable, settings.
- To apply appropriate algorithms for solving given AI problems.
- To Design and implement logical reasoning agents.
- To Design and implement agents that can reason under uncertainty.
- To understand the Implementation of these reasoning systems using either backward orforward inference mechanisms

Course Outcomes:

23ADC13.CO1	Implement simple PEAS descriptions for given AI tasks
23ADC13.CO2	Develop programs to implement simulated annealing and genetic algorithms
23ADC13.CO3	Demonstrate the ability to solve problems using searching and backtracking
23ADC13.CO4	Ability to Implement simple reasoning systems using either backward or forward inference mechanisms
23ADC13.CO5	Will be able to choose and implement a suitable technics for a given AI task

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC13.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC13.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC13.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC13.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC13.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Sl.No.	List of Experiments
1	Develop PEAS descriptions for given AI tasks
2	Implement basic search strategies for selected AI applications
3	Implement A* and memory bounded A* algorithms
4	Implement genetic algorithms for AI tasks
5	Implement simulated annealing algorithms for AI tasks
6	Implement alpha-beta tree search
7	Implement backtracking algorithms for CSP
8	Implement local search algorithms for CSP
9	Implement propositional logic inferences for AI tasks
10	Implement resolution based first order logic inferences for AI tasks
11	Implement classical planning algorithms
12	Mini-Project

Total Periods: 45

23ADC14	Data Analytics	L	T	P	C
		3	0	0	3

Course Objective:

- To study the basic inferential statistics and sampling distribution.
- To understand the concept of estimation of parameters using fundamental tests and testingof hypotheses.
- To understand the techniques of analysis of variance.
- To gain knowledge in predictive analytics techniques.
- To perform a case study with any available sample data sets

Course Outcomes:

23ADC14.CO1 Understand the concept of sampling

23ADC14.CO2 Apply the knowledge to derive hypotheses for given data

23ADC14.CO3 Demonstrate the skills to perform various tests in the given data

23ADC14.CO4 Ability to derive inference using Predictive Analytics

23ADC14.CO5 Perform statistical analytics on a data set

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC14.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC14.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC14.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC14.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC14.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I INFERENTIAL STATISTICS I **9**

Populations – samples – random sampling – probability and statistics Sampling distribution – creating a sampling distribution – mean of all sample means – standard error of the mean – other sampling distributions Hypothesis testing – z-test – z-test procedure – statement of the problem – null hypothesis – alternate hypotheses – decision rule – calculations – decisions - interpretations

Unit-II INFERENTIAL STATISTICS II **9**

Why hypothesis tests? – strong or weak decisions – one-tailed and two-tailed tests – case studies Influence of sample size – power and sample size Estimation – point estimate – confidence interval – level of confidence – effect of sample size

Unit-III T-TEST **9**

t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error – case studies t-test for two independent samples – statistical hypotheses – sampling distribution – test procedure – p-value – statistical significance – estimating effect size – meta analysis t-test for two related samples

Unit-IV ANALYSIS OF VARIANCE **9**

F-test – ANOVA – estimating effect size – multiple comparisons – case studies Analysis of variance with repeated measures Two-factor experiments – three f-tests – two-factor ANOVA – other types of ANOVA Introduction to chi-square tests

Unit-V PREDICTIVE ANALYTICS **9**

Linear least squares – implementation – goodness of fit – testing a linear model – weighted re-sampling Regression using Stats Models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy Time series analysis – moving averages – missing values – serial correlation – autocorrelation Introduction to survival analysis

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Robert S. Witte and John S. Witte	Statistics	Eleventh Edition, Wiley Publications	2017
2	Allen B. Downey	Think Stats: Exploratory Data Analysis in Python	Green Tea Press	2014

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Spiegelhalter	The Art of Statistics: Learning from Data	Pelican Books	2020
2.	Peter Bruce, Andrew Bruce, and Peter Gedek	Practical Statistics for Data Scientists	Second Edition, O'Reilly Publishers	2020
3.	Charles R. Severance	Python for Everybody: Exploring Data in Python 3	ShroffPublishers	2017
4.	Bradley Efron and Trevor Hastie	Computer Age Statistical Inference	Cambridge UniversityPress	2016
5.	Jake VanderPlas	Python Data Science Handbook	O'Reilly	2016

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23ADC15	Data Analytics Laboratory	L	T	P	C
		3	0	3	3

Course Objective:

- To study and write simple programs using the basic packages for handling data
- To do various sampling and T,Z,Anova test in various samples
- To perform case study and design a system
- To demonstrate Time Series Analysis in any real time application
- To Implement Goodness of fit

Course Outcomes:

23ADC15.CO1 To become skilled to use various packages in Python

23ADC15.CO2 Demonstrate the understanding of data distribution with various samples

23ADC15.CO3 Ability to Implement T-Test ,ANOVA and Z-Test on sample data sets

23ADC15.CO4 Understanding of Mathematical models in real world problems.

23ADC15.CO5 Conduct time series analysis and draw conclusion

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC15.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC15.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC15.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC15.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC15.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Sl.No.	List of Experiments
1.	Random Sampling
2.	Z-test case study
3.	T-test case studies
4.	ANOVA case studies
5.	Regression
6.	Logistic Regression
7.	Time series Analysis

Total Periods: 45

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23ADC16	Cognitive Systems	L	T	P	C
		3	0	0	3

Course Objective:

- To study the basic concepts and approaches in the field of cognitive science
- To apply the concepts of planning, reasoning and learning models in cognitive applications
- To understand language and semantic models of cognitive process.
- To Clarify Problem Solving and Neuroscience
- To Acquire Network Knowledge towards Cognitive Science

Course Outcomes:

23ADC16.CO1	Learn and understand the learning model and apply the same to appropriate real world applications
23ADC16.CO2	Apply reasoning methodology to real world applications
23ADC16.CO3	Students will understand and apply declarative and logic models
23ADC16.CO4	Envisage the concept of cognitive learning
23ADC16.CO5	Acquire knowledge in language processing and understanding

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC16.CO1	x	-	-	-	x	-	-	x	-	x	-	-	-	-	x
23ADC16.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC16.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC16.CO4	-	-	x	x	x	-	x	-	-	x	-	-	x	-	-
23ADC16.CO5	x	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I INTRODUCTION TO COGNITIVE SCIENCE 9

A Brave New World – Introduction Cognitive Science –Representation: Digital, Analog, Dual-Coding and Propositional – Computation - Interdisciplinary Perspective - Cognitive Approach: Mind as an Information Processor - Modularity of Mind - Theories of Vision and Pattern Recognition

Unit-II COGNITIVE AND PROBLEM SOLVING 9

Rise of Cognitive Psychology - Mind as an Information Processor - Evaluating the Modular Approach - Theories of Vision and Pattern Recognition - Theories of Attention - Evaluating theModel-Building Approach Types of Memory – Memory Models - Visual Imagery - Problem Solving - Overall Evaluation of the Cognitive Approach

Unit-III NETWORK AND NEUROSCIENCE APPROACH 9

Principles Underlying Artificial Neural Networks (ANN) - Characteristics of ANN – Conceptions of Neural Networks - Back Propagation and Convergent Dynamics - ANN Typologies - Evaluating the Connectionist Approach - Semantic Networks - Characteristics of Semantic Networks - Evaluation of the network approach Methodology in Neuroscience - Brain Recording Techniques - Brain Anatomy - Visual Object Recognition - Neuroscience of Attention

Unit-IV LINGUISTIC APPROACH: LANGUAGE AND COGNITIVE SCIENCE 9

Importance of Language – Nature Language - Language Use in Primates - Language Acquisition -Language Deprivation - Cognition and Linguistics: The Role of Grammar - Neuroscience and Linguistics - Artificial Intelligence and Linguistics – Speech Recognition - Evaluation of Natural Language Processing

Unit-V ARTIFICIAL INTELLIGENCE AND COGNITIVE SCIENCE 9

Definition of AI – History - Practical World of Artificial Intelligence - Approaches to the Design of Intelligent Agents - Machine Representation of Knowledge - Machine Reasoning - Logical Reasoning - Inductive Reasoning - Expert Systems

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Jay Friedenberg and Gordon Silverman	Cognitive Science: An Introduction to the Science of the Mind	Cambridge University Press, New York	2015
2	Stuart J. Russell, Peter Norvig	Artificial Intelligence - A Modern Approach	Third Edition, Pearson Publishers	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Paul Miller	An Introductory Course in Computational Neuroscience	MIT Press	2018
2.	Jerome R. Busemeyer, Zheng Wang, James T. Townsend, Ami Eidels(Ed)	The Oxford Handbook of Computational and Mathematical Psychology	Oxford University Press	2015
3.	Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein	Cognitive Science: An Introduction	Second Edition, MIT press	2015

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23ADC17	Optimization Techniques	L	T	P	C
		3	0	0	3

Course Objective:

- To formulate and solve linear programming problems (LPP)
- To evaluate Integer Programming Problems, Transportation and Assignment Problems.
- To obtain solution to network problems using CPM and PERT techniques.
- To optimize the function subject to the constraints.
- To Identify and solve problems under Markovian queuing models.

Course Outcomes:

23ADC17.CO1 Formulate and solve linear programming problems (LPP)

23ADC17.CO2 Evaluate Integer Programming Problems, Transportation and Assignment Problems.

23ADC17.CO3 Obtain solution to network problems using CPM and PERT techniques.

23ADC17.CO4 Able to optimize the function subject to the constraints.

23ADC17.CO5 Identify and solve problems under Markovian queuing models

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
23ADC17.CO1	x	-	-	-	x	-	-	x	-	x	-	-	-	-	x
23ADC17.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC17.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC17.CO4	-	-	x	x	x	-	x	-	-	x	-	-	x	-	-
23ADC17.CO5	x	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I INTRODUCTION TO COGNITIVE SCIENCE 9

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Big M method, Two-Phase method

Unit-II INTEGER PROGRAMMING AND TRANSPORTATION ROBLEMS 9

Integer programming: Branch and bound method- Transportation and Assignment problems - Travelling salesman problem.

Unit-III PROJECT SCHEDULING 9

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM

Unit-IV CLASSICAL OPTIMISATION THEORY 9

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.

Unit-V QUEUING MODELS 9

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Hamdy A Taha	Operations Research: An Introduction	Pearson, 10th Edition	2017

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	ND Vohra	Quantitative Techniques in Management	Tata McGraw Hill, 4th Edition	2011
2.	J. K. Sharma	Operations Research Theory and Applications	Macmillan, 5th Edition	2012
3.	Hiller F.S, Liberman G.J	Introduction to Operations Research	10th Edition McGraw Hill	2017
4.	Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim	Essentials of Linear Programming	Vikas Publishing House Pvt.Ltd. New Delhi	2194
5.	Ravindran A., Philip D.T., and Solberg J.J	Operations Research	John Wiley, 2nd Edition	2007

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23ADC18	Data Exploration And Visualization	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the basics of Data Explorations
- To understand the basic concepts of Data visualization
- To study the linear and non-linear ways of Data visualization
- To explore the data visualization using R language
- To apply various data visualization techniques for a variety of tasks

Course Outcomes:

23ADC18.CO1 Understand the basics of Data Exploration

23ADC18.CO2 Use Univariate and Multivariate Analysis for Data Exploration

23ADC18.CO3 Explain various Data Visualization methods

23ADC18.CO4 Apply the concept of Data Visualization on various datasets

23ADC18.CO5 Apply the data visualization techniques using R language

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
23ADC18.CO1	x	-	-	-	x	-	-	x	-	x	-	-	-	-	x
23ADC18.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC18.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC18.CO4	-	-	x	x	x	-	x	-	-	x	-	-	x	-	-
23ADC18.CO5	x	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I INTRODUCTION TO DATA EXPLORATION 9

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread -Scaling and Standardising – Inequality - Smoothing Time Series.

Unit-II INTRODUCING TWO VARIABLE AND THIRD VARIABLE 9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations - Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data.

Unit-III BASICS OF DATA VISUALIZATION 9

The Seven Stages of Visualizing Data - Getting Started with Processing - Mapping - Time Series -Connections and Correlations - Scatterplot Maps - Trees, Hierarchies, and Recursion – Networks and Graphs – Acquiring Data – Parsing Data

Unit-IV DATA EXPLORATION AND DATA VISUALIZATIONIN R 9

Introduction to R and RStudio - The Basics of Data Exploration - Loading Data into R - Transforming Data - Creating Tidy Data

Unit-V TECHNIQUES AND APPLICATIONS OF DATA EXPLORATION AND VISUALIZATION IN R 9

Basic Data Exploration Techniques - Basic Data Visualization Techniques - Visualizing Geographic Data with ggmap - R Markdown - Case Study – Wildfire Activity in the Western United States - Case Study – Single Family Residential Home and Rental Values

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Catherine Marsh, Jane Elliott	Exploring Data: An Introduction to Data Analysis for SocialScientists	Wiley Publications, 2nd Edition	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Eric Pimpler	Data Visualization and Exploration with R	Geo Spatial Training service	2017
2.	Xiang Zhou, Sean, Yong Rui, Huang, Thomas S	., Exploration of Visual Data	Springer Publications	2003
3.	Claus.O.Wlike	Fundamentals of Data Visualization, A primer on making informative and compelling Figures	O'Reily Publications	2021

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23ADC19	Machine Learning	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the basics of Machine Learning (ML)
- To understand the methods of Machine Learning
- To know about the implementation aspects of machine learning
- To understand the concepts of Data Analytics and Machine Learning
- To understand and implement usecases of ML

Course Outcomes:

23ADC19.CO1 Understand the basics of ML

23ADC19.CO2 Explain various ZMachine Learning methods

23ADC19.CO3 Demonstrate various ML techniques using standard packages.

23ADC19.CO4 Explore knowledge on Machine learning and Data Analytics

23ADC19.CO5 Apply ML to various real time examples

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC19.CO1	x	x	x	x	x	x	x	-	x	-	x	x	x	x	x
23ADC19.CO2	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x
23ADC19.CO3	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x
23ADC19.CO4	x	x	x	x	x	x	x	-	-	x	x	x	x	x	x
23ADC19.CO5	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x

Unit-I MACHINE LEARNING BASICS 9

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization

Unit-II MACHINE LEARNING METHODS 9

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models ––Unsupervised learning – Featurization

Unit-III MACHINE LEARNING IN PRACTICE 9

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon's Machine Learning Tool Kit: Sagemaker

Unit-IV MACHINE LEARNING AND DATA ANALYTICS 9

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration –Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

Unit-V APPLICATIONS OF MACHINE LEARNING 9

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ameet V Joshi	Machine Learning and Artificial Intelligence	Springer Publications	2020
2	John D. Kelleher, Brain Mac Namee, Aoife D' Arcy	Fundamentals of Machine learning forPredictive Data Analytics, Algorithms, Worked Examples and case studies	MIT press	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Christopher M. Bishop	Pattern Recognition and Machine Learning	Springer Publications	2011
2.	Stuart Jonathan Russell, Peter Norvig, John Canny	Artificial Intelligence: A ModernApproach	Prentice Hall	2020
3.	John Paul Muller, Luca Massaron	Machine Learning Dummies	Wiley Publications	2021

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23ADC20	Machine Learning Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To get practical knowledge on implementing machine learning algorithms in real time problem for getting solutions
- To implement supervised learning and their applications
- To understand unsupervised learning like clustering and EM algorithms
- To understand the theoretical and practical aspects of probabilistic graphical models.

Course Outcomes:

23ADC20.CO1 Understand the implementation procedures for the machine learning algorithms.

23ADC20.CO2 Design Java/Python programs for various Learning algorithms.

23ADC20.CO3 Apply appropriate Machine Learning algorithms to data sets

23ADC20.CO4 Identify and apply Machine Learning algorithms to solve real world problems.

23ADC20.CO5 Understand the implementation procedures for the machine learning algorithms.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC20.CO1	x	x	x	x	x	x	x	-	x	-	x	x	x	x	x
23ADC20.CO2	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x
23ADC20.CO3	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x
23ADC20.CO4	x	x	x	x	x	x	x	-	-	x	x	x	x	x	x
23ADC20.CO5	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x

Sl.No.	List of Experiments
1	Implement the concept of decision trees with suitable data set from real world problem andclassify the data set to produce new sample.
2	Detecting Spam mails using Support vector machine
3	Implement facial recognition application with artificial neural network
4	Study and implement amazon toolkit: Sagemaker
5	Implement character recognition using Multilayer Perceptron
6	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7	Implement sentiment analysis using random forest optimization algorithm
8	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. Youcan use Java/Python ML library classes/API.
9	Choose best machine learning algorithm to implement online fraud detection
10	Mini-project: students work in team on any socially relevant problem that needs a machinelearning based solution, and evaluate the model performance.

Total Periods: 45

23ADC21	Business Analytics	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

Course Outcomes:

23ADC21.CO1 Explain the real world business problems and model with analytical solutions.

23ADC21.CO2 Identify the business processes for extracting Business Intelligence

23ADC21.CO3 Apply predictive analytics for business fore-casting

23ADC21.CO4 Apply analytics for supply chain and logistics management

23ADC21.CO5 Use analytics for marketing and sales.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC21.CO1	x	x	-	-	-	-	-	-	-	-	-	-	x	x	-
23ADC21.CO2	x	-	x	-	x	-	-	-	-	-	-	x	-	-	-
23ADC21.CO3	x	-	-	x	x	-	-	-	-	-	-	-	-	x	-
23ADC21.CO4	-	x	x	x	x	-	-	-	x	-	-	x	-	x	x
23ADC21.CO5	-	x	x	x	x	-	-	-	x	-	-	x	x	-	x

Unit-I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

Unit-II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions

Unit-III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

Unit-IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

Unit-V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Philip Kotler and Kevin Keller	Marketing Management	15th edition, PHI	2016

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R. Evans James	Business Analytics	-	2017
2.	R N Prasad, Seema Acharya	Fundamentals of Business Analytics	-	2016
3.	VSP RAO	Human Resource Management	3rd Edition, Excel Books	2010
4.	Mahadevan B	"Operations Management - Theory and Practice"	3rd Edition, PearsonEducation	2018

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23ADC22	Internet Programming And Web Technologies	L	T	P	C
		3	0	0	3

Course Objective:

- To comprehend and analyze the basic concepts of web programming and internet Protocols.
- To describe how the client-server model of Internet programming works.
- To demonstrates the uses of scripting languages and their limitations.
- To study and developing the web applications.
- To impart the skill in the server side scripting.

Course Outcomes:

23ADC22.CO1 Know the different web protocols and web architecture.

23ADC22.CO2 Apply HTML and CSS effectively to create dynamic websites.

23ADC22.CO3 Create event responsive webpages using AJAX and JQuery.

23ADC22.CO4 Implement server-side programming like session, cookies, file handling and database connectivity using PHP.

23ADC22.CO5 Develop web applications using advanced technologies such as Node JS

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC22.CO1	x	x	-	x	x	-	-	-	-	-	-	x	-	x	-
23ADC22.CO2	x	-	x	x	x	-	x	x	-	-	x	-	-	-	-
23ADC22.CO3	x	-	x	x	x	-	-	-	x	-	x	-	-	x	-
23ADC22.CO4	x	-	x	x	x	-	x	-	-	-	x	-	-	-	x
23ADC22.CO5	x	x	-	x	x	x	-	-	x	-	x	-	x	-	-

Unit-I INTRODUCTION TO INTERNET 9

Internet Overview- Networks – WWW –Web Protocols –– Web Organization and Addressing – Internet Service Providers, DNS Servers, Connection Types, Internet Addresses - Web Browsers and Web Servers -Security and Vulnerability-Web System Architecture – URL - Domain Name – Web Content Authoring - Webserver Administration – Search Engines

Unit-II CLIENT SIDE SCRIPTING 9

HTML5 – Text tags; Graphics, Form elements, HTML 5 Input types, HTML 5 Input types, semantic tags, CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Cascading and inheritance of style properties - JavaScript -Variables and Data Types - Statements – Operators- Literals- Functions- Objects- Arrays- Built-in Objects, DOM – BOM - Regular Expression Exceptions, Event handling, Validation- JQuery

Unit-III DEVELOPING INTERACTIVE WEB APPLICATIONS 9

AJAX –AJAX calls - XML http – request – response – AJAX with PHP - Data Formats - AJAX withDatabase – Processing Server Response - AJAX Security

Unit-IV SERVER SIDE SCRIPTING 9

Introduction to Node.js- NPM - Events, Timers, and Callbacks in Node.js – file upload – email – Express framework – request –response –routing - templates- view engines. Introduction to Mongo DB- creating DB, collection – CRUD operations - Accessing MongoDB from Node.js. – Accessing online Mongo DB from Node JS

Unit-V REACT WEB FRAMEWORK **9**

Introduction – Environment setup – JSX – React DOM – React Elements - Components – react state – Props– Hooks – Component life cycle- React Router – event handlers - React lists – react forms – react HTML render – react refs – react CSS –Array immutability – Lazy loading – Storing to local storage – Create a sample React App

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Philip Kotler and Kevin Keller	Marketing Management	15th edition, PHI	2016

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R. Evans James	Business Analytics	-	2017
2.	R N Prasad, Seema Acharya	Fundamentals of Business Analytics	-	2016
3.	VSP RAO	Human Resource Management	3rd Edition, Excel Books	2010
4.	Mahadevan B	"Operations Management - Theory and Practice"	3rd Edition, PearsonEducation	2018

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23ADC23	Internet Programming And Web Technologies Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To get practical knowledge on implementing HTML form.
- To understand file handling concepts
- To understand AJAX application
- To understand the theoretical and practical aspects Node JS.

Course Outcomes:

23ADC23.CO1 Understand the implementation procedures for JavaScript

23ADC23.CO2 Design Java/Python programs for various PHP file handling and forms.

23ADC23.CO3 Apply appropriate database and server with AJAX.

23ADC23.CO4 Identify and apply Mongo DB to solve real world problems.

23ADC23.CO5 Understand the implementation procedures for Mongo DB

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC23.CO1	x	x	-	x	x	-	-	-	-	x	-	x	-	x	-
23ADC23.CO2	x	-	x	x	x	-	x	x	-	-	x	-	-	-	-
23ADC23.CO3	x	-	x	x	x	-	-	-	x	-	x	-	-	x	-
23ADC23.CO4	x	-	x	x	x	-	x	-	-	-	x	-	-	-	x
23ADC23.CO5	x	x	-	x	x	x	-	-	x	-	-	-	x	-	-

Sl.No.	List of Experiments
1	HTML form validation with JavaScript
2	PHP : Forms and File handling
3	PHP : Session Management and Cookies, Databases
4	Custom Services in Applications using AJAX
5	Database and Server Response with AJAX
6	React : Content projection, Manipulating Data With Pipes
7	Node JS and Mongo DB

Total Periods: 45

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		L	T	P	C
23ADC24	**Artificial Intelligence II**	**3**	**0**	**0**	**3**

Course Objective:

- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in probabilistic Reasoning.
- To know the automated learning techniques.
- To explore the techniques in Reinforcement Learning.
- To explore artificial intelligence techniques for Robotics.

Course Outcomes:

23ADC24.CO1 Explain the probabilistic reasoning using Bayesian inference

23ADC24.CO2 Apply appropriate Probabilistic reasoning techniques for solving uncertainty problems

23ADC24.CO3 Explain use of game theory for decision making.

23ADC24.CO4 Explain and apply probabilistic models for various use cases

23ADC24.CO5 Apply AI techniques for robotics

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC24.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC24.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC24.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC24.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC24.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I PROBABILISTIC REASONING I 9

Acting under uncertainty – Bayesian inference – naïve bayes models -Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks

Unit-II PROBABILISTIC REASONING II 9

Probabilistic reasoning over time – time and uncertainty – inference in temporal models – Hidden Markov Models – Kalman filters – Dynamic Bayesian networks-Probabilistic programming

Unit-III DECISIONS UNDER UNCERTAINTY 9

Basis of utility theory – utility functions – Multiattribute utility functions – decision networks – value of information – unknown preferences- Sequential decision problems – MDPs – Bandit problems – partially observable MDPs Multiagent environments – non-cooperative game theory – cooperative game theory – making collective decisions

Unit-IV LEARNING PROBABILISTIC MODELS 9

Statistical learning theory – maximum-likelihood parameter learning – naïve bayes models – generative and descriptive models – continuous models – Bayesisn parameter learning – Bayesian linear regression – learning Bayesian net structures – density estimation-EM Algorithm – unsupervised clustering – Gaussian mixture models – learning Bayes netparameters – learning HMM – learning Bayes net structures with hidden variables

Unit-V REINFORCEMENT LEARNING AND ROBOTICS 9

Learning from rewards – passive reinforcement learning – active reinforcement learning – generalization in reinforcement learning – policy search – inverse reinforcement learning – applications-Robots – robotic perception – planning movements – reinforcement learning in robotics – roboticframeworks -- applications of robotics-Philosophy, ethics, and safety of AI – the future of AI

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Stuart Russel and Peter Norvig	"Artificial Intelligence: A Modern Approach"	FourthEdition, Pearson Education	2020

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dan W. Patterson	"Introduction to AI and ES"	Pearson Education	2007
2.	Kevin Night, Elaine Rich, and Nair B	"Artificial Intelligence"	McGraw Hill	2008
3.	Patrick H. Winston	"Artificial Intelligence"	Third edition, Pearson Edition	2006
4.	Deepak Khemani	"Artificial Intelligence"	Tata McGraw Hill Education	2013

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23ADC25	Artificial Intelligence - Ii Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To impart knowledge about Artificial Intelligence..
- To understand the main abstractions and reasoning for intelligent systems.
- To understand the use of Artificial Intelligence in various applications

Course Outcomes:

23ADC25.CO1 Solve basic AI based problems.

23ADC25.CO2 Implement the concept of Bayesian Network.

23ADC25.CO3 Apply AI techniques to real-world problems to develop intelligent systems

23ADC25.CO4 Implement HMM for real-world application.

23ADC25.CO5 Use Reinforcement Learning to implement various intelligent systems.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC25.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC25.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC25.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC25.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC25.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Sl.No.	List of Experiments
1	To implement Bayesian Belief networks
2	Approximate inferences in Bayesian network
3	To implement decision problems for various real-world applications
4	To learn various Bayesian parameters
5	Implementation of Hidden Markov Models
6	Implement EM algorithm for HMM
7	Implement the Reinforcement learning for various reward based applications
8.	Mini-Project

Total Periods: 45

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		L	T	P	C
23ADC26	**Data And Information Security**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the basics of Number Theory and Security
- To understand and analyze the principles of different encryption techniques
- To understand the security threats and attacks
- To understand and evaluate the need for the different security aspects in real time applications
- To learn the different applications of information security

Course Outcomes:

23ADC26.CO1	Understand the fundamentals of security and the significance of number theory in computer security
23ADC26.CO2	Learn the public key cryptographic standards and authentication scheme
23ADC26.CO3	Able to apply the security frameworks for real time applications
23ADC26.CO4	Understand the security threats and attacks in IoT, Cloud.
23ADC26.CO5	Able to develop appropriate security algorithms understanding the possible threats

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
23ADC26.CO1	x	-	-	x	x	-	x	-	x	-	-	-	x	-	-
23ADC26.CO2	x	-	-	-	-	x	-	x	x	x	-	-	x		-
23ADC26.CO3	x	x	x	-	-	x	-	x	x	x	-	-	-	x	-
23ADC26.CO4	x	x	x	x	x	-	-	-	x	x	x	x	-	x	x
23ADC26.CO5	x	x	x	x	x	-	x	-	x	x	x	x	-	x	x

Unit-I FUNDAMENTALS OF SECURITY 9

Fundamental Security Design Principles – Attack Surfaces and Attack Trees. Computer Security Strategy– Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCD and Euclidean Algorithm, Chinese Remainder Theorem, Multiplication Modulo m and the Totient Function, Problems, Fermat and Euler Theorem. Primitive Roots and the Structure of F*p, Number in other Bases, Fast Computation of Powers in Z/mZ, Multiplicative Functions, Group Theory, Fields and Problems

Unit-II ENCRYPTION TECHNIQUES AND KEY MANAGEMENT 9

Symmetric Encryption Principles – Data Encryption Standard – Advanced Encryption Standard –Stream Ciphers and RC4 - Cipher Block Modes Operation – Digital Signatures - Key Distributions - Public Key Cryptosystem: RSA, Elliptic Curve Cryptography - Key Exchange Algorithms: Diffie Hellmen and ELGamal Key Exchange

Unit-III AUTHENTICATION, INTEGRITY AND ACCESS CONTROL 9

Authentication: Security Hash Function – HMAC – Electronic User Authentication Principles, Password Based Authentication, Token Based and Remote Authentication; Internet Authentication Applications: Kerberos X.509 – Public Key Infrastructure; Access Control: Access Control Principles - Subjects, Objects, and Access Rights - Discretionary Access Control

Unit-IV SECURITY 9

System Security: Firewall, Viruses, Worms, Ransomeware, Keylogger, Greyware, IDS, DDoS Network Security: SSL – TLs – HTTPS –IP Security; OS Security: Introduction to Operating System Security - System Security

Planning - Operating Systems Hardening - Application Security - Linux/Unix Security - Windows Security - Virtualization Security; Wireless Security: Risks and Threats of Wireless- Wireless LAN Security- Wireless Security Policy-Wireless Security Architectures-Wireless security Tools

Unit-V SECURITY APPLICATIONS 9

IOT security: Introduction- Architectures- Security challenges- Security requirements- Trust, Dataconfidentiality, and privacy in IOT- Security in future IOT systems; Cloud Security: Cloud Security Architecture- Security Management in the Cloud- Availability Management- SaaS Availability Management- PaaS Availability Management- IaaS Availability Management

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	William Stallings	"Cryptography and Network Security Principles and Practice"	Pearson Education International, Fifth Edition	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Tim Mather, Subra Kumaraswamy and Shahed Latif	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance	Oreilly	2009
2.	Mikhail Gloukhovtsev	IoT Security: Challenges, Solutions & Future Prospects	Knowledge Sharing Article, Dell Inc	2018
3.	Pradip KumarDas, Hrudaya Kumar Tripathy, Shafiz Affendi Mohd yusuf	Privacy and Security Issues in Big Data, An Analytical View on Business Intelligence	Springer	2021

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23ADC27	Deep Learning	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the basics of deep neural networks
- To understand CNN of architectures of deep neural networks
- To understand the concepts of Artificial Neural Networks
- To learn the basics of Data science in Deep learning
- To learn about applications of deep learning in AI and Data Science

Course Outcomes:

23ADC27.CO1 Explain the basics in deep neural networks

23ADC27.CO2 Apply Convolution Neural Network for image processing

23ADC27.CO3 Explain the basics of Artificial Intelligence using deep learning

23ADC27.CO4 Apply deep learning algorithms for data science

23ADC27.CO5 Apply deep learning algorithms for variety applications

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADC27.CO1	x	-	-	x	x	-	x	-	x	-	-	-	x	-	-
23ADC27.CO2	x	-	-	-	-	x	-	x	x	x	-	-	x		-
23ADC27.CO3	x	x	x	-	-	x	-	x	x	x	-	-	-	x	-
23ADC27.CO4	x	x	x	x	x	-	-	-	x	x	x	x	-	x	x
23ADC27.CO5	x	x	x	x	x	-	x	-	x	x	x	x	-	x	x

Unit-I DEEP NETWORKS BASICS 9

Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient- based Optimization – Machine Learning Basics: Capacity -- Overfitting and underfitting -- Hyperparameters and validation sets -- Estimators -- Bias and variance-- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deepfeedforward networks; Regularization -- Optimization.

Unit-II CONVOLUTIONAL NEURAL NETWORKS 9

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning:Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers -- Gradient Computation.

Unit-III DEEP LEARNING ALGORITHMS FOR AI 9

Artificail Neural Netowrks – Linear Associative Networks – Perceptrons -The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Autoencoders - Deep Backprop Networks- Autoencoders

Unit-IV DATA SCIENCE AND DEEP LEARNING 9

Data science fundamentals and responsibilities of a data scientist - life cycle of data science – Data science tools - Data modeling, and featurization - How to work with data variables and data science tools - How to visualize the data - How to work with machine learning algorithms and Artificial Neural Networks

Unit-V APPLICATIONS OF DEEP LEARNING **9**

Detection in chest X-ray images -object detection and classification -RGB and depth image fusion - NLP tasks - dimensionality estimation - time series forecasting -building electric power grid for controllable energy resources - guiding charities in maximizing donations and robotic control in industrial environments.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ian Goodfellow, Yoshua Bengio, Aaron Courville	Deep Learning	MIT Press	2016

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stone, James	Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning	Sebtel Press, United States	2021
2.	Vance, William	Data Science: A Comprehensive Beginners Guide to Learn the Realms ofData Science	Joiningthedotstv Limited	2020
3.	Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.)	Deep Learning Applications	Volume 3,Springer Publications	2022
4.	Charu C. Aggarwal	Neural Networks and Deep Learning: A Textbook	Springer International Punlishing	2018

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23ADC28	Deep Learning Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

1. To learn deep neural networks and apply for simple problems
2. To Learn and apply Convolution Neural Network for image processing
3. To Learn and apply Recurrent Neural Network and its variants for text analysis
4. To augment data using generative models
5. To explore real world applications with deep neural networks

Course Outcomes:

23ADC28.CO1 Apply deep neural network for simple problems

23ADC28.CO2 Apply Convolution Neural Network for image processing

23ADC28.CO3 Apply Recurrent Neural Network and its variants for text analysis

23ADC28.CO4 Apply generative models for data augmentation

23ADC28.CO5 Develop a real world application using suitable deep neural networks

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC28.CO1	x	-	-	x	x	-	x	-	-	-	-	-	x	-	-
23ADC28.CO2	x	-	-	-	-	x	-	x	x	x	-	-	x		-
23ADC28.CO3	x	x	-	-	-	x	-	x	x	x	-	-	-	x	-
23ADC28.CO4	x	-	x	x	-	-	-	-	x	x	x	x	-	x	x
23ADC28.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	x	x

Sl.No.	List of Experiments
1	Solving XOR problem using Multilayer perceptron
2	Implement character and Digit Recognition using ANN.
3	Implement the analysis of X-ray image using autoencoders
4	Implement Speech Recognition using NLP
5	Develop a code to design object detection and classification for traffic analysis using CN
6	Implement online fraud detection of share market data using any one of the data analytics tools.
7	Implement image augmentation using deep RBM.
8.	Implement Sentiment Analysis using LSTM.
9.	Mini Project: Number plate recognition of traffic video analysis.

Total Periods: 45

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23ADC29	AI And Robotics	L	T	P	C
		3	0	0	3

Course Objective:

- To study the Robot Locomotion and types of robots.
- To explore the kinematic models and constraints
- To Learn sensors of robots and image processing for robotics.
- To understand the methods for mobile robot Localization
- To study the Path planning and Navigation of Robots.

Course Outcomes:

23ADC29.CO1 Explain the types of Robots

23ADC29.CO2 Narrate the kinematics of Robots

23ADC29.CO3 Implement image processing algorithms

23ADC29.CO4 Devise Localization algorithms

23ADC29.CO5 Devise Path planning methods for navigation

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PS O2	PSO 3
23ADC29.CO1	x	-	-	x	x	-	x	-	-	-	-	-	x	-	-
23ADC29.CO2	x	-	-	-	-	x	-	x	x	x	-	-	x		-
23ADC29.CO3	x	x	-	-	-	x	-	x	x	x	-	-	-	x	-
23ADC29.CO4	x	-	x	x	-	-	-	-	x	x	x	x	-	x	x
23ADC29.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	x	x

Unit-I ROBOT LOCOMOTION 9

Introduction to AI and Robotics – robot locomotion – legged mobile robots – wheeled mobile robots – aerial mobile robots.

Unit-II MOBILE ROBOT KINEMATICS 9

Kinematic models and constraints – mobile robot maneuverability – mobile robot workspace – advanced kinematics – motion control.

Unit-III ROBOT PERCEPTION 9

Sensors for mobile robots – computer vision for robots – image processing for robotics – place recognition – range data.

Unit-IV MOBILE ROBOT LOCALIZATION 9

Introduction to localization – noise and aliasing – localization-based navigation – belief representation – map representation – probabilistic map-based localization – autonomous mapbuilding.

Unit-V ROBOT PLANNING AND NAVIGATION 9

Planning and navigation – planning and reacting – path planning – obstacle avoidance – navigation architectures.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza	Introduction to Autonomous Mobile Robots	Second Edition, MIT Press	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stuart Russel and Peter Norvig	Artificial Intelligence: A Modern Approach	Fourth Edition, Pearson Education	2020

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23ADE30	Iot System And Analytics	L	T	P	C
		3	0	0	3

Course Objective:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

Course Outcomes:

23ADE30.CO1 Explain the concept of IoT.

23ADE30.CO2 Analyze various protocols for IoT.

23ADE30.CO3 Design a PoC of an IoT system using Rasperry Pi/Arduino

23ADE30.CO4 Apply data analytics and use cloud offerings related to IoT.

23ADE30.CO5 Analyze applications of IoT in real time scenario

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
23ADE30.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE30.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE30.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE30.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE30.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I FUNDAMENTALS OF IoT **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

Unit-II IoT PROTOCOLS **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 2101.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

Unit-III DESIGN AND DEVELOPMENT **9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

Unit-IV DATA ANALYTICS AND SUPPORTING SERVICES **9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

Unit-V CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things	CiscoPress	2017
2	Arshdeep Bahga, Vijay Madisetti	Internet of Things – A hands-on approach	Universities Press	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Olivier Hersent, David Boswarthick, Omar Elloumi	The Internet of Things – Key applications and Protocols	Wiley	2012
2.	Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle	From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence	Elsevier	2014
3.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds)	Architecting the Internet of Things	Springer	2011

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23ADE31	Iot System And Analytics Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To study the assembly language using simulator and kit.
- To implement ALU operations.
- To generate waveforms and test timers
- To develop applications using Embedded C language.
- To design IoT applications using Aurdino, Raspberry Pi, and Bluemix.
- To study the assembly language using simulator and kit.

Course Outcomes:

23ADE31.CO1 Execute Assembly Language experiments using simulator

23ADE31.CO2 Implement ALU operations

23ADE31.CO3 Design waveforms and test timers.

23ADE31.CO4 Develop real time applications and explore ARM/PIC using Embedded C.

23ADE31.CO5 Demonstrate real time applications using Aurdino, Raspberry Pi, and Bluemix..

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE31.CO1	x	x	-	-	-	x	-	-	x	-	-	x	-	x	-
23ADE31.CO2	x	-	x	x	-	x	x	x	x	x	x	-	-	-	x
23ADE31.CO3	x	x	-	-	x	-	-	x	-	x	-	-	x	-	-
23ADE31.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE31.CO5	x	x	-	x	x	-	-	-	x	-	x	x	x	x	-

Sl.No.	List of Experiments
1	Write 8051 Assembly Language experiments using simulator.
2	Test data transfer between registers and memory.
3	Perform ALU operations.
4	Using interrupts generate waveforms and test Timers
5	Write assembly language experiments using Kit to test interfaces and interrupts using Traffic Generator, DAC, ADC, Stepper Motor (2).
6	Write Basic and arithmetic Programs Using Embedded C.
7	Write Embedded C program to test interrupt and timers.
8.	Develop Real time applications – clock generation, wave form generation, counter using embedded C.
9.	Explore ARM/PIC based controllers using Embedded C.
10.	Explore different communication methods with IoT devices
11.	Develop simple application – testing infrared sensor – IoT Applications – using Aurdino.
12.	Develop simple application – testing temperature, light sensor – IOT Application using open platform/Raspberry Pi.

13. Deploy IOT applications using platforms such as Bluemix.

Total Periods: 45

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23ADE32	Bio-Inspired Optimization Techniques	L	T	P	C
		3	0	0	3

Course Objective:

- To understand fundamental topics in bio-inspired optimization techniques
- To Learn the collective systems such as ACO, PSO, and BCO
- To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems
- To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
- To implement the Bio-inspired technique with other traditional algorithms.

Course Outcomes:

23ADE32.CO1	Familiarity with the basics of several biologically inspired optimization techniques.
23ADE32.CO2	Familiarity with the basics of several biologically inspired computing paradigms.
23ADE32.CO3	Ability to select an appropriate bio-inspired computing method and implementfor any application and data set.
23ADE32.CO4	Theoretical understanding of the differences between the major bio-inspired computing methods.
23ADE32.CO5	Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PS O2	PSO 3
23ADE32.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE32.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE32.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE32.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE32.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I INTRODUCTION **9**

Optimization Techniques: Introduction to Optimization Problems – Single and Muti- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

Unit-II SWARM INTELLIGENCE **9**

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards ArtificialAnts – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving usingACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.

Unit-III NATURAL TO ARTIFICIAL SYSTEMS **9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

Unit-IV SWARM ROBOTICS **9**

Foraging for food – Clustering of objects – Collective Prey retrieval –Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – ParticleSwarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in

engineering.

Unit-V CASE STUDIES **9**

Other Swarm Intelligence algorithms**:** Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems –Travelling Salesmanproblem.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	A. E. Elben and J. E. Smith	Introduction to Evolutionary Computing	Springer	2010
2	Floreano D. and Mattiussi C	Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies	MIT Press, Cambridge, MA	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Eric Bonabeau, Marco Dorigo, Guy Theraulaz	Swarm Intelligence: From Natural to Artificial Systems	Oxford University press	2000
2.	Christian Blum, Daniel Merkle (Eds.)	Swarm Intelligence: Introduction and Applications	Springer Verlag	2008
3.	Leandro N De Castro, Fernando J Von Zuben	Recent Developments in Biologically Inspired Computing	Idea Group Inc	2005

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23ADE33	Information Extraction And Retrieval	L	T	P	C
		3	0	3	3

Course Objective:

- To understand the different ways for extraction of multimedia data
- To learn and analyze the information retrieval techniques
- To apply the information retrieval algorithms for real time applications
- To understand and evaluate the applications of information retrieval techniques
- To understand the role of information retrieval systems in web applications

Course Outcomes:

23ADE33.CO1	Able to apply the information extraction techniques for real time applications
23ADE33.CO2	Design systems based on the concepts of information retrieval
23ADE33.CO3	Apply data specific information extraction and retrieval
23ADE33.CO4	Create web applications by understanding the information extraction and retrieval techniques
23ADE33.CO5	Use the concepts of information classification and clustering in wide range of other applications

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE33.CO1	x	x	-	x	x	-	x	-	x	-	x	x	x	x	-
23ADE33.CO2	x	-	x	x	-	x	-	x	-	x	x	-	-	-	-
23ADE33.CO3	x	-	-	-	x	-	-	x	-	x	-	-	-	-	-
23ADE33.CO4	x	x	x	-	x	x	x	-	x	x	x	-	x	-	x
23ADE33.CO5	x	x	-	x	-	-	-	-	x	-	x	x	-	x	-

Unit-I INTRODUCTION TO INFORMATION EXTRACTION 9

Introduction – Origins – Text, Audio ,Image, Video Extraction – Visual object Feature Localization - Entropy based Image Analysis – 3D shape Extraction Techniques - Semantic Multimedia Extraction using Audio & Video – Multimedia Web Documents.

Unit-II TEXT EXTRACTION 9

Pre-processing Techniques – Clustering – Probabilistic Models – Browsing and Query Refinement on presentation Layer- Link Analysis – Visualization Approaches and its Operations.

Unit-III INFORMATION RETRIEVAL SYSTEMS 9

Text formats –Retrieval and Ranking –Evaluation strategies – Tokens –Query processing –Static Inverted Indices – Dynamic Inverted Indices – Index compression –Categorization and Filtering Classifiers –Probabilistic, Linear ,Similarity based, Generalized Linear, Information Theoretic
models- XML Retrieval.

Unit-IV ALGORITHMS ON INFORMATION RETRIEVAL 9

Introduction – Strategies - Utilities – Crossing the language barrier- Cross Language strategies with Utilities – Efficiency Multidimensional data model- Parallel Information Retrieval – Distributed Information Retrieval

Unit-V APPLICATIONS 9

Sound Authoring Data with Audio MME-CBR Systems-Implementation of Message Recognition Systems – Paralinguistic Information Retrieval in Broadcast – Text mining Applications- Pre- processing Applications using Probabilistic and Hybrid Approaches – Web Search.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mark T. Maybury	Multimedia Information Extraction	Wiley (IEEE), John Wiley & Sons	2012
2.	Ronen Feldman, James Sanger	Text Mining Handbook	Cambridge University press	2006

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David A. Grossman, Ophir Frieder	Information Retrieval: Algorithms and Heuristics	Second Edition, Springer	2004
2.	Stefan Buttcher LA Clarke Gox v.Cormack	Information Retrieval: Implementing and Evaluating Search Engines	MIT Press	2016

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23ADE34	DATA SECURITY AND PRIVACY	L	T	P	C
		3	0	3	3

Course Objective:

- To understand the fundamentals of security, and how it relates to information systems.
- To identify risks and vulnerabilities in operating systems from a database perspective.
- To learn good password policies, and techniques to secure passwords in an organization.
- To learn and implement administration policies for users.
- To understand the various database security models and their advantages or disadvantages.

Course Outcomes:

23ADE34.CO1 Relates the fundamentals of security to information systems

23ADE34.CO2 Identify risks and vulnerabilities in operating systems

23ADE34.CO3 Analyze the techniques to secure passwords in an organization

23ADE34.CO4 Implement administration policies for users.

23ADE34.CO5 Implement privacy preserving data mining algorithms.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE34.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE34.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE34.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE34.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE34.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I SECURITY ARCHITECTURE & OPERATING SYSTEM SECURITY FUNDAMENTALS 9

Security Architecture: Introduction-Information Systems- Database Management Systems-Information Security Architecture- Database Security–Asset Types and value-Security Methods. Operating System Security Fundamentals: Introduction-Operating System Overview-Security Environment – Components- Authentication Methods-User Administration-Password Policies Vulnerabilities-E-mail Security.

Unit-II ADMINISTRATION OF USERS & PROFILES,PASSWORD POLICIES, PRIVILEGES AND ROLES 9

Administration of Users: Introduction-Authentication-Creating Users, SQL Server User-Removing, Modifying Users-Default, Remote Users-Database Links-Linked Servers-Remote Servers-Practices for Administrators and Managers-Best Practices Profiles, Password Policies, Privileges and Roles: Introduction-Defining and Using Profiles-Designing and Implementing Password Policies-Granting and Revoking User Privileges-Creating, Assigning and Revoking User Roles-Best Practices

Unit-III DATABASE APPLICATION SECURITY MODELS & VIRTUAL PRIVATE DATABASES 9

Database Application Security Models: Introduction-Types of Users-Security Models- Application Types-Application Security Models-Data Encryption Virtual Private Databases: Introduction-Overview of VPD-Implementation of VPD using Views, Application Context in Oracle-Implementing Oracle VPD-Viewing VPD Policies and Application contexts using Data Dictionary, Policy Manager Implementing Row and Column level Security with SQL Server

Unit-IV AUDITING DATABASE ACTIVITIES 9

Auditing Database Activities: Using Oracle Database Activities-Creating DLL Triggers with OracleAuditing Database Activities with Oracle-Auditing Server Activity with SQL Server 2000-Security and Auditing Project Case Study.

Unit-V PRIVACY PRESERVING DATA MINING TECHNIQUES 9

Privacy Preserving Data Mining Techniques: Introduction- Privacy Preserving Data Mining AlgorithmsGeneral Survey-Randomization Methods-Group Based Anonymization-Distributed Privacy Preserving Data Mining-Curse of Dimensionality-Application of Privacy Preserving Data Mining

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hassan A. Afyouni	Database Security and Auditing	Third Edition, Cengage Learning	2009
2.	Charu C. Aggarwal, Philip S Yu	Privacy Preserving Data Mining	Models and Algorithms, Kluwer Academic Publishers	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ron Ben Natan	Implementing Database Security and Auditing	Elsevier Digital Press	2005

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23ADE35	Adhoc And Sensor Networks	L	T	P	C
		3	0	3	3

Course Objective:

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.
- Be familiar with different types of adhoc routing protocols.
- Be expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks.

Course Outcomes:

23ADE35.CO1	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
23ADE35.CO2	Analyze the protocol design issues of ad hoc and sensor networks
23ADE35.CO3	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
23ADE35.CO4	Evaluate the QoS related performance measurements of ad hoc and sensor networks
23ADE35.CO5	Understand the architecture and protocols of wireless sensor networks

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE35.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE35.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE35.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE35.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE35.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Introduction **9**

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

Unit-II Mac Protocols For Ad Hoc Wireless Networks **9**

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

Unit-III Routing Protocols And Transport Layer In Ad Hoc Wireless Networks **9**

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

Unit-IV Wireless Sensor Networks (Wsns) And Mac Protocols **9**

Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

Unit-V Wsn Routing, Localization & Qos **9**

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C. Siva Ram Murthy, and B. S. Manoj	Ad Hoc Wireless Networks: Architectures and Protocols	Prentice Hall Professional Technical Reference	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Carlos De Morais Cordeiro, Dharma Prakash Agrawal	Ad Hoc & Sensor Networks: Theory and Applications	World Scientific Publishing Company	2006
2.	Feng Zhao and Leonides Guibas	Wireless Sensor Networks	Elsevier Publication	2002

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23ADE36	Digital Image Processing	L	T	P	C
		3	0	3	3

Course Objective:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

Course Outcomes:

23ADE36.CO1 Know and understand the basics and fundamentals of digital image processing

23ADE36.CO2 Operate on images using the techniques of smoothing, sharpening and enhancement.

23ADE36.CO3 Understand the restoration concepts and filtering techniques.

23ADE36.CO4 Learn the basics of segmentation, features extraction

23ADE36.CO5 Understand the compression and recognition methods for color models.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE36.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE36.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE36.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE36.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE36.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I DIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

Unit-II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

Unit-III IMAGE RESTORATION 9

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

Unit-IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

Unit-V IMAGE COMPRESSION AND RECOGNITION 9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rafael C. Gonzalez, Richard E. Woods	Digital Image Processing	Pearson, Third Edition	2010
2.	Anil K. Jain	Fundamentals of Digital Image Processing	Pearson	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kenneth R. Castleman	Digital Image Processing	Pearson	2006
2.	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins	Digital Image Processing using MATLAB	Pearson Education, Inc.	2011
3.	D,E. Dudgeon and RM. Mersereau	Multidimensional Digital Signal Processing	Prentice Hall Professional Technical Reference	2190
4.	William K. Pratt	Digital Image Processing	John Wiley, New York	2002

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23ADC37	Software Testing And Automation	L	T	P	C
		3	0	3	3

Course Objective:

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques
- To apply test metrics and measurements.
- To perform a case study with any available sample Testing

Course Outcomes:

23ADC37.CO1 Design test cases suitable for a software development for different domains

23ADC37.CO2 Identify suitable tests to be carried out

23ADC37.CO3 Prepare test planning based on the document

23ADC37.CO4 Document test plans and test cases designed

23ADC37.CO5 Use automatic testing tools.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC37.CO1	X	-	-	-	X	-	-	X	-	-	-	-	-	-	X
23ADC37.CO2	x	-	-	x	x	x	-	-	-	-	x	-	-	x	-
23ADC37.CO3	-	x	x	-	x	-	x	-	-	-	-	-	-	x	-
23ADC37.CO4	-	-	x	x	x	-	x	-	-	-	-	-	x	-	-
23ADC37.CO5	-	-	x	-	x	-	x	-	-	-	x	-	-	x	-

Unit-I Introduction **9**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester‘s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository.

Unit-II Test Case Design Strategies **9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.

Unit-III Levels Of Testing **9**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability andAccessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

Unit-IV Test Management **9**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – ReportingTest Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- .The Technical Training Program.

Unit-V Test Automation **9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Srinivasan Desikan and Gopalaswamy Ramesh,	Software Testing – Principles and Practices‖	Pearson Educatio	2006
2	Ron Patton	Software Testing‖, Second Edition	SamsPublishing , Pearson Education	2007

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ilene Burnstein	Practical Software Testing	Springer International Edition	2003
2	Edward Kit	Software Testing in the Real World	Improving the Process‖, Pearson Education	1995

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23ADC38	Computer Networks	L	T	P	C
		3	0	3	3

Course Objective:

- Build an understanding of the fundamental concepts of computer networking

  Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Independently understand basic computer network technology
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.

Course Outcomes:

23ADC38.CO1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.
23ADC38.CO2	Apply channel allocation, framing, error and flow control techniques.
23ADC38.CO3	Describe the functions of Network Layer i.e. Logical addressing, subnetting & Routing Mechanism
23ADC38.CO4	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism
23ADC38.CO5	Explain the functions offered by session and presentation layer and their Implementation

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC38.CO1	x	x	x	-	x	x	x	x	x	-	x	x	x	x	x
23ADC38.CO2	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x
23ADC38.CO3	x	x	-	x	x	x	x	x	X	x	x	x	-	x	-
23ADC38.CO4	x	x	x	-	x	x	x	-	-	x	x	x	x	x	x
23ADC38.CO5	x	x	x	x	x	x	x	-	X	-	x	x	x	x	x

Unit-I Introduction And Application Layer **9**

Data Communication – Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets – Application Layer protocols: HTTP – FTP – Email protocols (SMTP – POP3 – IMAP – MIME) – DNS – SNMP

Unit-II Transport Layer **9**

Introduction – Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control – Congestion Control – Congestion avoidance (DECbit, RED) – SCTP – Quality of Service

Unit-III Network Layer **9**

Switching : Packet Switching – Internet protocol – IPV4 – IP Addressing – Subnetting – IPV6, ARP, RARP, ICMP, DHCP

Unit-IV Routing **9**

Routing and protocols: Unicast routing – Distance Vector Routing – RIP – Link State Routing – OSPF – Path-vector routing – BGP – Multicast Routing: DVMRP – PIM..

Unit-V Software Testing And Maintenance **9**

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) – Physical Layer: Data and Signals – Performance – Transmission media- Switching – Circuit Switching.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James F. Kurose,	Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition,	Pearson Education	2021
2.	Behrouz A. Forouzan	Data Communications and Networking with TCP/IP Protocol Suite,	Sixth Edition TMH,	2022

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Larry L. Peterson, Bruce S. Davie	Computer Networks: A Systems Approach	Fifth Edition, Morgan Kaufmann Publishers Inc.,	2012
2.	William Stallings	Data and Computer Communications,	Tenth Edition, Pearson Education	2013
3.	Nader F. Mir	Computer and Communication Networks	Second Edition, Prentice Hall	2014
4.	Ying-Dar Lin, Ren-Hung Hwang, Fred Baker	"Computer Networks: An Open Source Approach"	McGraw Hill	2012

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23ADC39	Stream Processing	L	T	P	C
		3	0	0	3

Course Objective:

- Understand the applicability and utility of different streaming algorithms
- Describe and apply current research trends in data-stream processing.
- Analyze the suitability of stream mining algorithms for data stream systems
- Program and build stream processing systems, services and applications
- Solve problems in real-world applications that process data streams

Course Outcomes:

23ADC39.CO1 ıdents will be able to decompose the given project in various Data system.

23ADC39.CO2 ıdents will be able to choose appropriate process model depending on the user requirements.

23ADC39.CO3 ıdents will be able perform various life cycle activities like Analysis, Design Implementation Testing and Maintenance

23ADC39.CO4 ıdents will be able to know various processes used in all the phases of the product

23ADC39.CO5 ıdents can apply the knowledge, techniques, and skills in the development of a software product

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC39.CO1	x	x	x	-	x	x	x	x	x	-	x	x	x	x	x
23ADC39.CO2	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x
23ADC39.CO3	x	x	-	x	-	x	x	x	-	x	x	x	-	x	x
23ADC39.CO4	x	x	x	x	x	x	x	-	-	x	x	x	x	x	x
23ADC39.CO5	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x

Unit-I Foundations Of Data Systems **9**

Introduction to Data Processing,-Stages of Data processing- Data Analytics,-Batch Processing,-Stream processing-Data Migration-Transactional Data processing- Data Mining- Data Management Strategy-Storage-Processing- Integration- Analytics- Benefits of Data as a Service-Challenges

Unit-II Transport Layer **12**

Requirements Engineering-Establishing the Groundwork-Eliciting Requirement Developing use cases-Building the requirements model-Negotiating, validating Requirements-Requirements Analysis-Requirements Modeling Strategies

Unit-III Data Models And Query Languages **9**

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many-to-One and Many-to- Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

Unit-IV Software Implementation **12**

Structured coding Techniques- Coding Styles-Standards and Guidelines- Documentation Guidelines- Modern Programming Language Features: Type checking-User defined data types- Data Abstraction-Exception Handling- Concurrency Mechanism.

Unit-V Real-Time Processing Using Spark Streaming **12**

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics,

Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Tyler Akidau, Slava Chemyak	Large-Scale Data Processing	OReilly publication	2009
2	Martin Kleppmann	Designing Data-Intensive Applications	OReilly Media	1994

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Apache Spark,	Practical Real-time Data Processing and Analytics	Packt Publishing	2009
2	Richard Fairley	Software Engineering Concepts	Tata Mcgraw Hill	2008
3.	Ian Sommerville, "Software Engineering"	Seventh Edition	Pearson Education Asia	2007
4.	Gopalaswamy Ramesh, Ramesh Bhattiprolu, "Software Maintenance"	Foundations of Algorithms	Tata Mcgraw Hill	2003
5.	Shari Lwarence Pfleeger, Joanne M.Atlee	"Software Engineering Theory and Practice"	Third Edition, Pearson Education	2006

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23ADC40	Modern Cryptography	L	T	P	C
		3	0	0	3

Course Objective:

- To learn about Modern Cryptography
- To learn about Modern Cryptography
- To build a Pseudorandom permutation
- To construct Basic cryptanalytic techniques.
- To provide instruction on how to use the concepts of block.

Course Outcomes:

23ADC40.CO1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.
23ADC40.CO2	Apply channel allocation, framing, error and flow control techniques.
23ADC40.CO3	Describe the functions of Network Layer i.e. Logical addressing, subnetting & Routing Mechanism
23ADC40.CO4	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism
23ADC40.CO5	Explain the functions offered by session and presentation layer and their Implementation

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC40.CO1	x	x	x	-	x	x	x	x	x	-	x	x	x	x	x
23ADC40.CO2	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x
23ADC40.CO3	x	x	-	x	x	x	x	x	X	x	x	x	-	x	-
23ADC40.CO4	x	x	x	-	x	x	x	-	-	x	x	x	x	x	x
23ADC40.CO5	x	x	x	x	x	x	x	-	X	-	x	x	x	x	x

Unit-I Introduction **9**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

Unit-II Formal Notions Of Attacks **9**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen CiphertextAttacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM- CCA2, Inter-relations among the attack model

Unit-III Random Oracles **9**

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF)

Unit-IV Building A Pseudorandom Permutation **9**

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

Unit-V Message Authentication Codes **9**

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC,Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes:One-way functions

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hans Delfs and Helmut Knebl,	Introduction to Cryptography: Principles and Applications,	Pearson Education	2021
2.	Wenbo Mao	Modern Cryptography, Theory and Practice, Pearson Education	Sixth Edition TMH,	2022

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	ShaffiGoldwasser and MihirBellare	Notes on Cryptography,	Fifth Edition, Morgan Kaufmann Publishers Inc.,	2012
2.	OdedGoldreich	Foundations of Cryptography, CRC Press (Low Priced Edition Available)	Tenth Edition, Pearson Education	2013
3.	William Stallings	Cryptography and Network Security: Principles and Practice"	PHI 3rdEdition	2006

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23ADC41	Game Theory	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues
- To introduce contemporary topics in the intersection of game theory, computer science, and economics
- To understand concepts about game theory

Course Outcomes:

23ADC41.CO1 Understand the basics of data communication, networking, internet and their importance.

23ADC41.CO2 Analyze the services and features of various protocol layers in data networks.

23ADC41.CO3 Differentiate wired and wireless computer networks

23ADC41.CO4 Analyse TCP/IP and their protocols

23ADC41.CO5 Recognize the different internet devices and their functions.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC41.CO1	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X
23ADC41.CO2	X	X	X	X	X	X	-	X	X	X	X	X	X	-	X
23ADC41.CO3	-	-	-	X	-	X	X	X	X	X	-	X	-	X	X
23ADC41.CO4	X	X	X	X	X	X	X	-	X-	X	X	X	X	X	X
23ADC41.CO5	X	X	X	X	X	X	X	-	X	X	X	X	X	X	X

Unit-I Introduction **9**

Introduction – Making rational choices: basics of Games – strategy - preferences – payoffs – Mathematical basics - Game theory – Rational Choice - Basic solution concepts-noncooperative versus cooperative games - Basic computational issues - finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

Unit-II Games With Perfect Information **9**

Games with Perfect Information - Strategic games - prisoner's dilemma, matching penniesNash equilibria- theory and illustrations - Cournot's and Bertrand's models of oligopoly- auctionsmixed strategy equilibrium- zero-sum games- Extensive Games with Perfect Informationrepeated games (prisoner's dilemma)- subgame perfect Nash equilibrium; computational issues..

Unit-III Games With Imperfect Information **9**

Games with Imperfect Information - Bayesian Games – Motivational Examples – General Definitions – Information aspects – Illustrations - Extensive Games with Imperfect -Information - Strategies- Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations - Repeated Games – The Prisoner's Dilemma – Bargaining

Unit-IV Non-Cooperative Game Theory **9**

Non-cooperative Game Theory - Self-interested agents- Games in normal form - Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal-Form Games – Computing Nash equilibriaof two-player, zero-sum games -Computing Nash equilibria of twoplayer, general-sum games - Identifying dominated strategies

Unit-V Mechanism design **9**

Aggregating Preferences-Social Choice – Formal Model- Voting - Existence of social functions - Ranking systems - Protocols for Strategic Agents: Mechanism Design - Mechanism design with unrestricted preferences- Efficient mechanisms - Vickrey and VCG mechanisms (shortest paths) - Combinatorial auctions - profit maximization Computational applications of mechanism design - applications in Computer Science - Google's sponsored search - eBay auctions

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. J. Osborne	An Introduction to Game Theory"	Oxford University Press	2003

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N. Nisan, T. Roughgarden, E. Tardos,	"Algorithmic Game Theory",	Wiley Publishers.	2012
2.	Achyut S Godbole	"Algorithmic Game Theory",	Pearson Education	2006
3.	YoavShoham, Kevin Leyton-Brown	"Algorithmic Game Theory",	Wiley Publishers.	2005
4.	Zhu Han, Dusit Niyato, Walid Saad	"Algorithmic Game Theory",	Wiley	2016

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23ADC42	Image And Video Analytics	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

Course Outcomes:

23ADC42.CO1	Understand the basics of image processing techniques for computer vision and video analysis.
23ADC42.CO2	Explain the techniques used for image pre-processing.
23ADC42.CO3	Develop various object detection techniques.
23ADC42.CO4	Understand the various face recognition mechanisms.
23ADC42.CO5	Elaborate on deep learning-based video analytics.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC42.CO1	x	-	x	-	X	-	-	X	-	-	-	-	-	-	x
23ADC42.CO2	-	-	-	x	-	x	-	-	-	-	x	-	-	x	-
23ADC42.CO3	x	x	-	-	x	-	x	-	x	-	-	-	x	-	-
23ADC42.CO4	-	-	-	x	-	-	x	-	-	x	-	-	x	-	x
23ADC42.CO5	x	-	x	-	x	-	x	-	-	x	-	-	-	x	-

Unit-I Introduction **9**

Computer Vision – Image representation and image analysis tasks – Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

Unit-II Image Pre-Processing **9**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative- Scale in image processing - Canny edge detection – Parametric edge models - Edges in multi- speralct images - Local pre-processing in the frequency domain - Line detection by local pre- processing operators - Image restoration

Unit-III Object Detection Using Machine Learning **9**

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)- Salient features-Loss Functions-YOLO architectures

Unit-IV Face Recognition And Gesture Recognition **9**

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recognition.

Unit-V Video Analytics **9**

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem- RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture- Improvement in Inception v2-Video analytics- RestNet and Inception v3.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Milan Sonka, Vaclav Hlavac, Roger Boyle	Image Processing, Analysis, and Machine Vision,4th Edition	Thomson Learning	2013
2.	Vaibhav Verdhan	Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras	Apress	2021

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Milan Sonka, Vaclav Hlavac, Roger Boyle	Image Processing, Analysis, and Machine Vision,4th Edition	Thomso Learning	2013
2.	Vaibhav Verdhan	Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras	Apress	2021
3.	Milan Sonka, Vaclav Hlavac, Roger Boyle	Image Processing, Analysis, and Machine Vision,4th Edition	Thomso Learning	2013
4.	Vaibhav Verdhan	Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras	Apress	2021
5.	Milan Sonka, Vaclav Hlavac, Roger Boyle	Image Processing, Analysis, and Machine Vision,4th Edition	Thomso Learning	2013

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23ADC43	App Development	L	T	P	C
		3	0	0	3

Course Objective:

1. Understand system requirements for mobile applications
2. Generate suitable design using specific mobile development framework
3. Generate mobile application design
4. Implement the design using specific mobile development frameworks
5. Deploy the mobile applications in marketplace for distribution

Course Outcomes:

23ADC43.C01 Describe the requirements for mobile applications

23ADC43.C02 Explain the challenges in mobile application design and development

23ADC43.C03 Develop design for mobile applications for specific requirement

23ADC43.C04 Implement the design using Objective C and iOS

23ADC43.C05 Deploy mobile applications in Android and iPhone marketplace for distribution

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC43.C01	X	-	X	X	-	-	-	-	-	-	X	X	-	X	X
23ADC43.C02	-	X	X	X	X	X	-	-	-	-	X	X	X	-	X
23ADC43.C03	X	X	-	X	X	-	-	X		X	X	X	-	X	X
23ADC43.C04	X	-	X	X	-	X	-	X	-	X	-	X	X	-	X
23ADC43.C05	X	X	-	X	X	X	-	X	-	-	X	X	-	X	-

Unit-I Introduction **9**

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

Unit-II Basic Design **9**

applications, both hardware and software related – Architecting mobile applications – user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability. Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile

Unit-III Advanced Design **9**

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

Unit-IV Technology I – Android **9**

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

Unit-V Technology Ii - Ios **9**

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James Dovey and Ash Furrow	Beginning Objective C	Apress	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jeff McWherter and Scott Gowell,	Professional Mobile Application Development	Wrox	2012
2.	Charlie Collins, Michael Galpin and Matthias Kappler	Android in Practice	DreamTech	2012
3.	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson	Beginning iOS 6 Development	Exploring the iOS SDK	2013

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23ADC44	3D Printing and Design	L	T	P	C
		3	0	0	3

Course Objective:

- To ensure graduates will be proficient in utilizing the fundamental knowledge of basic sciences, mathematics, Computer Science and Creative Design thinking for the applications relevant to various streams of human centric Engineering and Technology
- To enrich graduates with the core competencies necessary for applying knowledge of computer science and Design to design, build, deploy, manage and analyze enterprise projects in the context of interactive applications.
- To enable graduates to gain employment in organizations and establish themselves as professionals by applying their technical and design thinking skills to solve real world problems and meet the diversified needs of industry, academia and research
- To equip the graduates with entrepreneurial skills and qualities which help them to perceive the functioning of technology and interactive media industry, diagnose computing and design problems, explore the entrepreneurial opportunities and prepare them to manage and contribute efficiently to those businesses.
- To ensure graduates will be proficient in utilizing the fundamental knowledge of basic

Course Outcomes:

23ADC44.CO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals,
23ADC44.CO2	Problem analysis: Identify, formulate, review research literature, and analyze complex
23ADC44.CO3	Design/development of solutions: Design solutions for complex engineering problems
23ADC44.CO4	Design/development of solutions: Design solutions for complex engineering problems
23ADC44.CO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
23ADC44.CO1	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X
23ADC44.CO2	X	X	X	X	X	X	-	X	X	X	X	X	X	-	X
23ADC44.CO3	-	-	-	X	-	X	X	X	X	X	-	X	-	X	X
23ADC44.CO4	X	X	X	X	X	X	X	-	X-	X	X	X	X	X	X
23ADC44.CO5	X	X	X	X	X	X	X	-	X	X	X	X	X	X	X

Unit-I Introduction **9**

Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain - ASTM/ISO 52900 Classification - Benefits - AM Unique Capabilities - AM File formats: STL, AMF Applications: Building Printing, Bio Printing, Food Printing, Electronics Printing, Automobile, Aerospace, Healthcare. Business Opportunities in AM.

Unit-II Vat Polymerization And Material Extrusion **9**

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process - top down and bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications. Material Extrusion: Fused Deposition Modeling (FDM) - Process-Materials -Applications and Limitations.

Unit-III Powder Bed Fusion And Binder Jetting **9**

Powder Bed Fusion: Selective Laser Sintering (SLS): Process - Powder Fusion Mechanism - Materials and Application. Selective Laser Melting (SLM), Electron Beam Melting (EBM): Materials - Process - Advantages and Applications. Binder Jetting: Three-Dimensional Printing - Materials - Process - Benefits - Limitations -

Applications

Unit-IV Material Jetting And Directed Energy Deposition **9**

Material Jetting: Multijet Modeling- Materials - Process - Benefits - Applications. Directed Energy Deposition: Laser Engineered Net Shaping (LENS) - Process - Material Delivery - Materials -Benefits -Applications.

Unit-V Sheet Lamination And Direct Write Technology **9**

Sheet Lamination: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding - Thermal Bonding - Materials - Application and Limitation. Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Rosen	Additive manufacturing technologies	Oxford University Press	2003

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Andreas Gebhardt,	3D Printing and Design	Wiley Publishers.	2012
2.	Milan Brandt	3D Printing and Design	Pearson Education	2006
3.	Susmita Bose	3D Printing and Design	Wiley Publishers.	2005
4.	Kamrani A.K	3D Printing and Design	Wiley	2016

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		L	T	P	C
23ADC45	**DESIGN PROJECT**	**0**	**0**	**15**	**12**

Course Objective:

- Plan an experimental design to solve Engineering problems
- Develop an attitude of team work and independent working on real time problems
- Analyze and process the experimental information
- Evaluate, interpret and justify the experimental results
- Develop a dissertation report

Course Outcomes:

23AD045.CO1	Design an experiment to solve engineering / societal problems using modern tools
23AD045.CO2	Develop lifelong learning to keep abreast of latest technologies.
23AD045.CO3	Implement the workflow to provide sustainable solutions
23AD045.CO4	Interpret the experimental results and the impact on society and environment
23AD045.CO5	Investigate the application for the real time problems

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC45.CO1	x	x	x	x	x	-	-	-	x	-	-	-	x	x	x
23ADC45.CO2	x	x	x	-	x	x	-	x		-	x	x	x	x	-
23ADC45.CO3	x	x	x	x	x	-	-	-	x	-	x	-	x	-	x
23ADC45.CO4	x	x	x	x	-	x	x	x	-	x	x	x	x		-
23ADC45.CO5	x	x	x	-	-	-	x	x	x	x	-	x	-	x	x

DESIGN PROJECT REVIEWS

Review 1: Design Project will have a minimum of three internal reviews by an appointed committee of faculty.

Review 2: The final review will be done by an external faculty

Review 3: Implementation Status and testing document

Review 4: Final Project Demonstration, Project Report and proper Result analysis

The group will submit at the end of semester II.

1. The Workable project.

2. Project report (Word Document) in the form of bound journal complete in all respect – 1 copy for the Institute, 1 copy for guide and 1 copy of each student in the group for certification.

The project report contains the details:

1. Problem definition

2. Requirement specification

   System design details (UML diagrams)

   System implementation – code documentation – dataflow diagrams/ algorithm, protocols used

   Test result and procedure

   Conclusions.

   Appendix

   a.Tools used

   b. References

   c. Papers published/certificates

Total Periods: 60

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		L	T	P	C
23ADC46	**Data Modelling And Business Intelligence**	**3**	**0**	**0**	**3**

Course Objective:

- To interpret basic architectures
- To understand about data models and experiment
- To know to apply the life cycle and its taskcogni
- To understand about ETL process
- To implement real life BI applications
- To interpret basic architectures

Course Outcomes:

23ADC46.CO1	Interpret basic business intelligence architectures
23ADC46.CO2	build various dimensional modeling data models and experiment various data preprocessing operations
23ADC46.CO3	apply Business Intelligence life cycle and its associated tasks
23ADC46.CO4	demonstrate ETL process and subsystems using ETL tools
23ADC46.CO5	design and implement ETL plan for various real life BI applications

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21ADC46.CO1	X	X	X	x	x	x	x	-	X	-	x	x	x	x	x
21ADC46.CO2	X	X	X	x	x	x	x	-	X	x	x	x	x	x	x
21ADC46.CO3	X	X	X	x	x	x	x	x	-	x	x	x	x	x	x
21ADC46.CO4	X	X	X	x	x	x	x	-	-	x	x	x	x	x	x
21ADC46.CO5	X	X	X	x	x	x	x	-	-	-	x	x	x	x	x

Unit-I Data Warehousing And Business Intelligence 9

Different Worlds of Data Capture and Data Analysis - Goals of Data Warehousing and Business Intelligence – Dimensional Modeling Introduction - Kimball's DW/BI Architecture - Alternative DW/BI Architectures - Dimensional Modeling Myths – More Reasons to Think Dimensionally - Agile Considerations

Unit-II Dimensional Modeling Techniques 9

Dimensional Modeling Techniques: Fundamental Concepts - Basic Fact Table Techniques - Basic Dimension Table Techniques -Integration via Conformed Dimensions - Dealing with Slowly Changing Dimension Attributes - Dealing with Dimension Hierarchies -Advanced Fact Table Techniques - Advanced Dimension Techniques - Special Purpose Schemas – Retail Sales: Four-StepDimensional Design Process – Case Study - Dimension Table Details - Retail Schema in Action - Retail Schema Extensibility –Factl ess Fact Tables - Dimension and Fact Table

Keys - Resisting Normalization Urges

Unit-III Dw/Bi Lifecycle, Process And Task 9

Lifecycle Roadmap – Launch Activities – Technology Track – Data Track – BI Applications Track – Wrap-up Activities –Dimensional Modeling Process and Task: Modeling Process – Get Organized – Design the Dimensional Model

Unit-IV Etl Subsystems And Techniques 9

Round up the requirements – The 34 Subsystems of ETL – Extracting: Getting Data Into the Data Warehouse – Cleaning and Conforming Data – Delivering: Prepare for Presentation – Managing the ETL Environment

Unit-V Other Types Of Learning 9

Reinforcement learning - Elements of Reinforce learning –Model based Learning – Temporal difference learning - representation Learning-Active learning –Instance based Learning – Association rule learning algorithm - Ensemble Learning Algorithm - Regularization Algorithm.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ralph Kimball, Margy Ross	."The Data Warehouse Toolkit"	3rd Edition, Wiley	2013

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ralph Kimball, Margy Ross, Warren Thornthwaite, Joy Mundy, Bob Becker.	The Data Warehouse Lifecycle Toolkit	3rdEdition, Wiley	2008

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23ADC47	Data Modeling And Business Intelligence Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To gain the ability to design and maintain efficient
- To scalable business intelligence solutions
- Sift data using slicers in multiple pivot tables
- Students will execute statistical analyses with professional statistical software.

Course Outcomes:

23ADC47.CO1	Be able to analyze large data sets to support data-driven decision making.
23ADC47.CO2	understanding of machine learning and statistical analysis techniques
23ADC47.CO3	able to discriminate between descriptive, diagnostic, predictive, and prescriptive analytics
23ADC47.CO4	evelop the ability to build and assess data-based models.
23ADC47.CO5	execute statistical analyses with professional statistical software

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC47.CO1	X	X	X	x	x	x	X	x	x	x	x	x	x	x	x
23ADC47.CO2	X	X	X	x	x	x	X	x	x	x	x	x	x	x	x
23ADC47.CO3	X	X	X	x	x	x	X	x	x	x	x	x	x	x	x
23ADC47.CO4	X	X	X	x	x	x	x	x	x	x	x	x	x	x	x
23ADC47.CO5	X	X	X	x	x	x	x	x	x	x	x	x	x	x	x

Sl.No.	List of Experiments
1.	Installation and Configuration of tableau and airflow
2.	Collecting, Cleaning and Connecting to data.
3.	Perform ETL process for the given data source.
4.	Create charts like bubble, bar, map using Airflow and Tableau.
5.	Create your story from the charts with valid reasons.
6.	Build a Map view using Tableau (Explore your data geographically)

7. Collect appropriate data, Perform ETL process and develop Scorecard using Air flow and Tableau

8. Collect appropriate data, Perform ETL process and develop dashboard for Health Care using Air flow and Tableau

Total Periods: 60

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		L	T	P	C
23ADC48	**Natural Language Processing**	**3**	**0**	**0**	**3**

Course Objective:

- To learn how to design NLP applications that perform question-answering and sentiment analysis
- Create tools to translate languages, summarize text, and even build chatbots.
- To auto-correct of grammar while typing, and automated answer generation.
- NLP uses many different techniques to enable computers to understand natural language as humans to
- Can use AI to take real-world input, process it and make sense of it in a way a computer can understand

Course Outcomes:

23ADC48.CO1 explore various text extraction techniques
23ADC48.CO2 apply various text processing techniques.
23ADC48.CO3 build text classification model
23ADC48.CO4 perform automatic text summarization
23ADC48.CO5 perform text similarity and clustering

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC48.CO1	X	X	-	-	-	-	X	-	X	-	X	X	X	X	-
23ADC48.CO2	X	X	-	X	-	X	-	-	-	-	X	X	X	X	X
23ADC48.CO3	X	X	-	X	X	-	-	X		X	X	X	X	-	X
23ADC48.CO4	X	X	X	-	-	-	-	-	-	X	X	X	X	X	X
23ADC48.CO5	X	X	X	X	-	X	-	X	-	-	X	X	X	X	X

Unit-I Introduction To Nlp **9**

Natural Language – Language Acquisition and Usage – Language Syntax and Structure – Language Semantics – Lexical Semantic Relations – Semantics Representation– Text Corpora – Accessing Text Corpora – Natural Language Processing – Text Analytics

Unit-II Processing And Understanding Text **9**

Text Tokenization – Text Normalization – Correcting Words – Stemming – Lemmatization – Text Syntax and Structure – POS Tagging – Shallow Parsing – Dependency Based Parsing – Constituency Based Parsing

Unit-III Text Classification **9**

Text Classification – Automated Text Classification – Text Classification Blueprint – Text Normalization – Feature Extraction – Bag of Words Model – TF-IDF Model – Advanced Word Vectorization Model – Classification Algorithm – Evaluating Classification Models – Building a Multi-Class Classification System – Application and Uses

Unit-IV Text Summarization **9**

Text Summarization – Text Normalization – Feature Extraction – Key Phrase Extraction – Topic Modeling – Automated Document Summarization

Unit-V Text Similarity And Clustering **9**

Information Retrieval – Feature Engineering – Similarity Measures – Unsupervised Machine Learning Algorithms – Text Normalization – Feature Extraction – Text Similarity – Analyzing Term Similarity – Analyzing Document Similarity – Document Clustering – Clustering Greatest Movies of All Time

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Dipanjan Sarkar,	"Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data	1st Edition, Apress	2016

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Michael W. Berry & Jacob Kogan	Text Mining Applications and Theory"	Wiley publications,	2010
2	Christopher Manning and Hinrich Schuetze	Foundations of Statistical Natural Language Processing	1st Edition, MIT Press, London,	2000

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		L	T	P	C
23ADC49	**Natural Language Processing Laboratory**	**0**	**0**	**2**	**1**

Course Objective:

- To helps computers communicate with humans in their own language
- To scales other language-related tasks
- will learn how to design NLP applications that perform question-answering
- create tools to translate languages, summarize text, and even build chatbots

Course Outcomes:

23ADC49.CO1	work with text extraction and processing
23ADC49.CO2	perform text classification and summarization
23ADC49.CO3	work with topic modeling and text similarity
23ADC49.CO4	helps computers communicate with humans in their own language
23ADC49.CO5	scales other language-related tasks.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC49CO1	X	X	X	x	x	x	X	x	x	x	x	x	x	x	x
23ADC49.CO2	X	X	X	x	x	x	X	x	x	x	x	x	x	x	x
23ADC49.CO3	X	X	X	x	x	x	X	x	x	x	x	x	x	x	x
23ADC49.CO4	X	X	X	x	x	x	x	x	x	x	x	x	x	x	x
23ADC49.CO5	X	X	X	x	x	x	x	x	x	x	x	x	x	x	x

Sl.No.	List of Experiments
1.	Create text corpus for analysis
2.	Work with text analytics framework
3.	Apply text processing methods for sample dataset
4.	Work with feature extraction techniques
5.	Perform text classification for sample dataset
6.	Build multiclass classification model for sample dataset

7. Perform text summarization for sample dataset

8. Work with topic modeling

Total Periods: 60

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		L	T	P	C
23ADC50	**Aws Academy Cloud Foundation**	**3**	**0**	**0**	**3**

Course Objective:

- Describe three cloud deployment models, and Overview of AWS Global infrastructure
- Understand the different AWS core services.
- Formulate virtual firewalls with security groups.
- Review the availability differences of alternative database solutions
- Can Summarize the AWS Shared Responsibility Model, Examine IAM users, groups, and roles

Course Outcomes:

23ADC50.CO1 Construct three cloud deployment models, and Overview of AWS Global infrastructure

23ADC50.CO2 Implement the different AWS compute services..

23ADC50.CO3 Create virtual firewalls with security groups

23ADC50.CO4 Construct the availability of different alternative database solutions

23ADC50.CO5 Implement AWS Shared Responsibility Model, Examine IAM users, groups, and roles

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC50.CO1	X	X	X	-	-	-	-	-	X	-	X	X	X	X	-
23ADC50.CO2	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X
23ADC50.CO3	X	X	X	X	X	-	-	X		X	X	X	X	-	X
23ADC50.CO4	X	X	X	X	-	-	-	X	-	X	X	X	X	X	X
23ADC50.CO5	X	X	X	X	-	X	-	X	-	-	X	X	X	X	X

Unit-I Cloud Concepts **9**

Cloud Concepts Overview - Introduction to Cloud Computing, Advantages of Cloud Computing, Introduction to Amazon Web Services (AWS), AWS Cloud Adoption Framework (CAF). Cloud Economics - Fundamentals of Pricing, Total Cost of Ownership, AWS Global Infrastructure Overview - AWS Global Infrastructure, AWS Service and Service Category Overview.

Unit-II Aws Core Services **9**

Compute - Compute Services Overview, Introduction to Amazon Elastic Compute Cloud (EC2), Amazon EC2 Cost Optimization, Introduction to AWS Lambda, Introduction to AWS Elastic Beanstalk. Storage - Amazon Elastic Block Store (EBS), Amazon Simple Storage Service (S3), Amazon Elastic File System (EFS), Amazon Glacier. VPC - Amazon Virtual Private Cloud (VPC), Amazon VPC Security Groups, Amazon CloudFront,.Database - Amazon Relational Database Service (RDS), Amazon DynamoDB, Amazon Redshift, Amazon Aurora. Balancing, Scaling, Monitoring - Elastic Load Balancing (ELB), Amazon CloudWatch, Auto Scaling

Unit-III Cloud Security **9**

AWS Shared Responsibility Model, AWS Identity and Access Management (IAM), AWS Trusted Advisor, AWS CloudTrail, AWS Config, AWS Day One Best Practice Review, AWS Security and Compliance Programs, AWS Security Resources

Unit-IV Cloud Architecting **9**

Introduction to the Well-Architected Framework, Well-Architected Design Principles, Understanding Reliability and High Availability.

Unit-V Cloud Support **9**

Introduction to AWS Organizations, AWS Cost Explorer, Overview of AWS Technical Support Plans andCosts

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cloud Experts	The AWS Handbook	-	2018
2.	Dan Sullivan	Official Google Cloud Certified Associate Cloud Engineer Study Guide	-	2019

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ben Piper, David Clinton	AWS Certified Cloud Practitioner Study Guide: CLF-C01 Exam	Addison-Wesley Professional	June 2019
2.	Mark Wilkins	Learning Amazon Web Services (AWS): A Hands- On Guide to the Fundamentals of AWS Cloud	Addison-Wesley Professional	July 2019
3.	Ben Piper, David Clinton	AWS Certified Cloud Practitioner Study Guide	Sybex	July 2019

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		L	T	P	C
23ADC51	**Foundation Of Data Science**	**3**	**0**	**0**	**3**

Course Objective:

- To Understand the key concepts of Data Science and its Applications
- To Analyze the results on Data Collection and Data Pre-Processing
- To Recall the mathematical concepts for descriptive and statistical analysis of the given dataset
- To Apply Model development and evaluation
- To Analyze the results on Model Evaluation metrics and validation

Course Outcomes:

23ADC51.CO1	Implement Data Science and its Applications
23ADC51.CO2	Apply results on Data Collection and Data Pre-Processing
23ADC51.CO3	Implement the Graph in Statistics.
23ADC51.CO4	Analyze Model development and evaluation
23ADC51.CO5	Analyze Model Evaluation metrics and validation

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADC51.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	X	X
23ADC51.CO2	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X
23ADC51.CO3	X	X	X	X	X	-	-	X		X	X	X	X	X	X
23ADC51.CO4	X	X	X	X	-	X	-	X	-	X	X	X	X	X	X
23ADC51.CO5	X	X	X	X	X	X	-	X	-	-	X	X	X	X	X

Unit-I Introduction **9**

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues

Unit-II Data Collection And Data Pre-Processing **9**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization

Unit-III Exploratory Data Analytics **9**

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot –

Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making

Unit-IV Model Development **9**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA

Unit-V Model Evaluation **9**

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting – Under Fitting and Model Selection Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jojo Moolayil	"Smarter Decisions : The Intersection of IoT and Data Science"	PACKT	2016

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cathy O'Neil and Rachel Schutt	"Doing Data Science"	O'Reilly	2015
2.	David Dietrich, Barry Heller, Beibei Yang	"Data Science and Big data Analytics"	EMC	2013
3.	Raj, Pethuru	"Handbook of Research on Cloud Infrastructures for Big DataAnalytics"	IGI Global	2017

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23ADC52	**Data Science Using Python Laboratory**	**0**	**0**	**2**	**1**

Course Objective:

- Understand the Python Programming packages Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Language.
- To prepare data for data analysis through understanding its distribution.
- Exposure on data processing using NUMPY and PANDAS
- To acquire knowledge in plotting using visualization tools.
- To understand and implement classification and Regression Model.

Course Outcomes:

23ADC52.CO1	Develop relevant programming abilities.
23ADC52.CO2	Demonstrate knowledge of statistical data analysis techniques
23ADC52.CO3	Exhibit proficiency to build and assess data-based models.
23ADC52.CO4	Demonstrate skill in Data management & processing tasks using Python
23ADC52.CO5	Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADC52.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADC52.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADC52.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADC52.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADC52.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Sl.No.	**List of Experiments**
1.	Working with Numpy arrays
2.	Working with Pandas data frames
3.	Basic plots using Matplotlib
4.	Frequency distributions
5.	Averages

6. Variability
7. Normal curves
8. Correlation and scatter plots
9. Correlation coefficient
10. Regression

Total Periods: 60

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23ADC53	**Game Design, Prototyping And Development**	**3**	**0**	**0**	**3**

Course Objective:

- To Understand Game Design Principles
- To Develop Prototyping Skills
- To Construct Master Unity and C# Programming.
- Examine Integrate Art and Sound:
- Demonstrate Apply Testing and Iteration Techniques:

Course Outcomes:

23ADC53.CO1	Recognize the design principles of gaming application.
23ADC53.CO2	Implement the use of gaming tools in application design automation
23ADC53.CO3	Construct an architectural design using the development process
23ADC53.CO4	Examine the prototype for an existing application
23ADC53.CO5	Demonstrate audio and visual effects in a game.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC53.CO1	X	X	-	-	-	-	-	-	X	X	X	X	X	X	-
23ADC53.CO2	X	X	X	X	X	X	-	-	X	-	X	X	X	X	X
23ADC53.CO3	X	X	-	X	X	X	-	-	X	X	X	X	X	X	X
23ADC53.CO4	X	-	X	X	X	-	-	-	X	X	X	X	X	X	X
23ADC53.CO5	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X

Unit-I Elements Of Gaming **9**

4 C's of game design- Game design atoms- Elements of chance, strategic skill and Twitchskill- Level design- Puzzle design- Design considerations for Massively MultiplayerOnline Games (MMOG) - Gaming tools.

Unit-II Game Architecture **9**

Current Development methods- Initial Design- Building block- Initial architecture design Development process..

Unit-III Game Design And Prototyping **9**

Game analysis framework- The tetra Layer- Design goals- Paper prototyping- Game testing- Math and Game balance - Game prototype: Apple picker.

Unit-IV Gaming With Pygame **9**

Introducing pygame- Understanding events- Creating visuals- Making things move Creating AI for games

Unit-V Gaming In Three Dimension **9**

Understanding 3D space- Working with OpenGL- Creating sound effects- Working with textures and Models- Setting the scene with OpenGL.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jeremy Gibson Bond	Introduction to Game Design, Prototyping, and Development	Addison-Wesley Professional	2022
2.	Jeremy Gibson Bond	Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#, 2nd Edition	Addison-Wesley Professional	2017

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23ADC54	**DEVOPS**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the basic concepts of WAMP
- To emphasize the settings for Docker
- To choose the appropriate tools for CD and CI
- To understand the basic concepts of Kubernetes
- To know the concepts of monitoring and provisioning

Course Outcomes:

23ADC54.CO1	Select and install a virtualization software and create a virtual machine for web application development using WAMP/LAMP.
23ADC54.CO2	Experiment with containerization by installing and setting up Docker and Docker Compose
23ADC54.CO3	Demonstrate Continuous Development (CD) / Continuous Integration (CI) using Jenkins integrated with other DevOps tools.
23ADC54.CO4	Make use of Kubernetes to build scalable applications on clusters to achieve load balancing.
23ADC54.CO5	Build and deploy cloud-based scalable solutions using Terraforms, Prometheus, and Grafana for effective monitoring and provisioning of resources.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADC54.CO1	X	X	X	x	x	x	x	-	X	-	x	x	x	x	x
23ADC54.CO2	X	X	X	x	x	x	x	-	X	x	x	x	x	x	x
23ADC54.CO3	X	X	X	x	x	x	x	x	-	x	x	x	x	x	x
23ADC54.CO4	X	X	X	x	x	x	x	-	-	x	x	x	x	x	x
23ADC54.CO5	X	X	X	x	x	x	x	-	-	-	x	x	x	x	x

Unit-I Introduction To Devops, Sdlc, Agile And Virtualization 9

Definition of DevOps –The need for DevOps – Key concepts and principles of DevOps – Overview of SDLC – Phases of SDLC (Planning,Analysis,Design,Development,Testing,Deployment,Maintenance) – Overview of Agile methodology – Agile principles and values – Agile practices (Scrum, Kanban, Lean) – Role of DevOps in SDLC – Continuous Integration and Continuous Deployment (CI/CD) – Virtualization vs containerization –Overview of virtualization technologies (VMware,VirtualBox). Setting up virtualization software (e.g., VirtualBox, VMware) and creating a virtual machine. Installing and configuring a Linux distribution on the virtual machine. Setting up a web application development environment with the LAMP stack (Linux, Apache, MySQL, PHP). Setting up version control with Git and creating a simple Git repository. Implementing Agile methodology with a team-based project using Scrum, Kanban or Lean methodologies.

Unit-II Containerization And Docker 9

Overview of containerization - Introduction to Docker - Docker architecture and components - Docker images and containers - Docker CLI commands – Docker file for building custom images - Docker Compose for multi-container applications. Installing and setting up Docker on a Linux machine. Building a Docker image using a

Docker file. Running a Docker container and accessing its shell. Creating and running a multi-container application with Docker Compose. Deploying a Docker container to a remote server

Unit-III Ci/Cd With Jenkins Pipeline 9

Introduction to Jenkins - Understanding Continuous Integration and Continuous Delivery/Deployment - Jenkins architecture and components - Setting up Jenkins and Creating jobs - Jenkins Pipeline as code - Jenkins Master-Slave setup - Jenkins security and User Management - Integrating Jenkins with other DevOps tools. Installing and setting up Jenkins on a Linux machine. Setting up a Jenkins pipeline job. Configuring the pipeline job to build and test a sample application from a Git Hub repository. Integrating the pipeline job with a Docker registry to store and deploy the Docker image. Adding notifications and alerts to the pipeline job using Slack or email.

Unit-IV Kubernetes 9

Introduction to Kubernetes - Kubernetes architecture and components - Kubernetes cluster setup and configuration - Kubernetes objects (Pods, Services, Deployments, etc.) - Kubernetes CLI commands - Kubernetes Networking and Service Discovery - Scaling and selfhealing with kubernetes. Creating and managing applications with Kubernetes. Installing and setting up Kubernetes on a local machine or a cloud provider. Deploying a sample application to Kubernetes using Kubernetes CLI commands. Creating and managing Kubernetes objects (Pods, Services, Deployments, etc.). Scaling the application by creating replicas and load balancing with Kubernetes. Upgrading and rolling back the application with Kubernetes.

Unit-V Terraform, Prometheus, And Grafana 9

Introduction to Infrastructure as Code (IaC) - Overview of Terraform - Terraform Configuration file - Terraform Providers and State Management - Terraform Modules and Variables - Provisioning Resources with Terraform - Overview of monitoring and alerting - Introduction to Prometheus and Grafana - Setting up Prometheus and Grafana - Creating and visualizing metrics with Prometheus and Grafana. Installing and setting up Terraform on a Linux machine. Creating and managing infrastructure using Terraform. Creating and configuring a Prometheus server to monitor a sample application. Setting up alert rules and notifications with Prometheus and Alert manager. Creating and visualizing metrics with Grafana

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gene Kim, Patrick Debois, John Willis, and Jez Humble	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations	IT Revolution Press	2016.

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		L	T	P	C
23ADE01	**Software Development Processes**	**3**	**0**	**0**	**3**

Course Objective:

- To acquire knowledge on software process management
- To acquire managerial skills for software project development.
- To understand software economics
- To acquire knowledge about real time software development scenarios.
- To understand real time software development processes

Course Outcomes:

23ADE01.CO1	Understand the software process phases in the cycle of software development.
23ADE01.CO2	Gain knowledge of software economics, project organization, projectcontrol and process instrumentation
23ADE01.CO3	Analyze the major and minor milestones, artifacts and metrics from management and technical perspective.
23ADE01.CO4	Design and develop software product using conventional and modern principles of software project management
23ADE01.CO5	Analyze the real time software development processes.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE01.CO1	x	-	x	-	x	-	x	-	-	x	-	x	-	x	-
23ADE01.CO2	x	-	x	-	-	x	-	x	x	x	-	-	x	-	-
23ADE01.CO3	x	x	-	x	x	x	-	x	x	x	-	-	-	x	-
23ADE01.CO4	x	-	x	-	-	-	-	-	x	x	x	x	-	x	x
23ADE01.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Software Process **9**

Software Process Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP)

Unit-II Software Economics And Lifecycle **9**

Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

Unit-III Software Processes Planning **9**

Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments. Process Planning Work breakdown structures, Planning

guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

Unit-IV Project Management And Metrics 9

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation

Unit-V Unit Title 9

CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Watts S. Humphrey	Managing the Software Process	Pearson Education	-
2.	Walker Royce	Software Project Management	Pearson Education	-

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Watts S. Humphrey, James R. Persse, O'Reilly	An Introduction to the Team Software Process	O'Reilly	2006
2.	Bob Hughes & Mike Cotterell	Software Project Management	fourth edition, TMH	2006
3.	Andrew Stellman & Jennifer Greene	Applied Software Project Management	O'Reilly	2007
4.	Jennifer Greene & Andrew Stellman	Head First PMP	O'Reilly	2007
5.	Richard H. Thayer & Edward Yourdon	Software Engineering Project Management	2 nd edition, Wiley India	2004
6.	Jim Highsmith	Agile Project Management	Pearson education	2004

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23ADE02	**Microprocessors And Microcontrollers**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

Course Outcomes:

23ADE02.CO1	Understand and execute programs based on 8086 microprocessor.
23ADE02.CO2	Design Memory Interfacing circuits.
23ADE02.CO3	Design and interface I/O circuits.
23ADE02.CO4	Design microcontroller based system
23ADE02.CO5	Design and implement 8051 microcontroller based systems.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE02.CO1	x	-	x	-	x	-	x	-	-	x	-	x	-	x	-
23ADE02.CO2	x	-	x	-	-	x	-	x	x	x	-	-	x	-	-
23ADE02.CO3	x	x	-	x	x	x	-	x	x	x	-	-	-	x	-
23ADE02.CO4	x	-	x	-	-	-	-	-	x	x	x	x	-	x	x
23ADE02.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I The 8086 Microprocessor **9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation

Unit-II 8086 System Bus Structure **9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

Unit-III I/O Interfacing **9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

Unit-IV Microcontroller **9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

Unit-V Interfacing Microcontroller **9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARMprocessors

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Yu-Cheng Liu, Glenn A.Gibson	Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design	Second Edition, Prentice Hall of India	2007
2.	Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay	The 8051 Microcontroller and Embedded Systems: Using Assembly and C	Second Edition, Pearson education	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Doughlas V.Hall	Microprocessors and Hardware	TMH	2012
2.	A.K.Ray,K.M.Bhurchandi	Advanced Microprocessors and Peripherals	3rd edition, Tata McGrawHill	2012

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23ADE03	Engineering Predictive Analytics	L	T	P	C
		3	0	0	3

Course Objective:

1. To explain terminology, technology and applications of predictive analysis
2. To apply data preparation techniques and generate appropriate association rules.
3. To discuss various descriptive models, their merits, demerits and application.
4. To describe various predictive modelling methods.
5. To introduce the text mining tools, technologies and case study which is used in day-to- day analytics cycle

Course Outcomes:

23ADE03.CO1 Explain terminology, technology and applications of predictive analysis

23ADE03.CO2 Explain terminology, technology and applications of predictive analysis

23ADE03.CO3 Discuss various descriptive models, their merits, demerits and application.

23ADE03.CO4 Describe principles of predictive analytics and apply them to achieve real, pragmatic solutions.

23ADE03.CO5 Illustrate the features and applications of text mining.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE03.CO1	x	-	x	-	x	-	x	-	-	x	-	x	-	x	-
23ADE03.CO2	x	-	x	-	-	x	-	x	x	x	-	-	x	-	-
23ADE03.CO3	x	x	-	x	x	x	-	x	x	x	-	-	-	x	-
23ADE03.CO4	x	-	x	-	-	-	-	-	x	x	x	x	-	x	x
23ADE03.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Introduction To Predictive Analytics **9**

Overview of Predictive Analytics- Setting Up the Problem - Data Understanding- Single Variable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions- The Value of Statistical Significance- Pulling It All Together into a Data Audit.

Unit-II Data Preparation And Association Rules **9**

Data Preparation- Variable Cleaning- Feature Creation- Item sets and Association Rules-Terminology- Parameter Settings- How the Data Is Organized- Measures of Interesting Rules- Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules

Unit-III Modelling **9**

Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation

Unit-IV Predictive Modelling **9**

Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms.

Unit-V Text Mining **9**

Motivation for Text Mining- A Predictive Modeling Approach to Text Mining- Structured vs. Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features- Modeling with Text Mining Features- Regular Expressions- Case Studies:- Survey Analysis.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dean Abbott	"Applied PredictiveAnalytics- Principles and Techniques for the Professional Data Analyst"	Wiley,	2014
2.	Jiawei Han and Micheline Kamber	Data Mining Concepts and Techniques	ThirdEdition, Elsevier	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Conrad Carlberg	"Predictive Analytics: Microsoft Excel"	1st Edition, Que Publishing	2012
2.	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer	2013
3.	Alberto Cordoba	"Understanding the Predictive Analytics Lifecycle"	Wiley	2014
4.	Anasse Bari, Mohammad Chaouchi, Tommy Jung,	Predictive Analytics for Dummies	2nd Edition	2017

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		L	T	P	C
3ADE04	**Agile Methodologies**	**3**	**0**	**0**	**3**

Course Objective:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing.

Course Outcomes:

23ADE04.CO1	Realize the importance of interacting with business stakeholders in determining the requirements for a software system
23ADE04.CO2	Perform iterative software development processes: how to plan them, how to execute them.
23ADE04.CO3	Point out the impact of social aspects on software development success.
23ADE04.CO4	Develop techniques and tools for improving team collaboration and software quality.
23ADE04.CO5	Perform Software process improvement as an ongoing task for development teams.

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE04.CO1	x	-	x	-	x	-	x	-	-	x	-	x	-	x	-
23ADE04.CO2	x	-	x	-	-	x	-	x	x	x	-	-	x	-	-
23ADE04.CO3	x	x	-	x	x	x	-	x	x	x	-	-	-	x	-
23ADE04.CO4	x	-	x	-	-	-	-	-	x	x	x	x	-	x	x
23ADE04.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Agile Methodology **9**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model- Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

Unit-II Agile Processes **9**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development- Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

Unit-III Agility And Knowledge Management **9**

Agile Information Systems – Agile Decision Making - Earl'S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile

Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

Unit-IV Agility And Requirements Engineering 9

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile– Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation

Unit-V Agility And Quality Assurance 9

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development –Agile Approach in Global Software Development.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David J. Anderson and Eli Schragenheim	Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results	Prentice Hall	2003
2.	Hazza and Dubinsky	Agile Software Engineering, Series: Undergraduate Topics inComputer Science	Springer	2009

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Craig Larman	Agile and Iterative Development: A Manager‘s Guide	Addison-Wesley	2004
2.	Kevin C. Desouza	Agile Information Systems: Conceptualization, Construction, and Management	Butterworth-Heinemann	2007

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23ADE05	Parallel Computing	L	T	P	C
		3	0	0	3

Course Objective:

- To understand different parallelism techniques.
- To know parallel architecture.
- To learn about parallel algorithm design
- Understand parallel programming
- Learn about the interpretation of parallel programming

Course Outcomes:

23ADE05.CO1	Understand different parallel computing technique
23ADE05.CO2	Learn parallel computing architecture
23ADE05.CO3	Learn to design parallel algorithms
23ADE05.CO4	Understand how to develop parallel program
23ADE05.CO5	Know compiler interpretation of parallel programming

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE05.CO1	x	-	x	-	x	-	x	-	-	x	-	x	-	x	-
23ADE05.CO2	x	-	x	-	-	x	-	x	x	x	-	-	x	-	-
23ADE05.CO3	x	x	-	x	x	x	-	x	x	x	-	-	-	x	-
23ADE05.CO4	x	-	x	-	-	-	-	-	x	x	x	x	-	x	x
23ADE05.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Introduction **9**

Historical progression leading to current state – types of parallism including temporal, data and functional. Instructional level parallelism – pipelined processors – super scalar processors – VLIW processors – multithreaded processors – proposed future processors including trace, multiscalar and super flow – case studies

Unit-II Parallel Architectures **9**

Classification – inter connection networks – vector computers – shared memory parallel computers – cache coherence – distributed shared memory parallel computers – message passing parallel computers – cluster of workstations.

Unit-III Parallel Algorithms Platform **9**

Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models

Unit-IV Parallel Programming Desgn **9**

Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.

Unit-V Compiler Transformations And Performance Evaluation **9**

Dependence analysis loop transformations – transformations for parallel computers including data layouts, computational and communication optimization. Peformance Metrics –performance lows – scalability – performance measurement books.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V. Rajaraman and C. Siva Ram Murthy	"Parallel Computers – Architecture and Programming"	Prentice-Hall of India	2003
2.	Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar	"Introduction toParallel Computing"	Pearson Education, Second edition	2004

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Selim G.Akl	The design and analysis of parallel algorithms	Prentice Hall International Inc	2189
2.	Hwang K. Briggs F.A.	Computer Architecture and parallel processing	MCGraw Hill	2185
3.	Shameem Akhter and Jason Roberts	Multi-core Programming	Intel Press	2006

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23ADE06	**Software Architecture**	**3**	**0**	**0**	**3**

Course Objective:

- Understand the fundamentals of software architecture.
- Study the various software development methodologies.
- Learn the importance of architectural documentation and evaluation.
- Learn the various software architecture design components.
- Relate software architecture and software quality.

Course Outcomes:

23ADE06.CO1	Develop Software applications starting from software architecture and design.
23ADE06.CO2	Learn and evaluate existing software architectures.
23ADE06.CO3	Realize importance of architectural documentation and document them.
23ADE06.CO4	Employ various software architecture design components.
23ADE06.CO5	Design methods for improving software quality from the perspective of software architecture.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE06.CO1	x	x	-	x	x	-	x	-	-	x	x	x	-	x	-
23ADE06.CO2	x	-	x	-	-	x	-	x	x	x	-	-	x	-	-
23ADE06.CO3	x	x	x	x	x	x	-	x	x	x	-	-	-	x	-
23ADE06.CO4	x	-	x	-	-	-	x	-	x	x	x	x	-	x	x
23ADE06.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Introduction **9**

Basic concepts of software architecture – Context of Software Architecture – ABC cycle – What software architecture is and what it isn't – Architectural patterns – Good Architecture- Reference models – Architectural structures and views-Introduction to styles – Decentralized Architectures

Unit-II Design Methodologies **9**

Structured design- Design practices-Stepwise refinement – Incremental design- Structured system analysis and design –Jackson structured programming – Jackson system Development.

Unit-III Architectural Description Documentation And Evaluation **9**

Early architecture description languages-Domain and style specific ADL's- Extensible ADL's – Documenting software architecture – Uses and Audiences for Architecture Documentation – Views – Choosing Views – Combining Views –Architecture evaluation – Evaluation Factors – Architecture Tradeoff Analysis Method –

Lightweight Architecture Evaluation – ATAM.

Unit-IV Architecture Design 9

Typical architectural design-Dataflow-Independent components-Call and return – Using styles in design – Architectural design space-Design space of architectural elements – Design space of architectural styles.

Unit-V Implementation And Conformance To Architecture 9

Understanding quality attributes- Implementation of Quality attributes in Architecture – Architecture and requirements conformance –Functionality– Quality attribute considerations – System quality attributes-Introduction to tactics – Achieving Quality Attributes through Tactics – Tactics types –Architectural patterns and styles – Architecture and Quality Attributes – Quality attribute scenarios in practice.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Len Bass, Paul Clements, Rick Kazman	Software Architecture in Practice	Third Edition, Addison,Wesley	2012
2.	David Budgen	Software Design	Second Edition, Pearson Education	2004

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy	SoftwareArchitecture, Foundations,Theory and Practice	Wiley	2010
2.	Hong Zhu	Software Design Methodology from Principles to Architectural Styles	Elsevier	2005
3.	Mary Shaw and David Garlan	Software Architecture – Perspectives on an emergingDiscipline	Pearson Education	2008

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23ADE07	**Internet Of Things**	**3**	**0**	**0**	**3**

Course Objective:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

Course Outcomes:

23ADE07.CO1 Explain the concept of IoT.

23ADE07.CO2 Analyze various protocols for IoT.

23ADE07.CO3 Design a PoC of an IoT system using Rasperry Pi/Arduino

23ADE07.CO4 Apply data analytics and use cloud offerings related to IoT.

23ADE07.CO5 Analyze applications of IoT in real time scenario

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE07.CO1	x	-	-	-	x	-	x	-	-	-	x	x	-	x	-
23ADE07.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
23ADE07.CO3	x	x	-	-	x	x	-	x	x	x	-	-	-	x	-
23ADE07.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE07.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Fundamentals Of Iot **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

Unit-II Iot Protocols **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 2101.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

Unit-III Design And Development **9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python

Programming.

Unit-IV Data Analytics And Supporting Services 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

Unit-V Case Studies/Industrial Applications 9

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things	CiscoPress	2017
2.	Arshdeep Bahga, Vijay Madisetti	Internet of Things – A hands-on approach	Universities Press	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Olivier Hersent, David Boswarthick, Omar Elloumi	The Internet of Things – Key applications and Protocols	Wiley	2012
2.	Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle	From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence	Elsevier	2014
3.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds)	Architecting the Internet of Things	Springer	2011
4.	Michael Margolis, Arduino Cookbook	Recipes to Begin, Expand, and Enhance Your Projects	2nd Edition, O'Reilly Media	2011

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		L	T	P	C
23ADE08	**Health Care Analytics**	**3**	**0**	**0**	**3**

Course Objective:

- Understand the health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

Course Outcomes:

23ADE08.CO1	Use machine learning and deep learning algorithms for health data analysis
23ADE08.CO2	Apply the data management techniques for healthcare data
23ADE08.CO3	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
23ADE08.CO4	Design health data analytics for real time applications
23ADE08.CO5	Design emergency care system using health data analysis

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE08.CO1	x	-	-	-	x	-	x	-	-	-	x	x	-	x	-
23ADE08.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
23ADE08.CO3	x	x	-	-	x	x	-	x	x	x	-	-	-	x	-
23ADE08.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE08.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Introduction To Healthcare Analysis **9**

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

Unit-II Analytics On Machine Learning **9**

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations –

Scikit –Learn : Pre-processing , Feature Selection.

Unit-III Health Care Management 9

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

Unit-IV Healthcare And Deep Learning 9

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

Unit-V Case Studies 9

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data

Analysis.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chandan K.Reddy, Charu C. Aggarwal	Health Care data Analysis	First edition, CRC	2015
2.	Vikas Kumar	Health Care Analysis Made Simple	Packt Publishing	2018

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl	Health Care Data Analysis and Management	First Edition, Academic Press	2018
2.	Hui Jang, Eva K.Lee	HealthCare Analysis : From Data to Knowledge to Healthcare Improvement	First Edition, Wiley	2016
3.	Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki	Big Data Analytics in HealthCare	Springer	2020

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23ADE09	Distributed Systems	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

Course Outcomes:

23ADE09.CO1	Elucidate the foundations and issues of distributed systems
23ADE09.CO2	Understand the various synchronization issues and global state for distributed systems.
23ADE09.CO3	Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems
23ADE09.CO4	Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
23ADE09.CO5	Describe the features of peer-to-peer and distributed shared memory systems

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE09.CO1	x	-	-	-	x	-	x	-	-	-	x	x	-	x	-
23ADE09.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
23ADE09.CO3	x	x	-	-	x	x	-	x	x	x	-	-	-	x	-
23ADE09.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE09.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Introduction **9**

Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication – Synchronous versus asynchronous executions –Design issues and challenges. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks – Global state – Cuts –Past and future cones of an event –Models of process communications. Logical Time: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP

Unit-II Message Ordering & Snapshots **9**

Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. Global state and snapshot recording algorithms: Introduction –System model

and definitions –Snapshot algorithms for FIFO channels

Unit-III Distributed Mutex & Deadlock 9

Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model.

Unit-IV Recovery & Consensus 9

Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. Consensus and agreement algorithms: Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

Unit-V P2P & Distributed Shared Memory 9

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kshemkalyani, Ajay D., and Mukesh Singhal	Distributed computing: principles,algorithms, and systems	Cambridge University Press	2011
2.	George Coulouris, Jean Dollimore and Tim Kindberg	Distributed Systems Concepts andDesign	Fifth Edition, Pearson Education	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pradeep K Sinha	Distributed Operating Systems: Concepts and Design	Prentice Hall of India	2007
2.	Mukesh Singhal and Niranjan G. Shivaratri	Advanced concepts in operating systems	McGraw-Hill, Inc.,	2194
3.	Tanenbaum A.S., Van Steen M.,	Distributed Systems: Principles and Paradigms	Pearson Education	2007

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23ADE10	**Mobile Applications Development**	**3**	**0**	**0**	**3**

Course Objective:

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in marketplace for distribution

Course Outcomes:

23ADE10.CO1 Describe the requirements for mobile applications
23ADE10.CO2 Design user interface for mobile applications
23ADE10.CO3 Store mobile data of android applications
23ADE10.CO4 Evaluate native capabilities of android applications
23ADE10.CO5 Design iOS applications with tools

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE10.CO1	x	-	-	-	x	-	x	-	-	-	x	x	-	x	-
23ADE10.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
23ADE10.CO3	x	x	-	-	x	x	-	x	x	x	-	-	-	x	-
23ADE10.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE10.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Introduction To Mobile Applications **9**

Web Vs mobile App – Cost of Development – Myths - Mobile Applications – Marketing - Mobile User Interface Design - Effective Use of Screen – Mobile Users - Mobile Information Design - Mobile Platforms - Tools of Mobile Interface Design

Unit-II Android User Interface Design **9**

Android Architecture – Android SDK Tools - Application Components - Intents - Content providers - Broadcast receivers – Services - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Notifications - Android Localization

Unit-III Android Data Storage **9**

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media Store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLite Databases

Unit-IV Android Native Capabilities **9**

Camera – Audio - Sensors and Bluetooth - Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services - Location Updates - Location Providers - Selecting a Location Provider - Finding Location

Unit-V Ios Design **9**

iPhone Craze – iOS Features – iOS Tools - iOS Project – Objective C Basics – Building iOS App– Actions and Outlets – Delegates - User Interface Elements – Accelerometer – Location Handling - SQLite Database

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jeff McWherter and Scott Gowell	Professional Mobile Application Development	Wrox	2012
2.	Reto Meier	Professional Android 4 Development	John Wiley and Sons	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson	Beginning iOS 6 Development: Exploring the iOS SDK	Apress	2013

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		L	T	P	C
23ADE11	**Software Testing And QualityAssurance**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the basics of testing, planning, designing and managing test cases.
- To study the various types of test in the life cycle of the software product.
- To build design concepts for system testing and execution.
- To learn the software quality assurance ,metrics, defect prevention techniques
- To learn the techniques for quality assurance and applying for applications.

Course Outcomes:

23ADE11.CO1	Understand the testing, planning, designing and managing test cases.
23ADE11.CO2	Perform functional and non-functional tests in the life cycle of the software product.
23ADE11.CO3	Understand system testing and test execution process.
23ADE11.CO4	Identify defect prevention techniques and software quality assurance metrics.
23ADE11.CO5	Apply techniques of quality assurance for typical applications.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE11.CO1	x	x	-	-	x	-	x	-	-	x	x	x	-	x	-
23ADE11.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
23ADE11.CO3	x	x	-	-	x	x	-	x	-	-	-	-	-	-	-
23ADE11.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE11.CO5	x	x	-	x	x	-	-	-	x	-	x	x	x	-	x

Unit-I Software Testing - Concepts, Issues, And Techniques 9

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, COURSE OBJECTIVES of Testing, Testing Activities, Test Case Selection White-Box and Black, test Planning and design, Test Tools and Automation, Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building

Unit-II System Testing 9

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

Unit-III System Test Categories **9**

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. System test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

Unit-IV Software Quality **9**

Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model.

Unit-V Software Quality Assurance **9**

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kshirasagar Naik, Priyadarshi Tripathy	Software Testing And Quality Assurance-Theory and Practice	John Wiley & Sons Inc	2008
2.	Daniel Galin	Software Quality Assurance - From Theory to Implementation	Pearson Education Ltd UK	2004

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hoboken, New Jersey	Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement	John Wiley & Sons, Inc.,	2005
2.	Milind Limaye	Software Quality Assurance	TMH ,New Delhi	2011

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23ADE12	**Cloud Computing**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

Course Outcomes:

23ADE12.CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
23ADE12.CO2	Learn the key and enabling technologies that help in the development of cloud.
23ADE12.CO3	Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
23ADE12.CO4	Explain the core issues of cloud computing such as resource management and security.
23ADE12.CO5	Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE12.CO1	x	-	-	-	x	-	x	-	-	-	x	x	-	x	-
23ADE12.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
23ADE12.CO3	x	x	-	-	x	x	-	x	x	x	-	-	-	x	-
23ADE12.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE12.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

Unit-I Introduction **9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning

Unit-II Cloud Enabling Technologies **9**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish- Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and

Disaster Recovery.

Unit-III Cloud Architecture, Services And Storage 9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

Unit-IV Resource Management And Security In Cloud 9

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security– IAM – Security Standards.

Unit-V Cloud Technologies And Advancements 9

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment forGoogle App Engine –– Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra	Distributed and Cloud Computing, FromParallel Processing to the Internet of Things	Morgan Kaufmann Publishers	2012
2.	Rittinghouse, John W., and James F. Ransome	Cloud Computing: Implementation, Management and Security	CRC Press	2017

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi	Mastering Cloud Computing	Tata Mcgraw Hill	2013
2.	Toby Velte, Anthony Velte, Robert Elsenpeter	Cloud Computing - A Practical Approach	Tata Mcgraw Hill	2009
3.	George Reese	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)	O'Reilly	2009

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23ADE13	**Embedded Systems AndProgramming**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the architecture of embedded processors, microcontrollers and peripheral devices
- To learn programming the embedded processor in assembly
- To understand the challenges in developing operating systems for embeddedsystems
- To learn programming the embedded systems in high level language such as C
- To understand the Real time operating systems

Course Outcomes:

23ADE13.CO1	Understand the embedded systems
23ADE13.CO2	Learn the embedded systems Architecture
23ADE13.CO3	Understand the embedded systems programming
23ADE13.CO4	Learn about the real time operating systems
23ADE13.CO5	Understand the concept on micro C

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE13.CO1	x	-	x	-	-	x	x	-	x	-	x	x	-	-	x
23ADE13.CO2	x	-	-	x	-	x	-	x	x	x	-	-	x	x	-
23ADE13.CO3	x	x	-	-	x	x	-	x	-	x	-	-	-	-	-
23ADE13.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE13.CO5	x	x	x	x	x	-	x	-	x	-	x	x	x	-	-

Unit-I Introduction To Embedded System **9**

Components of Embedded System – Classification - Characteristic of embedded system- Microprocessors & Micro controllers- Introduction to embedded processors - Embedded software architectures: Simple control loop - Interrupt controlled system - Cooperative multitasking - Preemptive multitasking or multi-threading - Micro kernels and kernels - Monolithic kernels -

Exotic custom operating systems.

Unit-II Embedded Hardware Architecture **9**

ARM 2 TDMI core based 32 Bitmicrocontrollers and family of processors, Register, Memory and Data transfer, Arithmetic and Logic instructions, Assembly Language, I/O operations interrupt structure, ARM cache. ARMBus,

Embedded systems with ARM.

Unit-III Real Time Operating Systems 9

Tasking Models, Task States, Services and Transitions - Real- Time Scheduling Algorithms: Round-Robin, FIFO, Priority-Based Preemptive Scheduling - Rate-Monotonic Scheduling - Priority Inversion and Priority Ceiling - Deadlocks - Process Synchronization – IPC - Shared Memory, Memory Locking, Memory Allocation - Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual Sockets.

Unit-IV Software Development 9

Embedded Programming in C and C++ - Source Code Engineering Toolsfor Embedded C/C++- Program Modeling Concepts in Single and Multiprocessor Systems - Software Development Process - Software Engineering Practices in the Embedded Software Development – Hardware / Software Co-design in an Embedded System

Unit-V Study Of Micro C/Os-Ii 9

RTOS System Level Functions – Task Service Functions Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions Mailbox Related Functions – Queue Related Functions – Case Studies of Programming withRTOS.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajkamal	Embedded System: Architecture, Programming and Design	Tata McGraw-Hill	2003
2.	Wayne Wolf	Computers as Components – Principles of Embedded Computing System Design	Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, First Indian Reprint	2001

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Steve Heath	Embedded Systems Design	Newnes, Second edition	2003
2.	Noergaard	Embedded System Architecture	Elsevier India Private Limited	2005
3.	Sriram Iyer and Pankaj Gupta	Embedded Real Time Systems Programming	TataMcGraw-Hill	2004

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23ADE14	**Operations And Supply ChainManagement**	**3**	**0**	**0**	**3**

Course Objective:

- To provide an insight on the operations
- To provide quality management and sampling tools
- To analyze fundamentals of supply chain networks
- To develop tools and techniques
- To understand supplier relationship management

Course Outcomes:

23ADE14.CO1	To know about the operations and fundamentals of supply chain
23ADE14.CO2	To understand the quality management tools and sampling process
23ADE14.CO3	To understand the design factors and various design options of distribution networks in industries and the role of transportation and warehousing
23ADE14.CO4	To understand the various sourcing decisions in supply chain
23ADE14.CO5	To understand the supply chain management in IT industries

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE14.CO1	x	-	x	-	-	x	x	-	x	-	x	x	-	-	x
23ADE14.CO2	x	-	-	x	-	x	-	x	x	x	-	-	x	x	-
23ADE14.CO3	x	x	-	-	x	x	-	x	-	x	-	-	-	-	-
23ADE14.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
23ADE14.CO5	x	x	x	x	x	-	x	-	x	-	x	x	x	-	-

Unit-I Introduction To Operations And Supply Chain Management 9

Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles - The Operations Function - The Evolution of Operations and Supply Chain Management – Globalization - Productivity and Competitiveness - Strategy and Operations-Operational Decision-Making Tools: Decision Analysis-Decision Analysis with and without Probabilities

Unit-II Quality Management 9

Quality and Value in Athletic Shoes -What Is Quality-Quality Management System-Quality Tools- Quality in Services-Six Sigma-Quality Costs and Productivity-Quality Awards-ISO 9000-Statistical Process Control-

Operational Decision-Making Tools: Acceptance Samp

Unit-III Network Design And Transportation 9

Factors influencing Distribution network design – Design options for Distribution Network-– factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation

Unit-IV Sourcing And Coordination 9

Role of sourcing supply chain - supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co- ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

Unit-V Supply Chain And Information Technology 9

The role IT in supply chain- The supply chain IT frame work - Customer Relationship Management– Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Roberta S. Russell, Bernard W. Taylor	Operations and Supply Chain Management	10thEdition, Wiley Publications	2021
2.	Sunil Chopra, Peter Meindl and Kalra	Supply Chain Management, Strategy, Planning, and Operation	Pearson Education	2010

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jeremy F.Shapiro	Modeling the Supply Chain	Thomson Duxbury	2002
2.	Srinivasan G.S	Quantitative models in Operations and Supply Chain Management	PHI	2010
3.	David J.Bloomberg , Stephen Lemay and Joe B.Hanna	Logistics	PHI	2002
4.	James B.Ayers	Handbook of Supply Chain Management	St.Lucle press	2000

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23ADE15	**Speech Processing And Analytics**	**3**	**0**	**0**	**3**

Course Objective:

1. To understand the need for morphological processing and their representation
2. To know about the various techniques used for speech synthesis and recognition
3. To appreciate the syntax analysis and parsing that is essential for natural language processing
4. To learn about the various representations of semantics and discourse
5. To have knowledge about the applications of natural language processing

Course Outcomes:

23ADE15.CO1	Identify the different linguistic components of natural language
23ADE15.CO2	Design a morphological analyser for a given natural language
23ADE15.CO3	Decide on the appropriate parsing techniques necessary for a given language and application
23ADE15.CO4	Design new tagset and a tagger for a given natural language
23ADE15.CO5	Design applications involving natural language

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE15.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE15.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE15.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE15.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE15.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Speech Processing **9**

Phonetics –Articulatory Phonetics -Phonological Categories -Acoustic Phonetics and Signals - Speech Synthesis – Text Normalization –Phonetic and Acoustic Analysis -Diphone Waveform synthesis –Evaluation-Automatic Speech Recognition –Architecture -Hidden Markov Model to Speech -MFCC vectors -Acoustic Likelihood Computation -Evaluation. Triphones – Discriminative Training -Modeling Variation. Computational Phonology-Finite-State Phonology–Computational Optimality Theory -Syllabification -Learning Phonology and Morphology

Unit-II Speech Analysis **9**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures

– mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and

Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths

Unit-III Speech Modeling 9

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

Unit-IV Speech Recognition 9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

Unit-V Speech Synthesis 9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jurafsky and Martin	Speech and Language Processing	Pearson Prentice Hall,Second Edition	2008
2.	Lawrence Rabinerand Biing-Hwang Juang	Fundamentals of Speech Recognition	Pearson Education	2003

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Steven W. Smith	The Scientist and Engineer's Guide to Digital Signal Processing	California Technical Publishing	-
2.	Thomas F Quatieri	Discrete-Time Speech Signal Processing – Principles and Practice	Pearson Education	-
3.	Claudio Becchetti and Lucio Prina Ricotti	Speech Recognition	John Wiley and Sons	2199
4.	Ben gold and Nelson Morgan	Speech and audio signal processing processing and perception of speech and music	Wiley- India Edition	2006
5.	Frederick Jelinek	Statistical Methods of Speech Recognition	MIT Press	-

		L	T	P	C
23ADE16	**Social Network Analytics**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To learn Extraction And Mining Communities
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

Course Outcomes:

23ADE16.CO1	Develop semantic web related applications.
23ADE16.CO2	Represent knowledge using ontology.
23ADE16.CO3	Extracting evolution of Web Community
23ADE16.CO4	Predict human behaviour in social web and related communities.
23ADE16.CO5	Visualize social networks.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE16.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE16.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE16.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE16.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE16.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Introduction **9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

Unit-II Modelling, Aggregating And Knowledge Representation **9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships -Aggregating and reasoning with social network

data - Advanced representations.

Unit-III Extraction And Mining Communities In Web Social Networks 9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

Unit-IV Predicting Human Behaviour And Privacy Issues 9

Understanding and predicting human behaviour for social communities - User data management- Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Unit-V Visualization And Applications Of Social Etworks 9

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations- Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Peter Mika	Social Networks and the Semantic Web	First Edition, Springer	2007
2.	Borko Furht	Handbook of Social Network Technologies and Applications	1st Edition, Springer	2010

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Guandong Xu ,Yanchun Zhang and Lin Li	Web Mining and Social Networking – Techniques and applications	First Edition, Springer	2011
2.	Dion Goh and Schubert Foo	Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively	IGI Global Snippet	2008

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23ADE17	**CYBER SECURITY**	**3**	**0**	**0**	**3**

Course Objective:

- To study the basics of Cyber security.
- To know about the security aspects operating systems and networks.
- To explore Cryptography , IDS and IPS
- To study the privacy principles and policies.
- To know about the Security management and incidents.

Course Outcomes:

23ADE17.CO1	Explain the basic concepts of computer security
23ADE17.CO2	Devise methods for Security in operating system & networks
23ADE17.CO3	Differentiate the various security counter measures.
23ADE17.CO4	Devise Privacy principles and policies
23ADE17.CO5	Manage the Cyber space.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE17.CO1	x	-	x	-	-	x	x	-	x	-	x	x	-	x	-
23ADE17.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	x	-
23ADE17.CO3	x	x	-	-	x	-	x	x	-	x	-	-	-	-	-
23ADE17.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	x	x
23ADE17.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	-	-

Unit-I Introduction To Cyber Security **9**

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls – Authentication- Access Control and Cryptography - Web-User Side - Browser Attacks - Web Attacks- Targeting Users - Obtaining User or Website Data - Email Attacks.

Unit-II Security In Operating System & Networks **9**

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack-Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

Unit-III Defences: Security Counter Measures **9**

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

Unit-IV Privacy In Cyberspace **9**

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining -Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies

Unit-V Management And Incidents **9**

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting -Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare andHome Land Security.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jan L.Harrington	Network Security – A Practical Approach	MorganKaufmann Publishers –An Imprint of Elsevier	2005
2.	William Stallings	Cryptography and Network Security – Principles and Practice	Pearson Education Asia, Fourth Edition	2005

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Edward Amoroso	Cyber Security	Silicon Press	2006
2.	Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies	Security in Computing	5th Edition , Pearson Education	2015
3.	George K.Kostopoulous	Cyber Space and Cyber Security	CRC Press	2013
4.	MarttiLehto, PekkaNeittaanmäki	Cyber Security: Analytics, Technology and Automation edited	Springer International Publishing Switzerland	2015
5.	Nelson Phillips and EnfingerSteuart	Computer Forensics and Investigations	CengageLearning, New Delhi	2009

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23ADE18	Web Services And Api Design	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the types of web services, resources, APIs and their architectures
- To analyze the web service / API design patterns
- To understand the design principles and best practices
- To develop, deploy RESTful web service APIs in JAVA
- To understand the security concerns.

Course Outcomes:

23ADE18.CO1 Use a suitable architecture for a given design problem

23ADE18.CO2 Analyze the types of resources and suitable design patterns for development and deployment

23ADE18.CO3 Create and Analyze front-end and Back end designs

23ADE18.CO4 Deploy RESTful API web services using JAVA

23ADE18.CO5 Implement security best practices for preventing security attacks

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE18.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE18.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE18.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE18.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE18.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Introduction **9**

Web Services - Building Blocks, Types; Service Oriented architectures - resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand.

Unit-II Resources And Design Patterns **9**

Resources - Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns.

Unit-III Restful Api Design Principles **9**

API front End Design, API back end Design, Identifier Design, Interaction Design with HTTP, Metadata Design, Representation Design, URI design, REST constraints, Best Practices

Unit-IV Development And Depolyment **9**

Frameworks, Standard Languages, API Description Languages, Handover points, Development and Deployment of RESTful web service applications in Java, microservice API, Best Practices.

Unit-V Performance And Security **9**

Performance and availability - caching - Traffic shaping - Evolution and versioning, Security concerns - Mechanisms, Authentication, Validation, Access Control, Token Based Authentication, Authorization

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Matthias Biehl	RESTful API Design, API University Series	1st Edition, CreateSpace Independent Publishing Platform	2016
2.	Mark Masse	REST API Design Rulebook: Designing Consistent RESTful Web Service Interfaces	1st Edition, O' Reilly	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Harihara Subramanian, Pethuru Raj	Hands-On RESTful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure "RESTful web APIs	Packt Publishing	2021
2.	JJ Geewax	API Design Patterns	1st Edition, Manning Publications	2021
3.	Bogunuva Mohanram Balachandar	Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java	3rd Edition, Ingram Short Title	2017

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		L	T	P	C
23ADE19	**Nonlinear Optimization**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the role of optimization techniques and its importance in engineering
- To introduce the concept of nonlinear optimization methods.
- To realize the application of non-traditional optimization algorithms
- To choose appropriate optimization method and solve real world problems.
- To understand the concept of Advanced Non-Linear Optimization

Course Outcomes:

23ADE19.CO1	Comprehend the need and applications of the optimization methods
23ADE19.CO2	understand basic theoretical principles for formulation of optimization models and its solution.
23ADE19.CO3	learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques
23ADE19.CO4	Apply detailed theoretical and practical aspects of intelligent modelling
23ADE19.CO5	Apply detailed aspects of optimization andcontrol of non-linear systems.

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE19.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE19.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE19.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE19.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE19.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Classical Optimization Techniques **9**

Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers,Karush-Kuhn-Tucker conditions

Unit-II Non-Linear Programming: One-Dimensional Minimization Method **9**

Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods

Unit-III Non-Linear Programming: Unconstrained Optimization Techniques **9**

Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method Indirect Search Methods: Steepest descent method, Fletcher-Reeves method, Newton's method

Unit-IV Non-Linear Programming: Constrained Optimization Techniques 9

Direct Methods: Random search method, Sequential linear programming, Indirect methods: Transformation techniques, Exterior penalty function method, Interior penalty function method

Unit-V Advanced Non-Linear Optimization 9

Genetic Algorithms -Working principle-Genetic operators-Numerical problem-Simulated Annealing – Numerical problem - Neural network based optimization-Optimization of fuzzy

systems-fuzzy set theory-computational procedure

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.S.Rao	Engineering Optimization Theory and Practice	New Age International (P),5th edition	2021
2.	C. B Gupta	Optimization Techniques in Operation Research	I.K.International House Pvt.Ltd	2007

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Godfrey C. Onwubolu, B. V. Babu	New Optimization Techniques in Engineering		2004
2.	Cesar Lopez	MATLAB Optimization Techniques		2014

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		L	T	P	C
23ADE20	**Ethics Of AI**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the need for ensuring ethics in AI
- To understand ethical issues with the development of AI agents
- To apply the ethical considerations in different AI applications
- To evaluate the relation of ethics with nature
- To overcome the risk for Human rights and other fundamental values.

Course Outcomes:

23ADE20.CO1	Understand the ethical issues in the development of AI agents
23ADE20.CO2	Learn the ethical considerations of AI with perspectives on ethical values
23ADE20.CO3	Apply the ethical policies in AI based applications and Robot development
23ADE20.CO4	To implement the AI concepts to societal problems by adapting the legal concepts bysecuring fundamental rights.
23ADE20.CO5	This study will help to overcome the evil genesis in the concepts of AI.

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE20.CO1	x	x	-	-	x	x	-	-	x	-	x	x	-	x	-
23ADE20.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	-
23ADE20.CO3	x	x	-	-	x	-	-	x	-	x	-	-	x	-	x
23ADE20.CO4	x	-	x	x	-	x	x	-	x	x	x	-	-	-	-
23ADE20.CO5	x	x	-	x	-	-	x	-	x	-	x	x	x	x	-

Unit-I Introduction To Ethics Of AI **9**

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities

Unit-II Framework And Models **9**

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

Unit-III Concepts And Issues **9**

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder

Unit-IV Perspectives And Approaches 9

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents

Unit-V Cases And Application 9

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Paula Boddington	Towards a Code of Ethics for Artificial Intelligence	Springer	2017
2.	Markus D. Dubber, Frank Pasquale, Sunit Das	The Oxford Handbook of Ethics of AI	Oxford University Press Edited book	2020

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. Matthew Liao	Ethics of Artificial Intelligence	Oxford University Press Edited Book	2020
2.	N. Bostrom and E. Yudkowsky	The ethics of artificial intelligence	Cambridge University Press	2014
3.	Wallach, W., & Allen, C	Moral machines: ceaching robots right from wrong	Oxford University Press	2008

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		L	T	P	C
23ADE21	**Engineering Economics**	**3**	**0**	**0**	**3**

Course Objective:

- To Learn the fundamental of Economics.
- To Understand different methods of depreciation use for calculation
- To know the various method of comparison used in economic
- To Understand how funds are managed in an organization.
- Different methods of production and marketing adopted in an industry.

Course Outcomes:

23ADE21.CO1	The basic concepts of economics are learned
23ADE21.CO2	Understand the various types depreciation used
23ADE21.CO3	Learn the different comparison technique used in industries.
23ADE21.CO4	The fund flow in the industries are learned
23ADE21.CO5	Understand the different Production and Marketing techniques used in the industries.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE21.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE21.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE21.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE21.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE21.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Micro And Macro Economics And Its Applications 9

Introduction – Micro Economics – Macro Economics – Economic decisions and Technical Decisions – Demand and Supply Concepts – Elasticity of Demand – Cost of Products – Price of products – Break-Even Analysis – Nature of Functioning of Money –Notional Income – GNPand Savings – Inflation and Deflation Concepts

Unit-II Methods Of Depreciation 9

Straight line method of Depreciation- Declining Balance Method of Depreciation-Sum of the Years Digits Method of Depreciation-Sinking Fund Method of Depreciation- Service-output Method of Depreciation.

Unit-III Methods Of Comparison Of Alternatives 9

Introduction – Elementary Economic Analysis – Interest Formulas and their Applications Comparisons – Present Worth Method – Future Worth Method – Annual Equivalent Method – Rate of Return Method.

Unit-IV Financial Management 9

Sources of finance, internal and external-preparation of balance sheet and profit and loss statements, Types of accounting and significance of each type, interest formulas and their applications.

Unit-V Production & Marketing Management 9

Types of Production; process of planning, scheduling, Routing, material control; product concept concepts of productivity, Core concepts of Marketing- Needs, Wants, Demand- Marketing Vs Selling- Products and Markets- Pricing and its related factors- Channels of Distribution- Promotion- Advertising- Market Research- Sales Forecasting.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	O.P. Khanna	Industrial Engineering and Management	Dhanpat Rai and Sons	-
2.	R. Pannerselvam	Engineering Economics	Prentice Hall of India Pvt	2014

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.K. Jain	Applied Economics for Engineers and Managers	Vikas Publications House, New Delhi	2017
2.	Mote Paul, Gupta	Managerial Economics	Tata Mc Graw Hill	2017
3.	Joseph L. Massie	Essentials of Management	Prentice-Hall of India, Third edition	2019

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		L	T	P	C
23ADE22	**PYTHON FOR DATA SCIENCE**	**3**	**0**	**0**	**3**

Course Objective:

- To acquire skills in data preparatory and preprocessing steps
- To understand the mathematical skills in statistics
- To learn the tools and packages in Python for data science
- To gain understanding in classification and Regression Model
- To acquire knowledge in data interpretation and visualization techniques

Course Outcomes:

23ADE22.CO1	Apply the skills of data inspecting and cleansing.
23ADE22.CO2	Determine the relationship between data dependencies using statistics
23ADE22.CO3	Can handle data using primary tools used for data science in Python
23ADE22.CO4	Represent the useful information using mathematical skills
23ADE22.CO5	Can apply the knowledge for data describing and visualization using tools.

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE22.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE22.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE22.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE22.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE22.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I DC Circuits Introduction **9**

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications

Unit-II Describing Data I **9**

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data

Unit-III Python For Data Handling **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 – hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

Unit-IV Describing Data I **9**

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean

Unit-V Python For Data Visualization **9**

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Cielen, Arno D. B. Meysman, and Mohamed Ali	Introducing Data Science	Manning Publications	2016
2.	Robert S. Witte and John S. Witte	Statistics	Eleventh Edition, Wiley Publications	2017

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jake VanderPlas	Python Data Science Handbook	O'Reilly	2016
2.	Allen B. Downey	Think Stats: Exploratory Data Analysis in Python	Green Tea Press	2014

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		L	T	P	C
23ADE23	**PYTHON LABORATORY**	**0**	**0**	**2**	**1**

Course Objective:

- Understand the Python Programming packages Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Language
- To prepare data for data analysis through understanding its distribution.
- Exposure on data processing using NUMPY and PANDAS
- To acquire knowledge in plotting using visualization tools
- To understand and implement classification and Regression Model.

Course Outcomes:

23ADE23.CO1	Develop relevant programming abilities.
23ADE23.CO2	Demonstrate knowledge of statistical data analysis techniques
23ADE23.CO3	Exhibit proficiency to build and assess data-based models.
23ADE23.CO4	Demonstrate skill in Data management & processing tasks using Python
23ADE23.CO5	Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE23.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE23.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE23.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE23.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE23.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Sl.No.	**List of Experiments**
1.	Working with Numpy arrays
2.	Working with Pandas data frames
3.	Basic plots using Matplotlib
4.	Frequency distributions
5.	Averages
6.	Variability
7.	Normal curves
8.	Correlation and scatter plots
9.	Correlation coefficient
10.	Regression

Total Periods: 60

		L	T	P	C
23ADE24	**DATA WAREHOUSING AND MINING**	**3**	**0**	**0**	**3**

Course Objective:

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.
- To understand and apply suitable Learning algorithms, Clustering algorithms.

Course Outcomes:

23ADE24.CO1	To understand and apply various classification and clustering techniques using tools.
23ADE24.CO2	Apply suitable pre-processing and visualization techniques for data analysis
23ADE24.CO3	Apply frequent pattern and association rule mining techniques for data analysis
23ADE24.CO4	Apply appropriate classification and clustering techniques for data analysis
23ADE24.CO5	Apply suitable Learning algorithms, Clustering algorithms.

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23ADE24.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE24.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE24.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE24.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE24.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I **Dc Circuits Data Warehousing, Business Analysis And On-Line Analytical Processing (Olap)** **9**

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP

Unit-II **Data Mining** **9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity

measures

Unit-III Data Mining - Frequent Pattern Analysis 9

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

Unit-IV Classification And Clustering 9

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines –– 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 – Evaluation of clustering – Clustering high dimensional data-Clustering with constraints, Outlier analysis-outlier detection methods.

Unit-V Weka Tool 9

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jiawei Han and Micheline Kamber	Data Mining Concepts and Techniques	Third Edition, Elsevier	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Alex Berson and Stephen J.Smith	Data Warehousing, Data Mining & OLAP‖	Tata McGraw – Hill Edition, 35th Reprint	2016
2.	K.P. Soman, Shyam Diwakar and V. Ajay	Insight into Data Mining Theory and Practice‖, Eastern Economy Edition	Prentice Hall of India	2006
3.	Ian H.Witten and Eibe Frank	Data Mining: Practical Machine Learning Tools and Techniques‖	Elsevier	Second Edition

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		L	T	P	C
23ADE25	**COGNITIVE SCIENCE AND ANALYTICS**	**3**	**0**	**0**	**3**

Course Objective:

- To explain cognitive computing and design principles.
- To distinguish between NLP and cognitive computing.
- To apply advanced analytics to cognitive computing.
- To discuss application of cognitive computing in business.
- To illustrate various applications of cognitive computing.

Course Outcomes:

23ADE25.CO1 Explain cognitive computing and design principles.
23ADE25.CO2 Distinguish between NLP and cognitive computing.
23ADE25.CO3 Apply advanced analytics to cognitive computing.
23ADE25.CO4 Discuss application of cognitive computing in business.
23ADE25.CO5 Illustrate various applications of cognitive computing.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE25.CO1	x	x	-	-	x	-	x	-	-	-	x	x	-	-	-
23ADE25.CO2	x	-	x	x	-	x	-	x	x	x	x	-	x	x	-
23ADE25.CO3	x	x	-	-	x	-	x	x	x	-	-	-	-	x	-
23ADE25.CO4	x	-	x	x	-	x	x	-	x	x	x	-	x	-	x
23ADE25.CO5	x	x	-	x	-	-	-	-	-	-	x	x	-	-	-

Unit-I DC Circuits Foundation & Design Principles 9

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition.Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.

Unit-II Nlp In Cognitive System 12

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems.Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.

Unit-III Big Data Vs Cognitive Computing 9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to createvalue, Impact of open source tools on advanced analytics.

Unit-IV Cognitive Computing In Business 12

The Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market-IBM Watson as a cognitive systems

Unit-V Applications **12**

The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing- Building a cognitive health care application- Smarter cities-Cognitive Computing in Government.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Judith H Hurwitz, Marcia Kaufman, Adrian Bowles	Cognitive computing and Big Data Analytics	Wiley	2015
2.	Vijay Raghvan, Venu Govindaraju, C.R. Rao	Cognitive Computing: Theory and Applications	by Elsevier publications, North Holland Publication, 1st Edition	2016

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernadette Sharp (Author), Florence Sedes (Author), Wieslaw Lubaszewski (Author)	Cognitive Approach to Natural Language Processing Hardcover	First Edition	2017
2.	Arun Kumar Sangaiah, Arunkumar Thangavelu, et al.,	Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and	1st edition	2018

		Communications Technologies		
3.	Min Chen and Kai Hwang	Big-Data Analytics for Cloud, IoT and Cognitive Computing	Wiley Publication, 1st Edition	2017
4.	Mallick, Pradeep Kumar, Borah, Samarjeet	Emerging Trends and Applications in Cognitive Computing	IGI Global Publishers	2021

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23ADE26	Big Data Analytics	L	T	P	C
		3	0	0	3

Course Objective:

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

Course Outcomes:

23ADE26.CO1	Work with big data tools and its analysis techniques
23ADE26.CO2	Analyze data by utilizing clustering and classification algorithms
23ADE26.CO3	Learn and apply different mining algorithms and recommendation systems for large volumes of data
23ADE26.CO4	Perform analytics on data streams
23ADE26.CO5	Learn NoSQL databases and management.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE26.CO1	x	x	-	x	x	-	x	-	x	-	x	x	-	x	-
23ADE26.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
23ADE26.CO3	x	x	x	-	x	-	-	x	-	x	-	-	-	-	-
23ADE26.CO4	x	-	x	-	-	x	x	-	x	-	x	x	-	-	x
23ADE26.CO5	x	x	-	x	x	-	-	-	x	x	x	-	x	x	-

Unit-I Introduction To Big Data **9**

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating- The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big DataApplications - Perception and Quantification of Value -Understanding Big Data Storage - AGeneral Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map
Reduce Programming Model

Unit-II Clustering And Classification **9**

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier.

Unit-III Association And Recommendation System **9**

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

Unit-IV Stream Memory **9**

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

Unit-V Nosql Data Management For Big Data And Visualization **9**

NoSQL Databases : Schema-less Models": Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding –- Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anand Rajaraman and Jeffrey David Ullman	Mining of Massive Datasets	Cambridge University Press	2012
2.	David Loshin	Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph	Morgan Kaufmann/El sevier Publishers	2013

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	EMC Education Services	"Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data	Wiley publishers	2015
2.	Bart Baesens	Analytics in a Big Data World: The Essential Guide to Data Science and its Applications	Wiley Publishers	2015
3.	Dietmar Jannach and Markus Zanker	Recommender Systems: An Introduction	Cambridge University Press	2010
4.	Kim H. Pries and Robert Dunnigan	Big Data Analytics: A Practical Guide for Managers	CRC Press	2015

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23ADE27	Big Data Analytics Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To implement Map Reduce programs for processing big data
- To realize storage of big data using H base, Mongo DB
- To analyze big data using linear models
- To analyze big data using machine learning techniques such as SVM / Decision tree

Course Outcomes:

23ADE27.CO1 Process big data using Hadoop framework

23ADE27.CO2 Build and apply linear and logistic regression models

23ADE27.CO3 Perform data analysis with machine learning methods

23ADE27.CO4 Perform graphical data analysis

23ADE27.CO5 Process big data using Hadoop framework

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE27.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE27.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE27.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE27.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE27.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Sl.No.	List of Experiments
1.	Install, configure and run Hadoop and HDFS
2.	Implement word count / frequency programs using MapReduce
3.	Implement an MR program that processes a weather dataset R
4.	Implement Linear and logistic Regression
5.	Implement SVM / Decision tree classification techniques
6.	Implement clustering techniques
7.	Visualize data using any plotting framework
8.	Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

Total Periods: 60

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23ADE28	Block Chain And Cryptography	L	T	P	C
		3	0	0	3

Course Objective:

- To Understand the emerging abstract models for Blockchain Technology
- Analyze the mechanism of digital money and Cryptography
- Summaries the necessary bitcoin and cryptocurrency background.
- Apply the function of initial coin offerings
- Implement the Applications of Block chain

Course Outcomes:

23ADE28.CO1 Understand the use cases in Block Chain

23ADE28.CO2 Demonstrate the digital transaction in same and different bank.

23ADE28.CO3 Implement the Bitcoin transactions.

23ADE28.CO4 Summarizes the functions of bitcoin and make use of it to solve problems

23ADE28.CO5 Demonstrates the foundations with Decentralized Applications

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE28.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE28.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE28.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE28.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE28.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Introduction To Blockchain **9**

Centralized vs. Decentralized Systems- Layers of Blockchain- Importance of Blockchain- Limitations of Centralized Systems- Blockchain Adoption- Blockchain Uses and Use Cases- Laying the Blockchain Foundation- Cryptography- Game Theory- Properties of Blockchain Solutions- Blockchain Applications

Unit-II Digital Money And Cryptography **9**

Interbank Payments-Same bank- diffferent banks- Correspondent Bank Accounts- Central Bank Accounts- International Payments- E-Money Wallets-Cryptography- Encryption and Decryption- Hashes-Digital Signatures-Alice and Bob

Unit-III Bitcoin And Cryptocurrency **9**

A basic crypto currency-Creation of coins- Bitcoin -Working with Bitcoins- The Bitcoin Blockchain- Block Structure, The Genesis Block- The Bitcoin Network- Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining, Block Propagation- Bitcoin Scripts

Unit-IV Initial Coin Offerings And Investing **9**

ICOs- Whitepapers- The Token Sale- ICO Funding Stages- Whitelisting- Funding Caps- Treasury-Exchange Listing- Pricing-Price utility tokens- Risks and Mitigations- Market Risk-Liquidity Risk-Exchange Risks-Wallet Risks-Regulatory Risks-Scams

Unit-V Blockchain Applications **9**

Foundations of Blockchain- Transaction Workflow, Simple Payment Verification, Blockchain Forks- Unpacking Ethereum- Overview- Ethereum Virtual Machine- Decentralized Applications- Decentralized Organizations- Blockchain in Science, Reproducibility Crisis, Clinical Trials, Reputation System, Pharmaceutical Drug Tracking

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bikramaditya Singhal Priyansu Sekhar Panda Gautam Dhameja	Beginning Blockchain-A Beginner's Guide to Building Blockchain Solutions	Apress	2018
2.	Antony lewis	The Basics of Bitcoins and Blockchains	Mango Publishing Group	2018
3.	Vikram Dhillon , David Metcalf, Max Hooper	Blockchain Enabled Applications-Understand the Blockchain Ecosystem and How to Make it Work for You	Apress	2017

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bashir, Imran	Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks	Springer	2017
2.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Bitcoin and cryptocurrency technologies: a comprehensive introduction	Princeton University Press	2016
3.	Joseph Bonneau	SoK: Research perspectives and challenges for Bitcoin and cryptocurrency	IEEE Symposium on security and Privacy	2015

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23ADE29	Principles Of Management	L	T	P	C
		3	0	0	3

Course Objective:

- To enable the students to study the evolution of Management
- To study the functions andprinciples of management
- To learn the application of the principles in an organization
- To understand the theories of leadership
- To learn the process of controlling

Course Outcomes:

23ADE29.CO1	Have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling
23ADE29.CO2	Have same basic knowledge on international aspect of management
23ADE29.CO3	Understand Human ResourceManagement
23ADE29.CO4	Analyze the process of communication
23ADE29.CO5	Understand System and process of controlling

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE29.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE29.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE29.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE29.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE29.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Introduction To Management And Organizations 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

Unit-II Planning 9

Nature and purpose of planning – planning process – types of planning – COURSE OBJECTIVES – setting COURSE OBJECTIVES – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

Unit-III Organising 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management

Unit-IV Directing 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication–communication and IT.

Unit-V Controlling 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and

preventive control – reporting.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stephen P. Robbins & Mary Coulter	Management	Prentice Hall (India) Pvt. Ltd., 10th Edition	2009
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert	Management	Pearson Education, 6th Edition	2004

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stephen A. Robbins & David A. Decenzo & Mary Coulter	Fundamentals of Management	Pearson Education, 7th Edition	2011
2.	Robert Kreitner & Mamata Mohapatra	Management	Biztantra	2008
3.	Harold Koontz & Heinz Weihrich	Essentials of management	Tata McGraw Hill	2008
4.	Tripathy PC & Reddy PN	Principles of Management	Tata McGraw Hill	2009

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23ADE30	Iot System And Analytics	L	T	P	C
		3	0	0	3

Course Objective:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

Course Outcomes:

23ADE30.CO1 Explain the concept of IoT.

23ADE30.CO2 Analyze various protocols for IoT.

23ADE30.CO3 Design a PoC of an IoT system using Rasperry Pi/Arduino

23ADE30.CO4 Apply data analytics and use cloud offerings related to IoT.

23ADE30.CO5 Analyze applications of IoT in real time scenario

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE30.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE30.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE30.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE30.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE30.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Fundamentals Of Iot **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

Unit-II Iot Protocols **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 2101.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

Unit-III Design And Development **9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

Unit-IV Data Analytics And Supporting Services **9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

Unit-V Case Studies/Industrial Applications **9**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart

Lighting, Smart Parking Architecture and Smart Traffic Control

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things	CiscoPress	2017
2.	Arshdeep Bahga, Vijay Madisetti	Internet of Things – A hands-on approach	Universities Press	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Olivier Hersent, David Boswarthick, Omar Elloumi	The Internet of Things – Key applications and Protocols	Wiley	2012
2.	Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle	From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence	Elsevier	2014
3.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds)	Architecting the Internet of Things	Springer	2011

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23ADE31	Iot System And Analytics Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To study the assembly language using simulator and kit.
- To implement ALU operations.
- To generate waveforms and test timers
- To develop applications using Embedded C language.
- To design IoT applications using Aurdino, Raspberry Pi, and Bluemix.

Course Outcomes:

23ADE31.CO1 Execute Assembly Language experiments using simulator

23ADE31.CO2 Implement ALU operations

23ADE31.CO3 Design waveforms and test timers.

23ADE31.CO4 Develop real time applications and explore ARM/PIC using Embedded C.

23ADE31.CO5 Demonstrate real time applications using Aurdino, Raspberry Pi, and Bluemix..

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE31.CO1	x	x	-	-	-	x	-	-	x	-	-	x	-	x	-
23ADE31.CO2	x	-	x	x	-	x	x	x	x	x	x	-	-	-	x
23ADE31.CO3	x	x	-	-	x	-	-	x	-	x	-	-	x	-	-
23ADE31.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE31.CO5	x	x	-	x	x	-	-	-	x	-	x	x	x	x	-

Sl.No.	List of Experiments
1.	Write 8051 Assembly Language experiments using simulator
2.	Test data transfer between registers and memory
3.	Perform ALU operations
4.	Using interrupts generate waveforms and test Timers.
5.	Write assembly language experiments using Kit to test interfaces and interrupts using Traffic Generator, DAC, ADC, Stepper Motor .
6.	Write Basic and arithmetic Programs Using Embedded C.
7.	Write Embedded C program to test interrupt and timers.
8.	Develop Real time applications – clock generation, wave form generation, counter using embedded C.
9.	Explore ARM/PIC based controllers using Embedded C.
10.	Explore different communication methods with IoT devices
11.	Develop simple application – testing infrared sensor – IoT Applications – using Aurdino.
12.	Develop simple application – testing temperature, light sensor – IOT Application using open platform/Raspberry Pi.
13.	Deploy IOT applications using platforms such as Bluemix.

Total Periods: 60

23ADE32	Bio-Inspired Optimization Techniques	L	T	P	C
		3	0	0	3

Course Objective:

- To understand fundamental topics in bio-inspired optimization techniques
- To Learn the collective systems such as ACO, PSO, and BCO
- To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems
- To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
- To implement the Bio-inspired technique with other traditional algorithms.

Course Outcomes:

23ADE32.CO1	Familiarity with the basics of several biologically inspired optimization techniques.
23ADE32.CO2	Familiarity with the basics of several biologically inspired computing paradigms.
23ADE32.CO3	Ability to select an appropriate bio-inspired computing method and implementfor any application and data set.
23ADE32.CO4	Theoretical understanding of the differences between the major bio-inspired computing methods.
23ADE32.CO5	Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE32.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE32.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE32.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE32.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE32.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Introduction **9**

Optimization Techniques: Introduction to Optimization Problems – Single and Muti- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

Unit-II Swarm Intelligence **9**

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards ArtificialAnts – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving usingACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.

Unit-III Natural To Artificial Systems **9**

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

Unit-IV Swarm Robotics **9**

Foraging for food – Clustering of objects – Collective Prey retrieval –Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – ParticleSwarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering

Unit-V Case Studies **9**

Other Swarm Intelligence algorithms**:** Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems –Travelling Salesmanproblem.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A. E. Elben and J. E. Smith	Introduction to Evolutionary Computing	Springer	2010
2.	Floreano D. and Mattiussi C	Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies	MIT Press, Cambridge, MA	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Eric Bonabeau, Marco Dorigo, Guy Theraulaz	Swarm Intelligence: From Natural to Artificial Systems	Oxford University press	2000
2.	Christian Blum, Daniel Merkle (Eds.)	Swarm Intelligence: Introduction and Applications	Springer Verlag	2008
3.	Leandro N De Castro, Fernando J Von Zuben	Recent Developments in Biologically Inspired Computing	Idea Group Inc	2005
4.	Albert Y.Zomaya	Handbook of Nature-Inspired and Innovative Computing	Springer	2006
5.	C. Ebelhart et al	Swarm Intelligence	Morgan Kaufmann	2001

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23ADE33	Information Extraction And Retrieval	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the different ways for extraction of multimedia data
- To learn and analyze the information retrieval techniques
- To apply the information retrieval algorithms for real time applications
- To understand and evaluate the applications of information retrieval techniques
- To understand the role of information retrieval systems in web applications

Course Outcomes:

23ADE33.CO1	Able to apply the information extraction techniques for real time applications
23ADE33.CO2	Design systems based on the concepts of information retrieval
23ADE33.CO3	Apply data specific information extraction and retrieval
23ADE33.CO4	Create web applications by understanding the information extraction and retrieval techniques
23ADE33.CO5	Use the concepts of information classification and clustering in wide range of other applications

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE33.CO1	x	x	-	x	x	-	x	-	x	-	x	x	x	x	-
23ADE33.CO2	x	-	x	x	-	x	-	x	-	x	x	-	-	-	-
23ADE33.CO3	x	-	-	-	x	-	-	x	-	x	-	-	-	-	-
23ADE33.CO4	x	x	x	-	x	x	x	-	x	x	x	-	x	-	x
23ADE33.CO5	x	x	-	x	-	-	-	-	x	-	x	x	-	x	-

Unit-I Introduction To Information Extraction **9**

Introduction – Origins – Text, Audio ,Image, Video Extraction – Visual object Feature Localization - Entropy based Image Analysis – 3D shape Extraction Techniques - Semantic Multimedia Extraction using Audio & Video – Multimedia Web Documents.

Unit-II Text extraction **9**

Pre-processing Techniques – Clustering – Probabilistic Models – Browsing and Query Refinement on presentation Layer- Link Analysis – Visualization Approaches and its Operations.

Unit-III Information Retrieval Systems **9**

Text formats –Retrieval and Ranking –Evaluation strategies – Tokens –Query processing –Static Inverted Indices – Dynamic Inverted Indices – Index compression –Categorization and Filtering Classifiers –Probabilistic, Linear ,Similarity based, Generalized Linear, Information Theoretic

Unit-IV Algorithms On Information Retrieval **9**

Introduction – Strategies - Utilities – Crossing the language barrier- Cross Language strategies with Utilities – Efficiency Multidimensional data model- Parallel Information Retrieval – Distributed Information Retrieval.

Unit-V Applications **9**

Sound Authoring Data with Audio MME-CBR Systems-Implementation of Message Recognition Systems – Paralinguistic Information Retrieval in Broadcast – Text mining Applications- Pre- processing Applications using Probabilistic and Hybrid Approaches – Web Search.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mark T. Maybury	Multimedia Information Extraction	Wiley (IEEE), John Wiley & Sons	2012
2.	Ronen Feldman, James Sanger	Text Mining Handbook	Cambridge University press	2006

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David A. Grossman, Ophir Frieder	Information Retrieval: Algorithms and Heuristics	Second Edition, Springer	2004
2.	Stefan Buttcher LA Clarke Gox v.Cormack	Information Retrieval: Implementing and Evaluating Search Engines	MIT Press	2016

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23ADE34	Data Security And Privacy	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the fundamentals of security, and how it relates to information systems.
- To identify risks and vulnerabilities in operating systems from a database perspective.
- To learn good password policies, and techniques to secure passwords in an organization.
- To learn and implement administration policies for users.
- To understand the various database security models and their advantages or disadvantages.

Course Outcomes:

23ADE34.CO1 Relates the fundamentals of security to information systems

23ADE34.CO2 Identify risks and vulnerabilities in operating systems

23ADE34.CO3 Analyze the techniques to secure passwords in an organization

23ADE34.CO4 Implement administration policies for users.

23ADE34.CO5 Implement privacy preserving data mining algorithms.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE34.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE34.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE34.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE34.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE34.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Security Architecture & Operating System Security Fundamentals 9

Security Architecture: Introduction-Information Systems- Database Management Systems-InformationSecurity Architecture- Database Security–Asset Types and value-Security Methods. Operating System Security Fundamentals: Introduction-Operating System Overview-Security Environment – Components- Authentication Methods-User Administration-Password Policies Vulnerabilities-E-mail Security.

Unit-II Administration Of Users & Profiles,Password Policies, Privileges And Roles 9

Administration of Users: Introduction-Authentication-Creating Users, SQL Server User-Removing, Modifying Users-Default, Remote Users-Database Links-Linked Servers-Remote Servers-Practices for Administrators and Managers-Best Practices Profiles, Password Policies, Privileges and Roles: Introduction-Defining and Using Profiles-Designing and Implementing Password Policies-Granting and Revoking User Privileges-Creating, Assigning and Revoking User Roles-Best Practices

Unit-III Database Application Security Models & Virtual Private Databases 9

Database Application Security Models: Introduction-Types of Users-Security Models- Application Types-Application Security Models-Data Encryption Virtual Private Databases: Introduction-Overview of VPD-Implementation of VPD using Views, Application Context in Oracle-Implementing Oracle VPD-Viewing VPD Policies and Application contexts using Data Dictionary, Policy Manager Implementing Row and Column level Security with SQL Server

Unit-IV Auditing Database Activities 9

Auditing Database Activities: Using Oracle Database Activities-Creating DLL Triggers with OracleAuditing Database Activities with Oracle-Auditing Server Activity with SQL Server 2000-Security and Auditing Project Case Study.

Unit-V Privacy Preserving Data Mining Techniques 9

Privacy Preserving Data Mining Techniques: Introduction- Privacy Preserving Data Mining AlgorithmsGeneral Survey-Randomization Methods-Group Based Anonymization-Distributed Privacy Preserving Data Mining-Curse of Dimensionality-Application of Privacy Preserving Data Mining

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hassan A. Afyouni	Database Security and Auditing	Third Edition, Cengage Learning	2009
2.	Charu C. Aggarwal, Philip S Yu	Privacy Preserving Data Mining	Models and Algorithms, Kluwer Academic Publishers	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ron Ben Natan	Implementing Database Security and Auditing	Elsevier Digital Press	2005

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23ADE35	Adhoc And Sensor Networks	L	T	P	C
		3	0	0	3

Course Objective:

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.
- Be familiar with different types of adhoc routing protocols.
- Be expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks.

Course Outcomes:

23ADE35.CO1	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
23ADE35.CO2	Analyze the protocol design issues of ad hoc and sensor networks
23ADE35.CO3	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
23ADE35.CO4	Evaluate the QoS related performance measurements of ad hoc and sensor networks
23ADE35.CO5	Understand the architecture and protocols of wireless sensor networks

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE35.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE35.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE35.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE35.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE35.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Introduction **9**

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

Unit-II Mac Protocols For Ad Hoc Wireless Networks **9**

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

Unit-III Routing Protocols And Transport Layer In Ad Hoc Wireless Networks **9**

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

Unit-IV Wireless Sensor Networks (Wsns) And Mac Protocols **9**

Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

Unit-V Wsn Routing, Localization & Qos **9**

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C. Siva Ram Murthy, and B. S. Manoj	Ad Hoc Wireless Networks: Architectures and Protocols	Prentice Hall Professional Technical Reference	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Carlos De Morais Cordeiro, Dharma Prakash Agrawal	Ad Hoc & Sensor Networks: Theory and Applications	World Scientific Publishing Company	2006
2.	Feng Zhao and Leonides Guibas	Wireless Sensor Networks	Elsevier Publication	2002
3.	Holger Karl and Andreas Willig	Protocols and Architectures for Wireless Sensor Networks	Wiley	2005
4.	Anna Hac	Wireless Sensor Network Designs	John Wiley	2003

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23ADE36	Digital Image Processing	L	T	P	C
		3	0	0	3

Course Objective:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

Course Outcomes:

23ADE36.CO1 Know and understand the basics and fundamentals of digital image processing

23ADE36.CO2 Operate on images using the techniques of smoothing, sharpening and enhancement.

23ADE36.CO3 Understand the restoration concepts and filtering techniques.

23ADE36.CO4 Learn the basics of segmentation, features extraction

23ADE36.CO5 Understand the compression and recognition methods for color models.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE36.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
23ADE36.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
23ADE36.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
23ADE36.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
23ADE36.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

Unit-I Digital Image Fundamentals **9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

Unit-II Image Enhancement **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

Unit-III Image Restoration **9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

Unit-IV Image Segmentation **9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm

Unit-V Image Compression And Recognition **9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rafael C. Gonzalez, Richard E. Woods	Digital Image Processing	Pearson, Third Edition	2010
2.	Anil K. Jain	Fundamentals of Digital Image Processing	Pearson	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kenneth R. Castleman	Digital Image Processing	Pearson	2006
2.	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins	Digital Image Processing using MATLAB	Pearson Education, Inc.	2011
3.	D,E. Dudgeon and RM. Mersereau	Multidimensional Digital Signal Processing	Prentice Hall Professional Technical Reference	2190
4.	William K. Pratt	Digital Image Processing	John Wiley, New York	2002

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23ADE37	MERN Stack Development	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the various components of Web development
- To learn features and applications with Java Script and React
- To develop applications with MongoDB
- To develop application with Node.js.
- To understand the role of Express in web applications

Course Outcomes:

23ADE37.CO1	Understand the basics and various stacks available for web application development
23ADE37.CO2	Understand React and Rest API
23ADE37.CO3	Develop applications with MongoDB
23ADE37.CO4	Use Node.js for application development
23ADE37.CO5	Develop applications on Express and Node

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE37.CO1	X	X	-	-	-	-	-	-	X	X	X	X	X	X	-
23ADE37.CO2	X	X	X	X	X	X	-	-	X	-	X	X	X	X	X
23ADE37.CO3	X	X	X	X	X	X	-	-	X	X	X	X	X	X	X
23ADE37.CO4	X	X	X	X	X	X	-	-	X	X	X	X	X	X	X
23ADE37.CO5	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X

Unit-I Basics Of Web Development **9**

Understanding the Basic Web Development -Browser – Webserver - Backend Services. HTML Structures – List – Table – Images – Anchor Tag - Forms – DOM. Basics of CSS – CSS Properties – CSS Flex and Grids.

Unit-II Javascript and react **9**

Introduction to JavaScript - Basic React applications – React Components – React State – Express REST APIs - Modularization and Web pack - Routing with React Router – Server-side rendering.

Unit-III Mongo DB **9**

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases –Managing collections

Unit-IV Node JS **9**

Basics of Node JS – Installation – Working with Node packages – Using Node packageManager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js

Unit-V Express **9**

Implementing Express in Node.js - Configuring routes - Using Request and Response Objects. Connecting to MongoDB from Node.js – Simple applications.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Brad Dayley, Brendan Dayley,Caleb Dayley	Node.js, MongoDB and Angular Web Development',	Addison-Wesley, Second Edition	2018

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chris Northwood	The Full Stack Developer	Apress; 1st edition	2018

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23ADE38	MERN Stack Development Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To develop full stack applications with clear understanding of user interface, business logic and data storage.
- To design and develop user interface screens for a given scenario
- To develop the functionalities as web components as per the requirements
- To implement the database according to the functional requirements
- To integrate the user interface with the functionalities and data storage.

Course Outcomes:

23ADE38.CO1	Design full stack applications with clear understanding of user interface, Business logic and data storage.
23ADE38.CO2	Design and develop user interface screens
23ADE38.CO3	Implement the functional requirements using appropriate tool
23ADE38.CO4	Design and develop database based on the requirements
23ADE38.CO5	Integrate all the necessary components of the application

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE38.CO1	X	X	X	-	X	-	-	-	X	X	X	X	X	X	-
23ADE38.CO2	X	X	X	X	X	-	-	-	X	-	X	X	X	X	X
23ADE38.CO3	X	X	X	X	X	X	-	-	X	X	X	-	X	X	-
23ADE38.CO4	X	X	X	X	X	-	-	-	-	X	X	-	X	X	-
23ADE38.CO5	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X

Sl.No.	List of Experiments
1.	Develop a portfolio website for yourself which gives details about you for a potential recruiter.
2.	Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items
3.	Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
4.	Create a food delivery website where users can order food from a particular restaurant listed in the website
5.	Develop a classifieds web application to buy and sell used products
6.	Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.
7.	Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, In Progress or Completed
8.	Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions

Total Periods: 60

23ADE39	Salesforce Crm And Platform	L	T	P	C
		3	0	0	3

Course Objective:

1. To learn the basics of Salesforce as a CRM and a Platform
2. To learn the administrative and configurable capabilities of Salesforce
3. To write business logic customizations using Apex triggers and classes customized using SOQL and DML
4. To describe how trigger code works within the basics of the Save Order of Execution and transactions
5. To write Visualforce markup code to customize the user interface

Course Outcomes:

23ADE37.CO1	Understand the basics of Salesforce platform
23ADE37.CO2	Leverage configurable aspects of Salesforce for business process automation
23ADE37.CO3	Understand Apex Programming and Visual force
23ADE37.CO4	Develop Apex program with SOQL & DML, Testing and Execution of triggers
23ADE37.CO5	Develop Visualforce pages with various controllers

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE37.CO1	X	X	-	-	-	-	-	-	X	X	X	X	X	X	-
23ADE37.CO2	X	X	X	X	X	X	-	-	X	-	X	X	X	X	X
23ADE37.CO3	X	X	-	X	X	X	-	-	X	X	X	X	X	X	X
23ADE37.CO4	X	-	X	X	X	-	-	-	X	X	X	X	X	X	X
23ADE37.CO5	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X

Unit-I Introduction To Salesforce **9**

Salesforce Overview - Architecture – Environment - Sales Cloud - Service Cloud - Navigating Setup - Salesforce Objects - Standard Objects - Custom Objects & Fields - Field Types - Master Detail - Lookup Relationship - Schema Builder - Global Search. Standard UI Configuration - Page Layouts - Record Types - Record Type Based Picklist Values. Process Automation - Validation Rules, Workflow Rules and Actions - Process Builder - Approval Process. Salesforce Security Model - Role Hierarchy - Profiles and Permission Sets - Access Controls - Object and Field Level Security - Record Level Security - Org Wide Defaults - Record Ownership - Sharing Rules

Unit-II Salesforce Crm Functionality **9**

CRM Basics : Introduction to CRM - Sales Objects - Service Objects. Sales Process: Lead - Web-to-Lead - Lead Conversion - Opportunities - Accounts & Contacts – Products. Service Process: Case, Email-to-Case, Web-to-Case. Automation Rules: Lead/Case Assignment Rules - Escalation Rules - Merge Records - Duplication Rules.

Unit-III Apex Programming Basics **9**

Programming with Apex: Introduction to Apex - Statements & Collections - Introduction to Apex Classes. SOQL: Syntax, SOQL in Apex, Dynamic SOQL. Query using relationships: Relationship name, child-to-parent relationship – parent-to-child relationship. DML essentials: DML operations with Apex - Transaction Controls - DML errors.

Unit-IV Apex Programming Development **9**

Apex Trigger Essentials: Introduction - Trigger Events - Syntax - Trigger context variables. Apex Class Implementation: Implement Business Logic in Apex class - Trigger Handlers and Controllers - Best Practices (Bulkification, No DML & queries inside loops) - Apex Test Classes. Advanced Apex: Asynchronous Apex - Apex Scheduler - Batch Apex - Future methods - Queueable Apex API Callouts - Apex Web Services - Standard APIs. Transactions: Lifecycle of a transaction – Memory life cycle for static variable - Salesforce order of Execution - Execution Governor Limits. Development Tools: Developer Console - Debug Logs - Eclipse & Force.com IDE -

Visual Studio – Workbench Q

Unit-V Visualforce Development **9**

Visualforce: Introduction – Creating Visualforce pages – Important Visualforce Tags - Exploring the View and Controller layers of Visualforce – Standard Controller – Display data from a record in a Visualforce page – Display related data – Invoke standard controller actions – Using standard list controller in a Visualforce page – Using custom controllers and extensions – Security concerns.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Paul Goodey	Salesforce CRM - The Definitive Admin Handbook	PACKT enterprises	2016
2.	Matt Kaufmann and Michael Wicherski	Learning Apex Programming	PACKT enterprises	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Keir Bowden	Visualforce Development Cookbook	PACKT enterprises	2016
2.	David Taber	Salesforce.com Secrets of Success: Best Practices for Growth and Profitability	Prentice Hall	2013
3.	Tom Wong, Liz Kao, Matt Kaufman	Salesforce.com For Dummies	O'Reilly	2015

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23ADE40	Sales Fore CRM And Platform Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To Salesforce professional frequently come into challenging problems that call for creative solutions.
- To design and develop user interface screens for a given scenario
- To develop the Salesforce skills can provide you with excellent critical thinking abilities
- To implement the database according to the functional requirements
- To designed to help users to sell,provide services, market products and services

Course Outcomes:

23ADE40CO1	Salesforce professional frequently come into challenging problems that call for creative solutions
23ADE40CO2	Developing your Salesforce skills can provide you with excellent critical thinking abilities
23ADE40.CO3	Implement and troubleshooting abilities,
23ADE40.CO4	Design and develop customer success platform, designed to help users to sell, provide services, market products and services, analyze data
23ADE40.CO5	Integrate all the necessary components of the application

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADE40CO1	X	X	X	-	X	-	-	-	X	X	X	X	X	X	-
23ADE40CO2	X	X	X	X	X	-	-	-	X	-	X	X	X	X	X
23ADE40.CO3	X	X	X	X	X	X	-	-	X	X	X	-	X	X	-
23ADE40..CO4	X	X	X	X	X	-	-	-	-	X	X	-	X	X	-
23ADE40.CO5	X	X	X	X	X	X	-	-	-	-	X	X	X	X	X

Sl.No.	List of Experiments
1.	Salesforce User Basics
2.	Salesforce Platform Basics
3.	Platform Development Basics
4.	Developer Console Basics
5.	Apex Basics for Admin
6.	Object Oriented Programming for Admin
7.	Apex Triggers
8.	SOQL Database .Net Basics
9.	Visual force Basics

Total Periods: 60

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23ADP01	Project Work Phase I	L	T	P	C
		0	0	15	12

Course Objective:

The practical implementation of theoretical knowledge gained during the study from First year to Third year

The student should be able implement their ideas/real time industrial problem/ current application of their engineering branch which they have studied in curriculum
To build confidence in the student what he has learnt theoretically

Describe the problem statement

Analyze and process the experimental information

Course Outcomes:

23ADP01.CO1	Understand the technical concepts of project area.
23ADP01.CO2	Identify the problem and formulation
23ADP01.CO3	Design the problem statement
23ADP01.CO4	Formulate the algorithms by using the design
23ADP01.CO5	Develop the module

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADP01.CO1	x	x	x	-	x	x	-	-	-	x	-	x	x	-	x
23ADP01.CO2	x	x	-	-	x	-	-	x	-	-	x	-	-	x	-
23ADP01.CO3	x	x	-	x	-	x	-	-	-	-	x	x	-	-	x
23ADP01.CO4	x	-	x	-	-	-	x	-	x	-	-	-	x	x	-
23ADP01.CO5	x	x	-	x	x	-	-	x	x	x	x	x	x	-	x

1. Project helped students to gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal.
2. B.E. Projects can be two types: Projects based on implementation of any application oriented problem, which will be more or less experimental in nature, and the others will be based on some innovative/ theoretical work.
3. In Project Phase-I the student will undertake project over the academic year, which will involve the analysis, design of a system or sub system in the area identified earlier in the field of Information Technology.
4. The topic must be formulated in consultation with the guide and project coordinator
5. The project will be undertaken preferably by a group of 1-3 students who will jointly work and implement the project.
6. The group will select a project with approval from a committee formed by the department of senior faculty to check the feasibility and approve the topic.

REVIEW COMMITTEE

1. The Head of the department/Project coordinator shall constitute a review committee for project work for project group
2. Project guide would be one member of that committee by default
3. The students or project group shall make presentation on the progress made by them before the committee.

4. The record of the remarks/suggestions of the review committee should be properly maintained and should be made available at the time of examination
5. Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion.

PROJECT WORK REVIEWS

1. Project work phases will have a minimum of three internal reviews by an appointed committee of faculty.

2. The final review will be done by an external faculty

Review 1: Finalization of scope - the objectives and scope of the project should be finalized in second week of their academic semester. Should finalize list of required hardware, software or other equipment for executing the project, test environment/tools

Review 2: Finalization - High level design, planning

Guidelines for Students and Faculty:

PROJECT REVIEW COMMITTEE

1. This committee will be responsible for evaluating the timely progress of the projects and communicating the progress report to the students.

2. As far as possible Students should finalize the same project title taken for Project.

3. Review committee should conduct "Feasibility Review" in first week after commencement of the term.

4. Review Committee should finalize the scope of the project.

5. If change in project topic is unavoidable then the students should complete the process of project approval by submitting synopsis along with the review of important papers. This new project topic should be approved by review committee

TERM WORK

1. The term work will consist of a report prepared by the student on the project allotted to them

2. They should use appropriate tools for the preparation of the report like project planning, UML diagram, testing tools, referencing tools etc.

REPORT STRUCTURE

- Contents
- List of Abbreviations
- List of Figures
- List of Graphs
- List of Tables
    1. Introduction and aims/motivation and objectives
    2. Literature Survey
    3. Problem Statement
    4. Project Requirements
    5. System Analysis Proposed Architecture/ high level design of the project
    6. Verification Validation
    7. Project Plan 8. Conclusion

References

Appendices

Base Paper(s)

EVALUATION GUIDELINES

A panel of examiner will evaluate the viability of project / project scope.

The panel will also verify that all the suggestions/comments in the review document are taken care and accordingly allot the term work marks.

Oral examination in the form of presentation will be based on the project work completed by the candidates. Preliminary report must also be presented during the oral examination.

Total Periods: 90

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23ADP02	Project Work - Phase II	L	T	P	C
		0	0	15	12

Course Objective:

Plan an experimental design to solve Engineering problems

Develop an attitude of team work and independent working on real time problems

Analyze and process the experimental information

Evaluate, interpret and justify the experimental results

Develop a dissertation report

Course Outcomes:

23ADP02.CO1	Design an experiment to solve engineering / societal problems using modern tools
23ADP02.CO2	Develop lifelong learning to keep abreast of latest technologies.
23ADP02.CO3	Implement the workflow to provide sustainable solutions
23ADP02.CO4	Interpret the experimental results and the impact on society and environment
23ADP02.CO5	Investigate the application for the real time problems

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADP02.CO1	x	x	x	x	x	-	-	-	x	-	-	-	x	x	x
23ADP02.CO2	x	x	x	-	x	x	-	x		-	x	x	x	x	-
23ADP02.CO3	x	x	x	x	x	-	-	-	x	-	x	-	x	-	x
23ADP02.CO4	x	x	x	x	-	x	x	x	-	x	x	x	x		-
23ADP02.CO5	x	x	x	-	-	-	x	x	x	x	-	x	-	x	x

Review 1: Project work phases will have a minimum of three internal reviews by an appointed committee of faculty.

Review 2: The final review will be done by an external faculty

Review 3: Implementation Status and testing document

Review 4: Final Project Demonstration, Project Report and proper Result analysis

The group will submit at the end of semester II.

1. The Workable project.
2. Project report (Word Document) in the form of bound journal complete in all respect – 1 copy for the Institute, 1 copy for guide and 1 copy of each student in the group for certification.

The project report contains the details:

1. Problem definition
2. Requirement specification

   System design details (UML diagrams)

System implementation – code documentation – dataflow diagrams/ algorithm, protocols used

Test result and procedure

Conclusions.

Appendix

a.Tools used

b. References

c. Papers published/certificates

Total Periods: 360

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23ADP03	Comprehension	L	T	P	C
		0	0	4	2

Course Objective:

To write effective and coherent paragraphs

To comprehend the overall and internal organization of an academic essay

To write an effective thesis statement

To understand vocabulary

To use pre-writing strategies to plan writing.

Course Outcomes:

23ADP03.CO1	Write a paragraph with a topic sentence, support, and concluding sentence
23ADP03.CO1	Produce coherent and unified paragraphs with adequate support and detail of the topic
23ADP03.CO1	Write an effective introduction thesis statement that addresses the writing prompt and conclusion
23ADP03.CO1	Produce appropriate vocabulary and correct word forms
23ADP03.CO1	Produce accurate grammatical structures for the paragraph writing.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADP03.CO1	x	-	-	-	x	x	x	x	x	x	-	x	-	x	-
23ADP03.CO1	x	-	-	-	-	x	-	x	x	x	-	x	-	-	x
23ADP03.CO1	x	x	x	x	x	x	-	-	x	x	x	x	-	x	-
23ADP03.CO1	x	-	-	-	-	x	-	-	x	x	x	x	x	-	x
23ADP03.CO1	x	-	-	-	x	x	-	-	x	x	x	x	x	x	-

Sl.No.	List of Experiments
1.	Cloud Computing for Small Businesses
2.	Role of Information Technology in Corporate Functions
3.	Knowledge Management
4.	The Impact of Cloud Computing
5.	Cluster computing
6.	Computer Forensics
7.	The Internet of Things
8.	Data Security
9.	Green Computing
10.	Issue on eGovernment Development and Applications
11.	Big Data
12.	Design of Reversible Computing Systems
13.	Social Platforms

Total Periods: 60

23ADP04	Technical Seminar	L	T	P	C
		0	4	0	2

Course Objective:

To develop Communication and Presentation skill

To expose students to the 'real' working environment and get acquainted with the organization structure

To develop the business operations and administrative functions

To promote and develop presentation skills and import a knowledgeable society

To set the stage for future recruitment by potential employers

Course Outcomes:

23ADP04	Develop a skill for work in actual working environment.
23ADP04	Utilize available technical resources in efficient manner
23ADP04	Write technical documents and give oral presentations related to the work completed
23ADP04	Prepare a presentation in latest trends in Information Technology
23ADP04	Implement the presentation in latest trends in Information Technology

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADP04	x	-	x	-	-	x	x	-	-	-	-	-	x	-	-
23ADP04	-	-	x	-	x	-	-	x	x	x	-	-	-	-	x
23ADP04	x	-	x	-	x	-	-	-	-	x	x	-	-	x	-
23ADP04	-	-	x	x	x	-	-	-	x	-	x	-	x	x	-
23ADP04	x	-	x	-	x	x	-	-	x	-	-	x	x	x	x

Sl.No.	List of Experiments
1.	Seminar topic should relate to the Information Technology, Some of the seminar topics are listed below:
2.	FreeNet
3.	Linear Programming in Cloud
4.	Blackberry Technology
5.	Biometric Security Systems
6.	Credit Card Fraud Detection
7.	Vehicle Management System
8.	Smartshader Technology
9.	Digital Piracy
10.	Google Glass
11.	Data Recover
12.	Cyber and Social Terrorism
13.	Space Mouse

14. Pill Camera
15. Ambient Intelligence
16. Mind Reading Computer
17. Honeypots
18. Security through Obscurity
19. Electronic Banking
20. Gi-Fi

SCHEME OF EVALUATION

I. The Course is evaluated based on:

- Presentation
- Student's reports
- PPT presentation
- Presentation will take place in the weekly class. The presentation is evaluation by your class in charge
- Report must be submitted during presentation. The report evaluation is done by your class in charge.
- A Viva voce comprising comprehensive questions based on the presentation

Total Periods: 60

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23ADP05	Entrepreneurship Development	L	T	P	C
		3	0	0	3

Course Objective:

To promote strong entrepreneurship among Engineers, Managers and Science students.
To promote entrepreneurship among relevant sectors in the state.

To collaborate with other organizations and institutions.

To organize entrepreneurship development and awareness programs.

To develop close links between industry-Institute by interaction programs. High priority to activities designedto bring about improvement in the performance of the industry.

Course Outcomes:

23ADP05	Identifying real problems and a solutions people want Pitching solutions, such as products and services.
23ADP05	Developing and managing early stage software.
23ADP05	Achieve high degree of productivity in a small team via agile, high quality practices and team organization approaches
23ADP05	Create a production software development environment.
23ADP05	Achieve customer satisfaction in the development of IT products and services

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADP05	x	-	x	x	-	-	-	-	-	x	-	x	x	x	-
23ADP05	x	x	-	-	x	-	-	x	x	x	-	-	x	-	-
23ADP05	x	x	x	x	-	x	-	-	x	x	x	x	x	x	-
23ADP05	x	x	x	x	-	x	-	-	x	x	x	-	x	-	x
23ADP05	x	x	x	x	-	x	-	-	x	x	x	x	x	x	-

Unit-I Concept Of Entrepreneurship: 9

Meaning and characteristics of entrepreneurship, entrepreneurial culture, socio-economic origin of entrepreneurship, factors affecting entrepreneurship, conceptual model of entrepreneurship, traits of a good entrepreneur, entrepreneur, intra-preneur and manager ENTREPRENEURIAL MOTIVATION: motivating, compelling and facilitating factors, entrepreneurial ambition, achievement motivation theory and Kakinada experiment.

Unit-II Establishment Of Entrepreneurial Systems 9

Search, processing and selection of idea, Input requirements SMALL SCALE INDUSTRY: meaning, importance, characteristics, advantages and problems of SSIs. Steps for starting a small industry, guidelines for project report registration as SSI.

Unit-III Assistance To Ssi 9

need for incentives & subsidies, need for institutional support, role of government and other institutions

Unit-IV Functional Plans 9

Marketing plan- marketing research for the new venture, steps in preparing marketing plan, contingency planning; Organizational plan- Forms of ownership, designing organizational structure, job design, manpower planning; Financial plan- cash budget, working capital, proforma income statement, Proforma cash flow, proforma balance sheet, break even analysis.

Unit-V Sources Of Finance 9

Debt or Equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs; legal issues- intellectual property rights, patents, trademarks, copy rights, trade secrets,

licensing franchising

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gupta C. B. and Srinivasan N. P	EntrepreneurialDevelopment	Sultan Chand & Sons	2014
2.	Vasant Desai	Management of a SmallScale Industry	Himalaya Publishing House	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sangeetha Sharma	Entrepreneurship Development	PHI Learning Pvt. Ltd	2016
2	K Ramachandran	Entrepreneurship Development	Tata McGraw-Hill	2009
3	Abhishek Nirjar	Entrepreneurship Development	CBS Publishers	2014
4	S. Anil Kumar	Entrepreneurship Development	New Age International	2008
5	Fang Zhao	Information Technology Entrepreneurship and Innovation	O'Reilly	2008

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23ADP06	Professional Practices	L	T	P	C
		0	0	6	3

Course Objective:

To examine important professional issues in contemporary practice and

To help students become an effective participant in a team of IT professionals.

To have gained a thorough understanding of the various issues/factors and IT professional faces and how oneshould respond.

To have learned what are considered professional behavior in the IT field

To have learned about the current IT practices.

Course Outcomes:

23ADP06.CO1	Describe the various issues/factors an information technology professional
23ADP06.CO2	Describe professional behavior in the information technology.
23ADP06.CO3	Recognize what are the current issues in IT and the emerging technology
23ADP06.CO4	Write properly formatted and organized technical reports
23ADP06.CO5	Develop professional attitude from the perspectives of experienced IT practitioners

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23ADP06	x	-	x	x	-	x	-	-	-	x	-	x	-	x	-
23ADP06	x	x	-	-	-	-	-	x	x	x	-	-	x	x	x
23ADP06	x	-	x	x	-	x	x	-	x	x	x	x	-	x	x
23ADP06	x	x	x	x	-	x	-	-	x	x	x	-	x	-	x
23ADP06	x	x	x	x	-	x	x	-	x	x	x	x	-	x	-

Sl.No.	List of Experiments
1.	Discipline-specific knowledge and capabilities: appropriate to the level of study related to an InformationTechnology profession.
2.	Communication: using oral, written and interpersonal communication to inform, motivate and effect change
3.	Digital literacy: using technologies to find, use and disseminate information
4.	Critical thinking: evaluating information using critical and analytical thinking and judgment
5.	Problem solving: creating solutions to authentic (real world and ill-defined) problems
6.	Self-management: working and learning independently, and taking responsibility for personal actions.
7.	Teamwork: working and learning with others from different disciplines and backgrounds
8.	Global citizenship: engaging ethically and productively in the professional context and with diverse communitiesand cultures in a global context

I **Information Technology Professionalism**

A. Privacy and confidentiality

B. Computer ethics

C. Intellectual property issues

D. Computer crime and fraud

E. Professional bodies

F. Impact of information technology on society

II **Information Technology Practices**

A. Effects of standardization

B. Effectiveness vs efficiency

C. Distributed systems issues

D. Emerging technologies

E. Quality issues

F. Current issues

Total Periods: 45

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