PANIMALAR
ENGINEERING COLLEGE

An Autonomous Institution

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

CURRICULUM & SYLLABUS
REGULATION 2023

FOR THE STUDENTS ADMITTED DURING 2023-24

B.TECH - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

www.panimalar.ac.in

PANIMALAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Bangalore Trunk Road, Varadharajapuram,
Poonamallee, Chennai – 600 123.

B.TECH. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(For the Students admitted during 2023-24)

CURRICULUM AND SYLLABUS

REGULATION-2023

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

VISION

To produce high quality creators and ethical engineers for innovative technology in the field of Artificial Intelligence and Data Science.

MISSION

M1: To develop the department as a center of Artificial Intelligence for significant breakthroughs in advancing the promise of human-machine systems that can address complex cognitive tasks.

M2: To impart quality and value-based education and contribute towards the innovation of computing Data Science for the translation of data into information to support and improve decision making.

M3: To produce ethical engineers and researchers by inculcate the values of humanity and courage in producing relevant solutions to address business and societal challenges.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

PEO 1: Mastering AI and Data science for Human machine Synergy

To enrich knowledge to the engineering students with cutting-edge technologies like Artificial Intelligence and Data science and enable them to develop innovative solutions to solve complex problems in various sectorsand to enhance the synergy between humans and intelligent systems for optimal performance.

PEO 2: Fostering Interdisciplinary Research Innovation and Ethics

To engage the students in advanced research with special focus on AI and cultivate a deep knowledge of ethical frameworks that will contribute to the development of fair and accountable systems that prioritize societal well-being.

PEO 3: Pathways to Professional Excellence

To enable the students to secure successful careers throughstrong technical expertize and skill sets and drive them to pursue lifelong learning with integrity-driven mindset and become successful entrepreneurs.

PROGRAM OUTCOMES (PO)

Program Outcomes (POs):

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for

i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Graduates should be able to evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains.

PSO2: Graduates should be able to arrive at actionable Fore sight, Insight, hind sight from data for solving business and engineering problems

PSO3: Graduates should be able to create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve wicked societal problems

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B.Tech- Artificial Intelligence and Data Science

CHOICE BASED CREDIT SYSTEM (CBCS)

I - VIII SEMESTERS CURRICULUM AND SYLLABI (REGULATION 2023)

Semester I							
S.No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1	23MA1101	Matrices and Calculus	BS	3/1/0	4	4	60/40
2	23ES1101	Problem Solving using C Programming	ES	3/0/0	3	3	60/40
Theory Cum Practical Courses							
3	23HS1101	Communicative English and Language Skills	HS	2/0/2	4	3	50/50
4	23PH1101	Engineering Physics	BS	2/0/2	4	3	50/50
5	23ES1102	Basic Electrical and Electronics Engineering	ES	3/0/2	5	4	50/50
Laboratory Course							
6	23ES1111	Problem Solving using C Programming Laboratory	ES	0/0/4	4	2	40/60
Mandatory Course							
7	23TA1101	தமிழர் மரபு / Heritage of Tamils	HS	1/0/0	1	1	60/40
TOTAL					**25**	**20**	

Semester II							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext/Int Weightage**
Theory Courses							
1	23MA1203	Transforms and Vector Calculus	BS	3/1/0	4	4	60/40
2	23AD1201	Data Structures and Algorithms	PC	3/0/0	3	3	60/40
3	23ES1103	Engineering Graphics	ES	2/0/2	4	3	60/40
4	23ES1201	Python Programming	ES	3/0/0	3	3	60/40
Theory Cum Practical Courses							
5	23HS1201	Communicative and Aptitude Skills	HS	2/0/2	4	3	50/50
Laboratory Courses							
6	23AD1211	Data Structures and Algorithms Laboratory	PC	0/0/4	4	2	40/60
7	23ES1211	Python Programming Laboratory	ES	0/0/4	4	2	40/60
8	23ES1212	Technical Skill Practices I	EEC	0/0/2	2	1	40/60
Mandatory Courses							
9	23TA1201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1/0/0	1	1	60/40
10		Mandatory Course I	MC	2/0/0	2	0	0/100
TOTAL					**31**	**22**	

Semester III							
S.No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23MA1304	Mathematical Foundations for Artificial Intelligence	BS	3/1/0	4	4	60/40
2.	23AD1301	Internals of Computer Systems	ES	3/0/0	3	3	60/40
3.	23AD1302	Artificial Intelligence and Expert Systems	PC	3/0/0	3	3	60/40
4.	23AD1303	Object Oriented Programming Paradigm	PC	3/0/0	3	3	60/40
5.	23CS1303	Database Management Systems	PC	3/0/0	3	3	60/40
Laboratory Course							
6.	23AD1311	Artificial Intelligence and Expert Systems Laboratory	PC	0/0/4	4	2	40/60
7.	23AD1312	Object Oriented Programming Paradigm Laboratory	PC	0/0/4	4	2	40/60
8.	23CS1312	Database Management Systems Laboratory	PC	0/0/4	4	2	40/60
9.	23ES1311	Technical Skill Practices II	EEC	0/0/2	2	1	40/60
Mandatory Course							
10.		Mandatory Course-II	MC	2/0/0	2	0	0/100
TOTAL					**32**	**23**	

Semester IV							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext/Int Weightage**
Theory Courses							
1.	23MA1405	Probability and Statistical techniques for Data Science	BS	3/1/0	4	4	60/40
2.	23AD1401	Machine Learning	PC	3/0/0	3	3	60/40
3.	23AD1402	Basics of Data Science	PC	3/0/0	3	3	60/40
4.	23AD1403	Software Development and Practices	PC	3/0/0	3	3	60/40
5.		Open Elective I	OE	3/0/0	3	3	60/40
Theory Cum Practical Courses							
6.	23AD1404	System Software and Operating Systems	PC	2/0/2	4	3	50/50
Laboratory Courses							
7.	23AD1411	Machine Learning Laboratory	PC	0/0/4	4	2	40/60
8.	23AD1412	Data Science Laboratory	PC	0/0/4	4	2	40/60
9.	23ES1411	Technical Skill Practices III	EEC	0/0/2	2	1	40/60
TOTAL					**30**	**24**	

Semester V							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext/Int Weightage**
Theory Courses							
1.	23AD1501	Formal Language and Automata Theory	PC	3/0/0	3	3	60/40
2.	23AD1502	Data Communication and Network Security	PC	3/0/0	3	3	60/40
3.	23AD1503	Data Analytics	PC	3/0/0	3	3	60/40
4	23AD1504	Knowledge Engineering and Intelligent Systems	PC	3/0/0	3	3	60/40
5.		Professional Elective I	PE	3/0/0	3	3	60/40
Theory Cum Practical Courses							
6.	23AD1505	Data Exploration and Visualization	PC	3/0/2	5	4	50/50
Laboratory Courses							
7.	23AD1511	Data Analytics Laboratory	PC	0/0/4	4	2	40/60
8.	23AD1512	Knowledge Engineering and Intelligent Systems Laboratory	PC	0/0/4	4	2	40/60
9.	23ES1511	Technical Skill Practices IV	EEC	0/0/2	2	1	40/60
TOTAL					**30**	**24**	

Semester VI							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext/Int Weightage**
Theory Courses							
1.	23AD1601	Deep Learning	PC	3/0/0	3	3	60/40
2.	23AD1602	Computer Vision	PC	3/0/0	3	3	60/40
3.	23AD1603	Business Analytics	PC	3/0/0	3	3	60/40
4.		Professional Elective II	PE	3/0/0	3	3	60/40
5.		Open Elective – II	OE	3/0/0	3	3	60/40
Theory Cum Practical Courses							
6.	23AD1604	Digital Image Processing	PC	2/0/2	4	3	50/50
Laboratory Courses							
7.	23AD1611	Deep Learning Laboratory	PC	0/0/4	4	2	40/60
8.	23AD1612	Computer Vision Laboratory	PC	0/0/4	4	2	40/60
9.	23ES1611	Technical Skill Practices V	EEC	0/0/2	2	1	40/60
TOTAL					**29**	**23**	

Semester VII							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext/Int Weightage**
Theory Courses							
1.	23AD1701	Augmented Reality and Virtual Reality with AI	PC	3/0/0	3	3	60/40
2.	23ML1702	Natural Language Processing	PC	3/0/0	3	3	60/40
3.		Professional Elective III	PE	3/0/0	3	3	60/40
4.		Professional Elective IV	PE	3/0/0	3	3	60/40
Theory Cum Practical Courses							
5.	23AD1702	AI in Robotics	PC	3/0/2	5	4	50/50
Laboratory Courses							
6.	23AD1711	Augmented Reality and Virtual Reality with AI Laboratory	PC	0/0/4	4	2	40/60
7.	23AD1712	Innovation Practices and Mini Project	EEC	0/0/4	4	2	40/60
Employability Enhancement Courses							
8.	23AD1703	Industrial training/Internship[#]	EEC	-	-	2	0/100
9.		Value added Course[##]	EEC	-	-	0	0/100
TOTAL					**25**	**22**	

The Students Shall undergo one 4-week or Two 2-week internship/ Industrial Training during the summer / Winter vacation from semester 03 to 06.The same will be Evaluated in Semester 07.Two weeks of Internship/Industrial Training carries one credit.

Value added course to be completed between III to VII Semesters.

Semester VIII							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext/Int Weightage**
Theory Courses							
1.		Professional Elective V	PE	3/0/0	3	3	60/40
2.		Professional Elective VI	PE	3/0/0	3	3	60/40
Laboratory Courses							
3.	23AD1811	Project Work	EEC	0/0/16	16	8	40/60
TOTAL					**22**	**14**	
Total No. of Credits: 172							

HUMANITIES AND SOCIAL SCIENCES (HS)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23HS1101	Communicative English & Language Skills (Lab Integrated)	HS	4	2	0	2	3
2.	23HS1201	Communicative and Aptitude Skills	HS	4	2	0	2	3
3.	23TA1101	Heritage of Tamils	HS	1	1	0	0	1
4.	23TA1201	Tamils and Technology	HS	1	1	0	0	1

BASIC SCIENCES (BS)

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23MA1101	Matrices and Calculus	BS	4	3	1	0	4
2.	23PH1101	Engineering Physics (Lab integrated)	BS	4	2	0	2	3
3.	23MA1203	Transforms and Vector Calculus	BS	4	3	1	0	4
4.	23MA1304	Mathematical Foundations for Artificial Intelligence	BS	4	3	1	0	4
5.	23MA1405	Probability and Statistical techniques for Data Science	BS	4	3	1	0	4

ENGINEERING SCIENCES (ES)

Sl. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ES1101	Problem Solving using C Programming	ES	3	3	0	0	3
2.	23ES1102	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4
3.	23ES1111	Problem Solving using C Programming Laboratory	ES	4	0	0	4	2
4.	23ES1103	Engineering Graphics	ES	4	2	0	2	3
5.	23ES1201	Python Programming	ES	3	3	0	0	3
6.	23ES1211	Python Programming Laboratory	ES	4	0	0	4	2
7.	23AD1301	Internals of Computer Systems	ES	3	3	0	0	3

PROFESSIONAL CORE (PC)

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23AD1201	Data Structures and Algorithms	PC	3	3	0	0	3
2.	23AD1211	Data Structures and Algorithms Laboratory	PC	4	0	0	4	2
3.	23AD1302	Artificial Intelligence and Expert Systems	PC	3	3	0	0	3
4.	23AD1303	Object Oriented Programming Paradigm	PC	3	3	0	0	3
5.	23CS1303	Database Management Systems	PC	3	3	0	0	3
6.	23AD1311	Artificial Intelligence and Expert Systems Laboratory	PC	4	0	0	4	2
7.	23AD1312	Object Oriented Programming Paradigm Laboratory	PC	4	0	0	4	2
8.	23CS1312	Database Management Systems Laboratory	PC	4	0	0	4	2
9.	23AD1401	Machine Learning	PC	3	3	0	0	3
10.	23AD1402	Basics of Data Science	PC	3	3	0	0	3
11.	23AD1403	Software Development and Practices	PC	3	3	0	0	3
12.	23AD1404	System Software and Operating Systems (Lab Integrated)	PC	4	2	0	2	3
13.	23AD1411	Machine Learning Laboratory	PC	4	0	0	4	2
14.	23AD1412	Data Science Laboratory	PC	4	0	0	4	2
15.	23AD1501	Formal Language and Automata Theory	PC	3	3	0	0	3
16.	23AD1502	Data Communication and Network Security	PC	3	3	0	0	3
17.	23AD1503	Data Analytics	PC	3	3	0	0	3
18.	23AD1504	Knowledge Engineering and Intelligent Systems	PC	3	3	0	0	3
19.	23AD1505	Data Exploration and Visualization (Lab integrated)	PC	5	3	0	2	4
20.	23AD1511	Data Analytics Laboratory	PC	4	0	0	4	2
21.	23AD1512	Knowledge Engineering and Intelligent Systems Laboratory	PC	4	0	0	4	2
22.	23AD1601	Deep Learning	PC	3	3	0	0	3

23.	23AD1602	Computer Vision	PC	3	3	0	0	3
24.	23AD1603	Business Analytics	PC	3	3	0	0	3
25.	23AD1604	Digital Image Processing (Lab integrated)	PC	3	2	0	2	3
26.	23AD1611	Deep Learning Laboratory	PC	4	0	0	4	2
27.	23AD1612	Computer Vision Laboratory	PC	4	0	0	4	2
28.	23AD1701	Augmented Reality and VirtualReality with AI	PC	3	3	0	0	3
29.	23ML1702	Natural Language Processing	PC	3	3	0	0	3
30.	23AD1702	AI in Robotics (Lab Integrated)	PC	5	3	0	2	4
31.	23AD1711	Augmented Reality and VirtualReality with AI Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science and Optimization	Vertical II Full Stack Development	Vertical III Cloud Computing And Data Center Technologies	Vertical IV Cyber Security and Data Privacy	Vertical-V Creative Media	Vertical VI Neworking	Vertical VII Intelligent Analytics
Data Warehousing and Data Mining 23AD1901	NextGen Web Development 23IT1901	Storage Technologies 23CS1901	Ethical Hacking 23IT1909	Video Creation and Editing 23CS1909	Communication Theory 23CS1917	Image and Video Analytics 23AD1910
Exploratory Data Analysis 23AD1902	Open Source Technologies 23IT1902	Cloud Tools and Techniques 23CS1902	Modern Cryptography 23IT1910	Digital Marketing 23CS1910	Network Design And Programming 23CS1918	Speech Processing and Analytics 23AD1911
Soft Computing 23AD1903	App Development 23IT1903	Virtualization 23CS1903	Digital and Mobile Forensics 23IT1911	Multimedia and Animation 23CS1911	Network Management 23IT1917	Health Care Analytics 23AD1912
Text Analytics 23AD1904	UI and UX Design 23IT1904	Cloud Services Management 23CS1904	Social Network Security 23IT1912	Streaming Media Tools and Technologies 23CS1912	Wireless Technologies 23IT1918	Optimization Techniques 23AD1913
Recommender Systems 23AD1905	DevOps 23IT1905	Security and Privacy in Cloud 23CS1905	Cryptocurrency and Blockchain Technologies 23IT1913	Visual Effects 23CS1913	Wireless Adhoc And Sensor Networks 23CS1919	Bio Inspired Optimization Computing 23AD1914
Engineering Predictive Analytics 23AD1906	Software Testing and Automation 23IT1906	Stream Processing 23CS1906	Engineering Secure Software Systems 23IT1914	3D Printing and Design 23CS1914	Protocols And Architectures For Wireless Sensor Networks 23IT1919	Game Theory 23AD1915
Ethics and AI 23AD1907	Web Application Security 23IT1907	Site Reliability Engineering 23CS1907	Cyber Physical Systems Security 23IT1915	Game Development 23CS1915	Software Defined Networks 23IT1920	Cognitive Science 23AD1916
Big Data Management 23AD1908	Project Management and Agile Technologies 23IT1908	Quantum Computing 23CS1908	Threat Detection and Incident Response 23IT1916	Data Visualization 23AD1909	Next Generation Networks 23CS1920	Robotic Process Automation and Development 23AD1917

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI.

These courses are listed in groups called verticals that represent a particular area of specialization /diversified group.

Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: DATA SCIENCE AND OPTIMIZATION

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23AD1901	Data Warehousing and Data Mining	PE	3	0	0	3	3
2.	23AD1902	Exploratory Data Analysis	PE	3	0	0	3	3
3.	23AD1903	Soft Computing	PE	3	0	0	3	3
4.	23AD1904	Text Analytics	PE	3	0	0	3	3
5.	23AD1905	Recommender Systems	PE	3	0	0	3	3
6.	23AD1906	Engineering Predictive Analytics	PE	3	0	0	3	3
7.	23AD1907	Ethics and AI	PE	3	0	0	3	3
8.	23AD1908	Big Data Management	PE	3	0	0	3	3

VERTICAL II: FULL STACK DEVELOPMENT

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23IT1901	NextGen Web Development	PE	3	0	0	3	3
2.	23IT1902	Open Source Technologies	PE	3	0	0	3	3
3.	23IT1903	App Development	PE	3	0	0	3	3
4.	23IT1904	UI and UX Design	PE	3	0	0	3	3
5.	23IT1905	DevOps	PE	3	0	0	3	3
6.	23IT1906	Software Testing and Automation	PE	3	0	0	3	3
7.	23IT1907	Web Application Security	PE	3	0	0	3	3
8.	23IT1908	Project Management and Agile Technologies	PE	3	0	0	3	3

VERTICAL III : CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23CS1901	Storage Technologies	PE	3	0	0	3	3
2.	23CS1902	Cloud Tools and Techniques	PE	3	0	0	3	3
3.	23CS1903	Virtualization	PE	3	0	0	3	3
4.	23CS1904	Cloud Services Management	PE	3	0	0	3	3
5.	23CS1905	Security and Privacy in Cloud	PE	3	0	0	3	3
6.	23CS1906	Stream Processing	PE	3	0	0	3	3
7.	23CS1907	Site Reliability Engineering	PE	3	0	0	3	3
8.	23CS1908	Quantum Computing	PE	3	0	0	3	3

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23IT1909	Ethical Hacking	PE	3	0	0	3	3
2.	23IT1910	Modern Cryptography	PE	3	0	0	3	3
3.	23IT1911	Digital and Mobile Forensics	PE	3	0	0	3	3
4.	23IT1912	Social Network Security	PE	3	0	0	3	3
5.	23IT1913	Cryptocurrency and Blockchain Technologies	PE	3	0	0	3	3
6.	23IT1914	Engineering Secure Software Systems	PE	3	0	0	3	3
7.	23IT1915	Cyber Physical Systems Security	PE	3	0	0	3	3
8.	23IT1916	Threat Detection and Incident Response	PE	3	0	0	3	3

VERTICAL V: CREATIVE MEDIA

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23CS1909	Video Creation and Editing	PE	3	0	0	3	3
2.	23CS1910	Digital Marketing	PE	3	0	0	3	3
3.	23CS1911	Multimedia and Animation	PE	3	0	0	3	3
4.	23CS1912	Streaming Media Tools and Technologies	PE	3	0	0	3	3
5.	23CS1913	Visual Effects	PE	3	0	0	3	3
6.	23CS1914	3D Printing and Design	PE	3	0	0	3	3
7.	23CS1915	Game Development	PE	3	0	0	3	3
8.	23AD1909	Data Visualization	PE	3	0	0	3	3

VERTICAL VI: NETWORKING

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23CS1917	Communication Theory	PE	3	0	0	3	3
2.	23CS1918	Network Design And Programming	PE	3	0	0	3	3
3.	23IT1917	Network Management	PE	3	0	0	3	3
4.	23IT1918	Wireless Technologies	PE	3	0	0	3	3
5.	23CS1919	Wireless Adhoc And Sensor Networks	PE	3	0	0	3	3
6.	23IT1919	Protocols And Architectures For Wireless Sensor Networks	PE	3	0	0	3	3
7.	23IT1920	Software Defined Networks	PE	3	0	0	3	3
8.	23CS1920	Next Generation Networks	PE	3	0	0	3	3

VERTICAL VII: INTELLIGENT ANALYTICS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23AD1910	Image and Video Analytics	PE	3	0	0	3	3
2.	23AD1911	Speech Processing and Analytics	PE	3	0	0	3	3
3.	23AD1912	Health Care Analytics	PE	3	0	0	3	3
4.	23AD1913	Optimization Techniques	PE	3	0	0	3	3
5.	23AD1914	Bio Inspired Optimization Computing	PE	3	0	0	3	3
6.	23AD1915	Game Theory	PE	3	0	0	3	3
7.	23AD1916	Cognitive Science	PE	3	0	0	3	3
8.	23AD1917	Robotic Process Automation and Development	PE	3	0	0	3	3

OPEN ELECTIVE – I

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	23CE1010	Air Pollution and Control Engineering	OE	3	3	0	0	3
2.	23ME1008	Energy Conservation and Management	OE	3	3	0	0	3
3.	23GE1004	Hospital Waste Management	OE	3	3	0	0	3
4.	23ME1009	Industrial Nanotechnology	OE	3	3	0	0	3
5.	23EE1003	Logic and Distributed Control Systems	OE	3	3	0	0	3
6.	23EC1011	Telehealth Technology	OE	3	3	0	0	3

OPEN ELECTIVE – II

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	23EE1001	Basic Circuit Theory	OE	3	3	0	0	3
2.	23ME1010	Energy Engineering	OE	3	3	0	0	3
3.	23EC1004	Electronic Devices	OE	3	3	0	0	3
4.	23CE1009	Environmental and Social Impact Assessment	OE	3	3	0	0	3
5.	23GE1003	Hospital Management	OE	3	3	0	0	3
6.	23EC1002	Medical Electronics	OE	3	3	0	0	3
7.	23EC1009	Signals and Systems	OE	3	3	0	0	3
8.	23ME1006	Systems Engineering	OE	3	3	0	0	3
9.	23ME1944	Supply Chain Management	OE	3	3	0	0	3
10.	23CY1003	Waste Water Treatment	OE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ES1212	Technical Skill Practices I	EEC	2	0	0	2	1
2.	23ES1311	Technical Skills Practices II	EEC	2	0	0	2	1
3.	23ES1411	Technical Skills Practices III	EEC	2	0	0	2	1
4.	23ES1511	Technical Skills Practices IV	EEC	2	0	0	2	1
5.	23ES1611	Technical Skills Practices V	EEC	2	0	0	2	1
6.	23AD1712	Innovation Practices and Mini Project	EEC	4	0	0	4	2
7.	23AD1703	Industrial training/Internship[#]	EEC	-	-	-	-	2
8.		Value added Course[##]	EEC	-	-	-	-	0
9.	23AD1811	Project Work	EEC	16	0	0	16	8

MANDATORY NONCREDIT COURSES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23MC1001	Environmental Science	MC	2	2	0	0	0
2.	23MC1002	Constitution of India	MC	2	2	0	0	0
3.	23MC1003	Human Values	MC	2	2	0	0	0
4.	23MC1004	Energy Studies	MC	2	2	0	0	0
5.	23MC1005	Essence of Indian TraditionalKnowledge	MC	2	2	0	0	0
6.	23MC1006	Soft Skills and Personality Development	MC	2	2	0	0	0
7.	23MC1007	Value Education, Human Rights and Legislature Procedure	MC	2	2	0	0	0

CREDIT DISTRIBUTION

S.No.	Subject Area / Semester	Credits Per Semester								Credits Total	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities and Social Studies (HS)	4	4							8	4.65
2.	Basic Sciences(BS)	7	4	4	4					19	11.05
3.	Engineering Sciences (ES)	9	8	3						20	11.63
4.	Professional Core (PC)		5	15	16	20	16	12		84	48.84
5.	Professional Electives (PE)					3	3	6	6	18	10.47
6.	Open Electives (OE)				3		3			6	3.49
7.	Project Work (PR/EEC)		1	1	1	1	1	2	8	15	8.72
8.	Non-Credit/ (Mandatory)		0	0						0	0.00
9.	Industrial training/ Internship							2		2	1.16
10.	Value added Course							0		0	0.00
	TOTAL	**20**	**22**	**23**	**24**	**24**	**23**	**22**	**14**	**172**	**100.00**

SEMESTER – I

23MA1101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- Matrix algebra can be readily applied to the structural properties of graphs from an algebraic point of view.
- To introduce the concepts of limits, continuity, derivatives and maxima and Minima.
- To Familiarize the functions of two variables and finding its extreme points.
- To provide understanding of various te4chniques of integration.
- To introduce integral ideas in solving areas, volumes and other practical problems.

UNIT I MATRICES 9+3

Eigenvalues and Eigenvectors of a real matrix - Characteristic equation -Properties of Eigenvalues and Eigenvectors -Cayley Hamilton theorem -Diagonalization of matrices- Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (Sum, Product & Quotient rule, Chain rule, logarithmic and implicit differentiation) - Maxima and Minima of functions of one variable and its applications**.**

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial differentiation - Total derivative - Change of variables — Jacobian's - Taylor's series for functions of two variables - Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS 9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts - Bernoulli's formula- Integration of rational functions by partial fraction - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS 9+3

Double integrals in Cartesian and polar coordinates - Change of order of integration in Cartesian coordinates - Area enclosed by plane curves - Change of variables in double integrals -Triple integrals - Volume of Solids.

TOTAL :60 PERIODS

COURSE OUTCOMES

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

CO1 Able to find Eigen values and Eigen vectors, diagonalization of a matrix, symmetric matrices, positive definite matrices.

CO2 Apply limit definition and rules of differentiation to differentiate functions.

CO3 Understand familiarity in the knowledge of Maxima and Minima, Jacobian, Taylor series and apply the problems involving Science and Engineering.

CO4 Understand the knowledge of Integration by parts, Integration of rational functions by partial fraction.

CO5 Understand the knowledge of Area enclosed by plane curves, Change of variables in double integrals, Triple integrals, Volume of Solids.

TEXT BOOKS

1. Gerwal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44rdEdition, 2018.
2. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 9thEdition, New Delhi, 2015.
3. Bali N., Goyal M. and Walkins C., “Advanced Engineering Mathematics”, Firewall

REFERENCE BOOKS

1. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt.Ltd.Chennai, 2007.
2. Srimantha Paland Bhunia, S.C, "Engineering Mathematics “Oxford University Press, 2015.
3. B.V. Ramana“Higher Engineering Mathematics”, McGraw Hill Education, India.
4. Erwin Kreyzig, Advanced Engineering Mathematics, JohnWiley sons, 10th Edition, 2015.
5. Siva Ramakrishna Dass, C. Vijayakumari, “Engineering Mathematics”, PearsonEducation India, 4th Edition 2019.
6. Sundar Raj. M and Nagarajan. G , “Engineering Mathematics-I”,3rd Edition, Sree Kamalamani Publications, Chennai, 2020.

ONLINE COURSES / RESOURCES

1.https://onlinecourses.nptel.ac.in/noc21_ma60/preview

2.https://onlinecourses.nptel.ac.in/noc21_ma58/preview

CO-PO-PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	1	3	2	2
CO2	3	3	3	-	-	-	-	-	-	-	1	2	3	2
CO3	3	3	3	-	-	-	-	-	-	-	1	3	3	2
CO4	3	3	3	-	-	-	-	-	-	-	1	2	2	1
CO5	3	3	3	-	-	-	-	-	-	-	1	3	2	1

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60%

23ES1101	PROBLEM SOLVING USING C PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the syntax for C programming
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions, pointers
- To develop applications using structures and union

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Algorithms – Flowchart - Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Type Conversion Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Format specifiers, Assignment statements – Decision making statements - Switch statement – Break – Continue - Goto statement -Looping statements – Pre-processor directives - Compilation process.

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Multiplication, Determinant and Transpose) - String operations: length, compare, concatenate, copy, Reverse and Palindrome – Selection sort, Insertion sort - linear and binary search.

UNIT III FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT IV STRUCTURES AND UNION 9

Structure - Nested structures– Pointer and Structures– Array of structures – Example Program using structures and pointers – Self-referentials structures – Dynamic memory allocation – Singly linked list– typedef and Union.

UNIT V FILE PROCESSING 9

Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1 Learn the syntax for C programming

CO2 Develop simple applications in C using basic constructs

CO3 Design and implement applications using arrays and strings

CO4 Develop and implement applications in C using functions and pointers.

CO5 Develop applications in C using structures and union.

TEXT BOOKS

1. Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition,Pearson Education, 2006.

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, —– C How to Program, Seventh edition, Pearson Publication, 2015
2. Juneja, B. L and Anita Seth, —Programming in C, CENGAGE Learning India pvt.Ltd.,2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, FirstEdition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schism"s Outline of Theory and Problems of Programming withC",McGraw-Hill Education, 1996.

CO-PO-PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	1	-	-	-	-	-	2	2	3
CO2	2	1	1	1	2	1	-	-	-	-	-	2	2	3
CO3	3	2	2	1	3	1	-	-	-	-	-	3	2	3
CO4	3	2	2	1	3	1	-	-	-	-	-	3	2	3
CO5	2	1	1	1	2	1	-	-	-	-	-	3	2	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / MiniProject	Written Test	Written Examinations
40	60	40	60	100
40%				60%

23HS1101	COMMUNICATIVE ENGLISH AND LANGUAGE SKILLS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To induce the basic reading and writing skills among the first year engineering and technology students.
- To assist the learners to develop their listening skills, which will enable them listening to lectures and comprehend them by asking questions and seeking clarifications
- To succor the learners to develop their speaking skills and speak fluently in real contexts.
- To motivate the learners to develop vocabulary of a general kind by developing their reading skills for meeting the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments
- To learn to use basic grammatical structures in suitable contexts

UNIT I INFORMAL COMMUNICATION 6

Listening: Listening and filling details, Listening to Speeches by Specialists and Completing Activities such as Answering Questions, Identifying the Main Ideas, Style, etc. **Speaking**: Introducing One-self — Introducing a Friend/ Family. **Reading**: Descriptive Passages (From Newspapers / Magazines).**Writing**: Autobiographical Writing, Developing Hints. **Grammar**: Noun, Pronoun & Adjective. **Vocabulary Development**: One Word Substitution.

UNIT II CONVERSATIONAL PRACTICE 6

Listening: Listening to Conversations (Asking for and Giving Directions).**Speaking**: Making Conversation Using (Asking for Directions, Making an Enquiry), Role Plays, and Dialogues. **Reading**: Reading a Print Interview and Answering Comprehension Questions. **Writing**: Writing a Checklist, Dialogue Writing **Grammar**: Tenses and Voices, Regular and Irregular Verbs. **Vocabulary Development**: Prefix &Suffix, Word formation.

UNIT III OFFICIAL COMMUNICATIONS 6

Listening: Listening for specific information. Speaking: Giving Short Talks on a given Topic. **Reading**: Reading Motivational Essays on Famous Engineers and Technologists (Answering Open-Ended and Closed Questions).**Writing**: Writing Permission Letters/Editor, Complaint, and Invitation. Emails and Review Writing-Books, Films. **Grammar**: Adverb, Prepositions & Conjunctions. **Vocabulary Development**: Collocations — Fixed Expressions.

UNIT IV COMMUNICATION AT WORK PLACE 6

Listening: Listening to Short Talks (5 Minutes Duration and Fill a Table, Gap-Filling Exercise) Note Taking/Note Making .**Speaking**: Small Group Discussion, Giving Recommendations. **Reading**: Reading Problem — Solution Articles/Essays Drawn From Various Sources .**Writing**: Making Recommendations. **Grammar**: Subject-Verb Agreement, Framing Questions. **Vocabulary Development**: Infinitives and Gerunds, Reference Words, Technical Vocabulary.

UNIT V DEFINITIONS AND PRODUCT DESCRIPTION 6

Listening: Listening to a Product Description (Labelling and Gap Filling) Exercises. **Speaking**: Describing a Product and Comparing and Contrasting it with Other Products. **Reading**: Reading Graphical Material for Comparison (Advertisements).**Writing**: Essay Writing. Compare and Contrast Paragraphs, Essay writing. **Grammar**: Phrasal Verbs — Cause and Effect Sentences –Compound Nouns and Definitions. **Vocabulary Development:** Use of Discourse Markers.

THEORY :30 PERIODS

TEXT BOOKS

1. N P Sudharshana & C Savitha. English for Technical Communication Delhi: CUP,2019.
2. Board of Editors. English for Engineers and Technologists Volume 1 Orient Black SwanLimited, 2020.

REFERENCE BOOKS

1. Board of Editors. Using English-A course book for Undergraduate engineers and Technologists Orient Black Swan Limited, 2017
2. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
3. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011 3. Means,
4. L.Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning, USA:2007.
5. Redston, Chris &Gillies Cunningham Face2Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005.

WEB REFERENCES

1. https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary -exams/wordformation
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES

1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20 18031621.pdf
4. https://www.ego4u.com/en/cram-up/grammar/prepositions

LIST OF EXPERIMENTS

1. Listen to lectures- articulate a complete idea as opposed to producing fragmented utterances- Tedtalks, Science Fiction- My Fair Lady
2. Listening — following, responding to explanations, giving directions and instructions in academic and business contexts- IELTS,TOEFL.
3. Listening to transcripts and answer to the questions.
4. Listening for specific information: accuracy and fluency – BEC.
5. Reading: Different Text Type.
6. Reading: Predicting Content using pictures and titles.
7. Reading: Use of Graphic Organizers to review.
8. Reading: Aid Comprehension.
9. Reading: Speed Reading Techniques.
10. Reading and Comprehending the passages in the competitive exams like GATE,TOEFL,GRE,IELTS and other exams conducted by Central and state Governments.

PRACTICAL : 30 PERIODS
TOTAL : 60 PERIODS

REFERENCE BOOKS

1. SureshKumar.E and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Blackswan: Hyderabad,2012
2. Davis, Jason and Rhonda Liss. Effective Academic Writing (level 3) Oxford University Press: Oxford,2006
3. Withrow, Jeans and et al. Inspired to write. Reading and Tasks to develop writing skills. Cambridge University Press: Cambridge,2004.

COURSE OUTCOMES

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

CO1 Comprehend conversation and short talks delivered in English.
CO2 Participate effectively in informal conversation; introduce themselves and their friends and express opinions English.
CO3 Read articles of a general kind in magazines and newspaper
CO4 Write short essays of a general kind and personal letters and emails in English.
CO5 Gain understanding of basic grammatical structures and use them in right context.
CO6 Use appropriate words in a professional context.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	3	-	2	2	2	3
CO2	-	-	-	-	-	-	-	3	3	-	2	2	2	3
CO3	-	-	-	-	-	-	-	2	3	-	2	2	2	2
CO4	-	-	-	-	-	-	-	2	3	-	2	2	2	3
CO5	-	-	-	-	-	-	-	2	3	-	2	2	2	3
CO6	-	-	-	-	-	-	-	3	3	-	2	2	3	3

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23PH1101	ENGINEERING PHYSICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To impart knowledge in basic concepts of physics relevant to engineeringapplications
- To introduce advances in technology for engineering applications

UNIT – I PROPERTIES OF MATTERS 6

Elasticity: Stress, strain, Hooke's law and elastic moduli – stress-strain diagram – twisting couple per unit twist for solid cylinder – torsional pendulum (theory) – bending moment of beam – non-uniform and uniform bending (theory)– I-shape girder.

Thermal Physics: Mode of heat transfer: conduction, convection and radiation – thermal expansion of solids – bimetallic strips – thermal conductivity – Forbe's method and Lee's disc method; theory and experiment – thermal insulation – applications.

UNIT – II SEMICONDUCTING AND MAGNETIC MATERIALS 6

Semiconducting Materials: Intrinsic Semiconductors – energy band diagram – carrier concentration in intrinsic semiconductors – extrinsic semiconductors (N-type & P-type) – variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Zener and avalanche breakdown in p-n junctions – Ohmic contacts – Schottky diode – tunnel diode.

Magnetic Materials: Magnetism in materials – Basic definitions – Classifications of Magnetic Materials- Ferromagnetic Domain theory – M versus H behavior- Hard and Soft Magnetic materials- Magnetic principle in Computer data storage – Magnetic Hard Disc and Embedded systems**.**

UNIT – III MODERN OPTICS 6

Laser: Population of energy levels, Einstein's A and B coefficients derivation — optical amplification (qualitative) — Semiconductor lasers: homo junction and hetero junction **– Fiber Optics**: components and principle of fiber optics — numerical aperture and acceptance angle derivation — types of optical fibers (material, refractive index, mode) — losses associated with optical fibers– fiber as pressure and displacement sensors.

UNIT –IV QUANTUM PHYSICS AND NANOSCIENCE 6

Quantum Physics: Blackbody radiation – Planck's hypothesis and derivation – wave particle duality of light: concepts of photon – de Broglie hypotheses – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations.

Nanoscience: Introduction – Classification of nanomaterials – preparation (bottom up and top-down approaches), mechanical, optical and electrical properties – applications: NEMS and MEMS– carbon nanotubes: types.

UNIT –V ELECTROMAGNETIC WAVES 6

Divergence – curl – integral calculus – Gauss divergence theorem – Stoke's theorem – equation of continuity – displacement current – Maxwell's equations – Gauss's laws – Faraday's law –Ampere-Maxwell law – mechanism of electromagnetic wave propagation – Hertz observation – production and detection of electromagnetic wave – properties of electromagnetic waves.

THEORY: 30 HOURS

LIST OF EXPERIMENTS

1. Determination of Moment of Inertia of the disc and Rigidity Modulus of the materialof the wire — Torsional Pendulum.
2. Determination of Young's Modulus – Non - Uniform Bending.
3. Determination of Thermal Conductivity of the Bad Conductor – Lee's Disc Method.
4. Determination of thickness of a thin wire – Air wedge method.
5. i) Determination of wavelength of Laser using Grating and Particle sizedetermination.
   ii) Determination of Numerical Aperture and Acceptance angle of an Optical Fiber.
6. Determination of Velocity of ultrasonic waves in a liquid and compressibility of the liquid — Ultrasonic Interferometer.
7. Determination of wavelength of Hg source using grating by normal incidence method using spectrometer.

PRACTICAL : 30 PERIODS
TOTAL : 60 PERIODS

TEXT BOOKS

1. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012
2. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition,Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014.
3. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017.
4. Basics of laser physics: for students http://www.springer.com/978-3- 319- 50650-0 of science and engineering

REFERENCE BOOKS

1. Halliday, D., Resnick, R. & Walker, J.—Principles of Physics, Wiley, 2015.
2. Tipler, P.A. & Mosca, G. —– Physics for Scientists and Engineers with ModernPhysics'. W.H.Freeman, 2007.
3. Ruby Das, C.S. Robinson, Rajesh Kumar, Prashant Kumar Sahu, A Textbook of Engineering Physics Practical, University Science Press, Delhi, II Edition (2016),ISBN 978-93-80386-86-7

COURSE OUTCOMES

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

CO1 Understand the basics properties of materials, especially elastic and thermal properties of materials.

CO2 Adequate knowledge on the concepts of semiconducting and magnetic materials and their applications in memory storage.

CO3 Acquire the knowledge on the concepts of lasers, fiber optics and their technological applications.

CO4 Get knowledge on fundamental concepts of quantum theory, Nano science its applications

CO5 Gain knowledge on the basics of electromagnetic waves and its properties.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	2	2	3
CO2	**3**	**3**	**2**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	3	2	3
CO3	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	3	2	3
CO4	**3**	**3**	**1**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	2	3	2
CO5	**3**	**3**	**1**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	3	2	2

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**61%**

23ES1102	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

- To learn the concepts related with Electrical circuits and Wiring.
- To study the concept of electrical machines.
- To understand basics of Semiconductor Devices.
- To understand the basics of Sensors and Actuators
- To develop IOT infrastructure for Real time applications

UNIT I BASIC ELECTRICAL CIRCUITS AND HOUSE WIRING 9

Electrical Quantities — Ohms Law — Kirchhoff's Law — Series and Parallel Connections — Earthing and its Types- basic house wring - tools and components, different types of wiring, safety measures at home and industry. **Case Study** -staircase Wiring and ceiling fan Wiring.

UNIT II ELECTRICAL MACHINES 9

Construction, Working Principle of Dc motors, Brushless dc motor, Permanent magnet DC Motor, stepper motor, Servo Motor(No Problems). -Application of motor in Industrial automation.

UNIT III SEMICONDUCTOR DEVICES AND CIRCUITS 9

PN junction diode -Zener diode – Half wave and Full wave rectifier, - BJT, MOSFET,IGBT-Characteristics- **Case Study**: SMPS in computer and UPS in Residential Application.

UNIT IV SENSORS AND ACTUATORS 9

Sensors: Temperature Sensor- Pressure Sensor-Proximity Sensor, Ultrasonic sensors. Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals. **Case Study**: Integrated sensor and actuator systems in automation.

UNIT V EMERGING TECHNOLOGIES 9

Solar PV system- solar and battery powered Electric Vehicle - IOT Concept and its Functional blocks- Introduction to Arduino Uno. Case Study: Smart and Connected Cities: Smart Lighting-Smart Parking Architecture - Smart Traffic Control.

THEORY :45 PERIODS

TEXT BOOKS

1. Hughes revised by Mckenzie Smith with John Hilcy and Keith Brown, Electrical and Electronics Technology, 8th Edition, Pearson, 2012.
2. R.J. Smith, R.C. Dorf, Circuits Devices and Systems, 5th Edition, John Wiley and sons,2001.
3. P. S. Dhogal, Basic Electrical Engineering – Vol. I & II, 42nd Reprint, McGraw Hill,2012.
4. Clarence W. de Silva, "Sensors and Actuators: Engineering System Instrumentation", 2nd Edition, CRC Press, 2015
5. Clarence W. de Silva, "Sensors and Actuators: Engineering System Instrumentation", 2nd Edition, CRC Press, 2015
6. David Hanes, Gonzalo Salgueiro, Patrick Grossetete. Rob Barton and Jerome Henry, "IOT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

WEB REFERENCES

1. https://electrical-engineering-portal.com/download-center/books-and-guides/electrical-engineering/basic-course
2. https://www.infoq.com/articles/internet-of-things-reference-architecture/

ONLINE COURSES / RESOURCES

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/105/108105155/
3. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

LIST OF EXPERIMENTS

1. i. Study of Electronic components and equipment's – Resistor, colour coding

   ii. Soldering practice – Components Devices and Circuits–Using general purpose PCB
2. Electrical House Wiring:

3. i. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
   ii. Fluorescent lamp wiring
   iii. Stair case wiring
   iv. Study of Home Appliances- wiring and assembly
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

5. Design of Half wave Rectifier & Full wave Rectifier

6. Simulation of following circuits using suitable software

   i.Seven segment LED display
   ii. Stepper Motor control
   iii.Traffic Light Control
7. 2D & 3D Electrical wiring Model using suitable Software.

SOFTWARE REQUIRED: Keil/Proteus/Fusion 360

PRACTICAL: 30 PERIODS
TOTAL: 75 PERIODS

COURSE OUTCOMES

On Successful Completion of the course student will be able to:

CO1 Acquire basic knowledge on Basic Electrical circuits and House Wiring.
CO2 Understand the construction, working principle and applications of DC and ACMachines
CO3 Acquire basic knowledge on semiconductor devices and their applications
CO4 Illustrate the concepts of Sensors and Actuators
CO5 Identify and analyse Various Emerging Technologies.
CO6 Analyse the applications of IOT in real time scenario.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	2	2	3
CO2	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	3	2	2
CO3	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	2	2	3
CO4	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	2	2	3
CO5	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	3	3	2
CO6	**3**	**2**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**1**	2	3	3

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23ES1111	PROBLEM SOLVING USING C PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To write, test, and debug simple Python programs
- .To implement Python programs with conditions and loops
- To use functions for structuring Python programs.
- To represent compound data using Python lists, tuples, dictionaries.
- To learn to implement string functions and file operations
- To understand python packages and GUI development.

LIST OF EXPERIMENTS

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction,multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights basedon the following conditions
   a) if it is a perfect cube
   b) if it is a multiple of 4 and divisible by 6
   c) if it is a prime number
   d) Sort the numbers based on the weight in the increasing order as shown below <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are abovethe average height.
8. Given a string —a$bcd./fgǁ find its reverse without changing the position ofspecial characters. (Example input:a@gh%;j and output:j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbersusing user defined functions.
10. From a given paragraph perform the following using built-in functions:
    a) Find the total number of words.
    b) Capitalize the first word of each sentence.
    c) Replace a given word with another word.
11. a) Sort the list of numbers using Selection sort and insertion sort
    b) Sort the list of numbers using pass by reference.
12. a) Search an element from an unsorted array using linear search
    b) Search an element in an array using Binary search recursion call.
13. Generate salary slip of employees using structures and pointers.
    a) Programs using Pointers
    b) Pointer demonstration the use of & and *
    c) Access Elements of an Array Using Pointer
    d) Perform the string operations like Length of the String , Concatenation of string and compare the string using Pointer

Count number of words, digits, vowels using pointers

a) Add two matrices using Multidimensional Arrays with pointers

b) Multiply two matrices using pointers

c) Multiply two numbers using Function Pointers

14. Compute internal marks of students for five different subjects using structuresand functions
15. Program to demonstrate the difference between unions and structures
16. Insert, update, delete and append telephone details of an individual or acompany into a telephone directory using random access file.
17. Count the number of account holders whose balance is less than the minimumbalance using sequential access file.

TOTAL: 60 PERIODS

COURSE OUTCOMES

On successful completion of the course, student will be able to:

CO1 Write, test, and debug simple C programs.

CO2 Implement C programs with conditionals and loops.

CO3 Develop C programs for simple applications making use arrays and strings.

CO4 Develop C programs involving functions, recursion, pointers, and structuresand union.

CO5 Design applications using sequential and random access file processing.

CO6 Perform task as an individual and / or team member to manage the task in time

WEB REFERENCES

1. https://www.programiz.com/c-programming/examples
2. https://beginnersbook.com/2015/02/simple-c-programs/
3. https://www.programmingsimplified.com/c-program-examples
4. https://www.tutorialgateway.org/c-programming-examples/
5. https://www.javatpoint.com/c-programs

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	2	2	3
CO2	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	2	2	3
CO3	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	3	2	3
CO4	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	3	2	3
CO5	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	3	3	3
CO6	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	2	2	2

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23TA1101	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT – I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages — Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land Bakthi Literature Azhwars and N ayanmars - Formsof minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT – II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT – III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT –IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT –V CONTRIBUTION OF TAMILS TO INDIAN NATIONALMOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India — Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books

TOTAL: 15 PERIODS

23TA1101	தமிழர் மரபு	L	T	P	C
		1	0	0	1

UNIT – I **மொழி மற்றும் இலக்கியம்** **3**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி –தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை –சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக்கருத்துக்கள் – தமிழ் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

UNIT – II **மரபு-பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை** **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரி முனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

UNIT – III **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்** **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

UNIT –IV **தமிழர்களின் திணைக் கோட்பாடுகள்** **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்க கால நகரங்களும் துறைமுகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி

UNIT –V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்ட தமிழர்களின் பங்களிப்பு** **3**

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL: 15 PERIODS

TEXT-CUM REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர்.இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL — (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies
7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu(Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

SEMESTER-II

23MA1203	TRANSFORMS AND VECTOR CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To acquaint the student with the concepts of vector calculus needed for problems in AI&DS discipline.
- Introduce Fourier series analysis which is central to many applications in engineeringapart from its use in solving boundary value problems.
- To make the student appreciate the purpose of using transforms to create a newdomain in which it is easier to handle the problem that is being investigated.
- To develop Z transform techniques for discrete time systems

UNIT I VECTOR CALCULUS 9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vectorfields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem(excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds

UNIT II FOURIER SERIES 9+3

Dirichlet'sconditions – General Fourier series – Odd and even functions – Half range sineseries – Half range cosine series – Complex form of Fourier series – Harmonic analysis.

UNIT III FOURIER TRANSFORMS 9+3

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine andcosine transforms — Properties — Transforms of simple functions — Convolution theorem — Parseval'sidentity.

UNIT IV LAPLACE TRANSFORM 9+3

Laplace transform – Sufficient condition for existence – Transform of elementary functions– Basicproperties – Transforms of derivatives and integrals of functions - Derivatives and integralsoftransforms - Transforms of unit step function and impulse functions – Transform of periodic functions.Inverse Laplace transforms -Statement of Convolution theorem – Initial and final value theorems.

UNIT IV Z-TRANSFORMS AND DIFFERENCE EQUATIONS 9+3

Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

COURSE OUTCOMES

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

CO1 Solve gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.

CO2 Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO3 Determine the Fourier transforms for a function and evaluates special integrals.

CO4 Find out Laplace transform for a function using the properties

CO5 Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
2. Grewal B.S., “Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New
3. Delhi, 2014.
4. Narayanan.S, ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics ForEngineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCE BOOKS

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing CompanyLimited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education,2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics", Sixth Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.
7. Nagarajan. G and Sundar Raj. M, “Transforms and Partial Differential Equations” ,5th Edition, SreeKamalamani Publications, Chennai, 2020.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**2**
CO5	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**3**	**3**

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60%**

23AD1201	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To design linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees.
- To learn sorting, searching and indexing methods to increase the knowledge of usage of datastructures in algorithmic perspective.
- To select and design data structures and algorithms that is appropriate for problems.
- To understand the concepts behind NP Completeness, Approximation algorithms.

UNIT I ABSTRACT DATA TYPES AND LINEAR DATA STRUCTURES **9**

Abstract Data Types (ADTs) - **Stack ADT** – Operations – Applications – Balancin Symbols – Evaluating arithmetic expressions Infix to Postfix conversion – **Queue ADT** Operations – Circular Queue – DE Queue – Applications of Queues.

UNIT II NON-LINEAR DATA STRUCTURES **9**

Tree – Binary tree ADT-Tree -Traversals Algorithms –Search Tree – Binary Search Trees-AVL Trees (Insertion, Deletion) –Splay Trees (Insertion, Deletion, Searching)-Red-Black Trees**.**

UNIT III DIVIDE AND CONQUER STRATEGY AND GREEDYSTRATEGY **9**

Divide and Conquer Strategy: Quick Sort-Multiplication of large integers and Strassen's Matri Multiplication**. Greedy Technique**: Prim's Algorithm - Kruskal's Algorithm- Dijkistra's Algorithm Huffman Trees and Code.

UNIT IV DYNAMIC PROGRAMMING AND BACKTRACKING **9**

Dynamic Programming: Computing binomial coefficient - Warshall's and Floyd's algorithm.
Backtracking: General method – N Queens Problem – Hamiltonian Circuits .Exhaustive search: DFS, BFS.

UNIT V BRANCH-AND-BOUND,NP PROBLEMS AND APPROXIMATION ALGORITHMS **9**

Branch and Bound-Assignment -Knapsack problem – Traveling salesman problem - NP Complete and NP-Hard problems. **Approximation Algorithms** - NP Hard Problems Knapsack and Travelling Sales Man Problem.

TOTAL :45 PERIODS

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1 Design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications.
CO2 Implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting.
CO3 Analyse and design various problems using divide and conquer and greedy strategy
CO4 Create the algorithms using dynamic programming and backtracking and to solve problems.
CO5 Apply Branch and Bound technique to different real time applications.
CO6 Solve problems using approximation algorithms.

TEXT BOOKS

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, ―Data Structures & Algorithms in Python‖, John Wiley & Sons Inc., 2021
2. Anany Levitin, "Introduction to design and analysis of algorithms",3rd Edition,Pearson Education,2017.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India, New Delhi, 2012.

REFERENCE BOOKS

1. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.
2. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C++‖, Fourth Edition,Pearson Education, 2014.
3. Sara Baase and Allen Van Gelder, Computer Algorithms – Introduction to Design & Analysis, Third Edition, Pearson Education, New Delhi, 2000.
4. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms,Second Edition, Universities Press, Hyderabad, 2008.

WEB REFERENCES

1.https://www.geeksforgeeks.org/c-language-set-1-introduction/

2.https://www.codechef.com/certification/data-structures-and-algorithms/prepare

3.https://www.w3schools.in/data-structures-tutorial/intro/

ONLINE COURSES / RESOURCES

1.https://nptel.ac.in/courses/

2.https://www.w3schools.in/data-structures-tutorial/

3.https://www.tutorialspoint.com/data_structures_algorithms**/**

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	2	-	-	-	1	1	1	2	3	2	2
CO2	2	3	1	2	-	-	-	2	2	1	2	3	3	2
CO3	2	1		1	-	-	-	2	1	1	2	3	3	3
CO4	1	2	3	1	-	-	-	-	-	-	-	3	3	3
CO5	1	1	-	-	-	-	-	-	-	-	-	3	3	3
CO6	1	1	-	-	-	-	-	-	-	-	-	3	3	3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ES1103	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- Drawing Engineering curves
- Drawing orthographic projections of lines and planes
- Drawing orthographic projections of solids
- Drawing section and development of the surfaces of objects
- Drawing isometric views and intersection curves of simple solids
- Drawing free hand sketches of basic geometrical shapes, multiple views of objects and Applications of Engineering Graphics

UNIT 1 CONCEPTS AND CONVENTIONS (Not for Examination) 2

Importance of drawing in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning - Introduction to Scales - Geometric construction - to draw perpendiculars, parallel lines, divide a line and circle, to draw equilateral triangle, square, regular polygons. Introduction to drafting packages like CAD and demonstration of their use in engineering fields.

UNIT I ENGINEERING CURVES AND PROJECTION OF POINTS AND LINES 6+6

Basic construction of cycloid, epicycloid and hypocycloid - Drawing of tangents and normal to the above curves. Construction of involutes of square, pentagon and circle - Drawing of tangents and normal to the above involutes.

Orthographic projection — Introduction to Principal Planes of projections - First angle projection - Projection of points. Projections of straight lines (only in First angle projections) inclined to both the principal planes - Determination of true lengths, true inclinations and traces by rotating line method

UNIT II PROJECTIONS OF PLANES AND PROJECTIONS OF SOLIDS 6+6

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method and auxillary plane method.

Projection of simple solids like prisms, pyramids, cylinder, and cone when the axis isinclined to one principle planes by rotating object method.

UNIT III SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of solids in simple vertical position when the cutting plane is inclined to the oneof the principal planes and perpendicular to the other – obtaining true shape of section.

Development of lateral surfaces of simple solids and frustum and truncated solids – Prisms, pyramids cylinders and cones.

UNIT IV INTERSECTION OF SOLIDS AND ISOMETRIC PROJECTIONS 6+6

Line of intersection - Determining the line of intersection between surfaces of two interpenetrating two square prisms and Intersection of two cylinders with axes of the solids intersecting each other perpendicularly, using line method.

Principles of isometric projection — isometric scale –Isometric projections and isometric views of simple solids and frustum and truncated solids - Prisms, pyramids, cylinders, cones-

combination of two solid objects in simple vertical positions.

UNIT V FREE-HAND SKETCHING 5+5

Steps in free hand sketching - Orthographic views (front, top and side views) of simple blocks from their Isometric view, Isometric view of simple blocks from their Orthographic views (front, top and side views)

TOTAL :60 PERIODS

COURSE OUTCOMES

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

CO1 Draw the engineering curves and draw orthographic projections of lines and planes
CO2 Draw orthographic projections of planes and solids
CO3 Draw the sections and development of the surfaces of objects
CO4 Draw isometric projections and intersection of curves of simple solids.
CO5 Draw free hand sketching of basic geometrical shapes, multiple views of objects

TEXT BOOKS

1. Natarajan, K. V., "A text book of Engineering Graphics", 28thEd.,Dhanalakshmi Publishers, Chennai, 2015.
2. Venugopal, K. and Prabhu Raja, V., "Engineering Graphics", New Age Publications,2008.

REFERENCE BOOKS

1. Bhatt, N.D.,Panchal V M and Pramod R. Ingle, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.
3. Agrawal, B. and Agrawal C.M., "Engineering Drawing", Tata McGraw, N.Delhi, 2008.

WEB REFERENCES

1. https://nptel.ac.in/courses/105/104/105104148/

2. https://www.youtube.com/channel/UCkCk0nvNyWhEOLge9JtDLDg

ONLINE COURSES / RESOURCES

1.https://nptel.ac.in/courses/112/103/112103019/

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	3	3	2	2	2
CO2	3	3	3	-	-	-	-	-	-	3	3	2	2	2
CO3	3	3	3	-	-	-	-	-	-	3	3	2	2	2
CO4	3	3	3	-	-	-	-	-	-	3	3	2	2	2
CO5	3	3	3	-	-	-	-	-	-	3	3	2	2	2

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ES1201	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the basic programming constructs and control structures in python
- To use python data structures – Lists, Tuples and Dictionary
- To define Python functions and use Strings
- To learn about input/output with files in Python.
- To understand python packages and GUI concepts

UNIT - I INTRODUCTION TO PYTHON PROGRAMMING ANDCONTROL STRUCTURES 9

Introduction to Python, Demo of Interactive and script mode, Tokens in Python — Variables, Keywords, Comments, Literals, Data types, Indentation, Operators and its precedence, Expressions, Input and Print functions, Type Casting. Illustrative problems: find minimum in a list, guess an integer number in a range, Towers of Hanoi.

Control Structures: Selective statements — if, if-else, nested if, if — elif ladder statements ; Iterative statements - while, for, range functions, nested loops, else inloops, break, continue and pass statements. Illustrative programs: exchange the values of two variables,circulate the values of n variables, distance between two points.

UNIT - II FUNCTIONS AND STRINGS 9

Functions: Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments, Scope of variables: Local and global scope, Recursion and Lambda functions.Illustrative programs:power of a number,sorting,Fibonacci series using lambda.

Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions, Regular expression: Matching the patterns, Search and replace. Illustrative programs:check whether the string is symmetrical,reverse a string,length of a string.

UNIT – III COLLECTIONS 9

List: Create, Access, Slicing, Negative Indices, List Methods, and comprehensions Tuples: Create, Indexing and Slicing, Operations on tuples.Dictionary: Create, add, and replace values, operations on dictionaries.Sets: Create and operations on set. Illustrative programs: Interchange first and last element in a list, maximum andminimum N elements in a tuple, sort dictionary by key or value, size of a set.

UNIT –IV FILES AND EXCEPTION HANDLING 9

Files: Open, Read, Write, Append and Close. Tell and seek methods. Illustrative programs: word count, copy file.

Command line arguments, Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Exception Chaining, User-defined Exceptions, Defining Clean-Up actions.

Illustrative programs: prompt the user to input an integer and raises a ValueError exception if the input is not a valid integer, open a file and handles a FileNotFoundError exception if the file does not exist, prompt the user to input two numbers and raises a TypeError exception if the inputs are not numerical, executes an operation on a list and handles an IndexError exception if the index is out of range.

UNIT -V **PACKAGES & GUI** **9**

Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc. Illustrative programs:create a pandas series using numpy,make a pandas dataframe with 2D list.

GUI Programming: Tkinter introduction, Tkinter and PythonProgramming, Tk Widgets, Tkinter examples. Python programming with IDE. Illustrative programs:create a GUI marksheet,calendar,file explorer using Tkinter,

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of the course student will be able to:

CO1	Develop and execute simple Python programs using conditionals and loopsfor solving problems.
CO2	Express proficiency in the handling of strings and functions
CO3	Represent compound data using Python lists, tuples, dictionaries,sets etc
CO4	Read and write data from/to files and handle exceptions in Python programs
CO5	Implement python packages in data analysis and design GUI
CO6	Examine various problem solving concepts in python to develop real time applications.

TEXT BOOKS

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, PearsonEducation, 1st Edition, 2021.
2. Reema Thareja,”Problem Solving and Programming with Python’’, 2ndedition, Oxford University Press, New Delhi, 2019.
3. Alan D. Moore, Python GUI Programming with Tkinter, Design and BuildFunctional and User-friendly GUI Applications, Packt Publishing, 2021.

REFERENCE BOOKS

1. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-GrawHill, 2018
2. Eric Matthes, “Python Crash Course, A Hands - on Project BasedIntroduction to Programming”, 2nd Edition, No Starch Press, 2019.
3. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”,2nd Edition, O’Reilly Publishers, 2016.

ONLINE COURSES / RESOURCES

1. https://docs.python.org/3/tutorial/
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/python/index.htm
4. https://www.javatpoint.com/python-tutorial
5. https://nptel.ac.in/courses/

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	1	2						1	2	2	2
CO2	2	3	3	1	2						1	2	2	2
CO3	2	3	3	1	2						1	2	2	2
CO4	2	3	3	1	2						1	2	2	2
CO5	2	3	3	1	2						1	3	3	3
CO6	2	3	3	1	2						1	3	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23HS1201	COMMUNICATIVE AND APTITUDE SKILLS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To develop linguistic and strategic competence in workplace context and to enhance language proficiency and thereby the employability of budding engineers andtechnologists.
- To improve the relevant language skills necessary for professional communication.
- To help learners to develop their listening skills, which will, enable them to listen to lectures and comprehend them by asking questions; seeking clarification anddeveloping their speaking skills and to speak fluently in real contexts.
- To improve the verbal ability skill and communicative skill of the students.
- To enhance the analytical and problem solving skills of the students.
- To prepare them for various public and private sector exams & placement drives.

UNIT I INTERPERSONAL COMMUNICATION 6

Listening: Listening to Telephone Etiquettes and Conversations. **Speaking**: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks. **Reading**: Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting). **Writing**: Writing a Short Biography of an Achiever Based on Given Hints, **Grammar**: Comparative Adjective, Numerical Expressions and Sentence pattern. **Vocabulary Development**: Idioms and Phrases

UNIT II TECHNICAL COMMUNICATION 6

Listening: Listening to Talks/Lectures Both General and Technical and Summarizing the Main Points. **Speaking**: Participating in Debates, TED Talks. **Reading**: Reading Technical Essays/ Articles and Answering Comprehension Questions. **Writing**: Summary Writing, Minutes of the meeting. **Grammar**: Prepositional Phrases and Relative Clauses. **Vocabulary Development:** Abbreviations and Acronyms.

UNIT III PROCESS DESCRIPTION 6

Listening: Listening to a Process Description and Drawing a Flowchart. **Speaking**: Participating in Group Discussions, Giving Instructions, Presentation. **Reading**: Reading Instruction Manuals **Writing**: Process Descriptions — Writing Instructions **Grammar**: Use of Imperatives, Tenses, Impersonal Passive Voice and Phrasal verbs **Vocabulary Development**: Misspelt words. Homophones and Homonyms.

UNIT IV REPORT WRITING 6

Listening: Listening to a Presentation and Completing Gap-Filling Exercises. **Speaking**: Making Formal Presentations, **Reading**: Reading and Interpreting Charts/Tables and diagrams. **Writing**: Interpreting Charts/Tables and Diagrams, Writing a Report. **Grammar**: Reported Speech; Interrogatives- Question Tags and Articles — omission of articles **Vocabulary Development**: Technical Jargon.

UNIT V INTERVIEW SKILLS 6

Listening: Listening to a Job Interview and Completing Gap-Filling Exercises **Speaking**: Mock Interview, Telephone Interviews & Etiquette, and Group Discussion .**Reading: Reading** a Job Interview, SOP, Company Profile and Completing Comprehension Exercises **Writing**: Job Applications and Resume. **Grammar**: Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement.

APTITUDE SKILLS

Ratio and Proportion – Ratio, Proportion, Simple equations, Problems on Ages, **Percentages** - Percentages increase/decrease, Simple and Compound interest, **Number system -** Factors, Multiples - HCF and LCM, **Permutation** - Combination and Probability

THEORY : 30 PERIODS

TEXT BOOKS

1. Board of Editors. English for Engineers and Technologists Volume 2 Orient BlackSwan Limited, 2020
2. Richards, C. Jack. Interchange, New Delhi: CUP, 2017
3. Aggarwal R.S. (2017). Quantitative Aptitude for Competitive Examinations 3rd (Ed.) New Delhi: S.Chand Publishing.

REFERENCE BOOKS

1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
2. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principlesand Practice. Oxford University Press: New Delhi, 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford:2007.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges.Cengage Learning, USA: 2007.
5. Sharma Arun.(2016). Quantitative Aptitude, 7th (Ed.). Noida: McGraw Hill Education Pvt.Ltd.

WEB REFERENCES

1. https://learnenglishteens.britishcouncil.org/exams/grammar-and- vocabularyexams/word-formation.
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018.
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm .
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules/
5. https://www.math-only-math.com/practice-test-on-ratio-and- proportion.html
6. https://www.hitbullseye.com/Simple-Interest-and-Compound-Interest.php

ONLINE COURSES / RESOURCES

1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018 /02/2018031621
4. https://www.ego4u.com/en/cram-up/grammar/prepositions.
5. https://www.classcentral.com/course/quantitative-methods-4340
6. https://www.classcentral.com/subject/qualitative-research

LIST OF EXPERIMENTS

1.Speaking- sharing personal information- self introduction

2.Speaking- Group Discussion, Small talk or Peb Talk

3.Speaking- Presentation- Formal and Informal

4.Speaking- Mock Interview

5.Speaking- FAQ's on Job Interview

6.Speaking – JAM

7.Speaking- Debate and Story Narration

8.Writing: Error Detection- Spotting and reasoning the errors from the passages in competitive exams.

9. Writing: Letter of recommendation

10.Writing: Elements of a good essay

11.Writing: Types of essays. Descriptive – Narrative-Issue based.

PRACTICAL : 30 PERIODS
TOTAL :60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Recognize the need for life skills; apply them to different situations, thebasic communication practices in different types of communication.
CO2	Gain confidence to communicate effectively in various situations to acquire employability skills.
CO3	Develop knowledge, skills, and judgment around human communicationthat facilitate their ability to work collaboratively with others.
CO4	Communicate effectively & appropriately in real life situation and enhancestudent's problem solving skill.
CO5	Prepare for various public and private sector exams & placement drives.
CO6	Enhance students' problem solving skills.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1								**3**	**3**		**2**	**2**	**2**	**2**
CO2								**3**	**3**		**2**	**2**	**2**	**2**
CO3								**2**	**3**		**2**	**2**	**2**	**2**
CO4								**2**	**3**		**2**	**2**	**3**	**3**
CO5								**2**	**3**		**2**	**3**	**3**	**2**
CO6								**3**	**1**		**3**	**2**	**3**	**3**

<table>
<tr><td colspan="2">Assessment
(40% weightage)
(Theory Component)</td><td colspan="2">Assessment
(60% weightage)
(Laboratory Component)</td><td>End Semester Examination</td></tr>
<tr><td>Individual Assignment / Case Study / Seminar / Mini Project</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record</td><td>Test</td><td>Written Examination</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td><td rowspan="2">100</td></tr>
<tr><td colspan="4">100</td></tr>
<tr><td colspan="4">50 %</td><td>50 %</td></tr>
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23AD1211	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To demonstrate array implementation of linear data structure algorithms
- To design and implement the Application of Stack and Queue
- To understand the complex data structures such as tree.
- To solve real time problems.

LIST OF EXPERIMENTS

1. Write a program for Array based implementation of stack.
2. Design a program for Implementation of Evaluating Postfix Expressions.
3. Design, develop and execute a program to evaluate a valid postfix expression usingstack. Assume that the postfix expression is read as a single line consisting of non- negative single digit operands and binary arithmetic operators. The operators are + (add), - (subtract), *(multiply), /(divide).
4. Write a program to perform Binary search tree operations.
5. Write a program for implementation of AVL tree.
6. Design a program for implementation of various operations that can be performed onRed Black Tree.
7. Write a program for Quick sort using Divide and Conquer strategy (without usingBuilt in Function).
8. Write a program for Minimum cost spanning tree using Greedy approach.
9. Write a program for Huffman Coding.
10. Design, develop and execute a program to read a sparse matrix of integer values. and make a transpose of it. Use the triple to represent an element in sparse matrix.
11. Write a program for All pairs shortest path problem using dynamic programming.
12. Design a program Backtracking – N Queens Problem.
13. Design a program Branch and Bound – Travelling salesman problem.
14. Design a program using Approximation algorithms for knapsack problems.
15. Mini Project on Real time Applications.

Software Requirement:

PYTHON 3.11.4

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Develop programs to implement linear data structures algorithms.

CO2 Implement applications using Stacks and Linked lists.

CO3 Analyse the concept of trees in real world scenarios.

CO4 Decide on the data structure for any practical problem.

CO5 Implement backtracking technique to real time applications.

CO6 Solve approximation algorithms in case study.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	1	2	2	1	-	-	-	2	1	2	2	3	2	2
CO2	3	3	1	1	-	-	-	1	1	1	3	3	2	2
CO3	2	1	3	1	-	-	-	1	1	2	3	2	3	2
CO4	3	1	3	3	-	-	-	1	2	3	3	3	3	3
CO5	1	1	-	-	-	-	-	3	3	3	1	2	3	3
CO6	1	1	-	-	-	-	-	2	2	2	2	2	3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23ES1211	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To write, test, and debug simple Python programs
- To implement Python programs with conditions and loops
- To use functions for structuring Python programs.
- To represent compound data using Python lists, tuples, dictionaries.
- To learn to implement string functions and file operations
- To understand python packages and GUI development.

LIST OF EXPERIMENTS

1. Basic Python Programs
2. Write programs to demonstrate different number data types in python
3. Develop python programs to demonstrate various conditional statements
4. Implement user defined functions using python
5. Develop python scripts to demonstrate built-in functions
6. Develop python programs to perform various string operations like slicing, indexing &formatting
7. Develop python programs to perform operations on List & Tuple
8. Demonstrate the concept of Dictionary with python programs
9. Develop python programs to perform operations on Sets.
10. Develop python codes to perform matrix addition, subtraction and transpose ofthe given matrix
11. Develop python codes to demonstrate the concept of function composition and anonymous functions.
12. Demonstrate python codes to print try, except and finally block statements
13. Implement python programs to perform file operations
14. Write a python code to raise and handle various built in exceptions.
15. Implement python programs using packages numpy and pandas
16. UI development using tkinter

Mini Project :Suggested Topics(but not limited to)

- Dice roll simulator
- Guess the number game
- Random password generator

TOTAL: 60 PERIODS

COURSE OUTCOMES

On Successful Completion of the course student will be able to

CO1 Develop and execute simple Python programs

CO2 Implement programs in Python using conditionals and loops for solving problems.

CO3 Deploy functions to decompose a Python program.

CO4 Analyze string operations and develop relevant programs.

CO5 Utilize Python packages in data analysis

CO6 Create GUI for python applications

WEB REFERENCES

1. https://www.programiz.com/python-programming/examples
2. https://www.geeksforgeeks.org/python-programming-examples/
3. https://beginnersbook.com/2018/02/python-programs/
4. https://www.javatpoint.com/python-programs
5. https://www.w3schools.com/python/python_examples.asp
6. https://www.sanfoundry.com/python-problems-solutions/

CO- PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO6	3	3	3	3	3	-	-	-	-	-	-	2	2	2

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23ES1212	TECHNICAL SKILL PRACTICES I	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To impart essential problem solving skills through general problem solving concepts.
- To provide basic knowledge on programming essentials using C as implementationtool.
- To introduce various programming methods using C.

LIST OF EXPERIMENTS

1. Data Types, Variables, Operators
2. Expressions, Precedence , Operators
3. Conditional Statements , Switch Statements
4. Looping, Nested Loops
5. Problems on Bit Manipulation
6. Patterns
7. Number Problems
8. Array Basics , Static vs Dynamic Array, Two Dimensional Matrix
9. Structure , Union ,Storage Classes
10. Function , Parameters passing
11. Recursion
12. Strings
13. Pointers
14. Command Line Arguments, Pre-processors
15. File Handling & Exception Handling.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Propose solutions for a given problem.

CO2 Infer the fundamental programming elements in C language and learn to applybasic control structures in C.

CO3 Demonstrate the applications of structures and unions.

CO4 Visualize the capabilities of modular programming approach in C.

CO5 Understand the basic principles of pointers and their association during implementations.

CO6 Apply various input, output and error handling functions in C.

TEXT BOOKS

1. Reema Thareja, ``Programming in C"", 2nd edition, OXFORD University Press, New Delhi, 2019.
2. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, PearsonPublication, 2016.

REFERENCE BOOKS

1. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education,2014.
2. Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill, 2000.

ONLINE COURSES / RESOURCES:

1. https://www.javatpoint.com/c-programming-language-tutorial
2. https://www.tutorialspoint.com/cprogramming/
3. https://nptel.ac.in/Courses/

CO-PO-PSO MAPPING

	PO 1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	3	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	3	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	3	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	3	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	3	3	2	2
CO6	3	3	3	3	3	-	-	-	-	-	3	2	2	2

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23TA1201	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT – I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) — Graffiti on Potteries.

UNIT – II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age — Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT – III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper andgold-Coins as source of history - Minting of Coins — Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gemstone types described in Silappathikaram.

UNIT –IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea – Fisheries-Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT –V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries — Sorkuvai Project.

Total : 15 PERIODS

23TA1201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

UNIT – I **நெசவு மற்றும் பானைத் தொழில்நுட்பம்** **3**

சங்ககாலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

UNIT – II **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்** **3**

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாடு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ- சாரோசோனிக் கட்டிடக் கலை.

UNIT – III **உற்பத்தி தொழில்நுட்பம்** **3**

கப்பல் கட்டும் கலை - உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

UNIT –IV **வேளாண்மை மற்றும் நீர் பாசனத் தொழில்நுட்பம்** **3**

அணை, ஏரி, குளங்கள், மதகு – சோழர் காலக் குமிழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன் வளம் – முத்து மற்றும் முத்துக் குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

UNIT –V **அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்** **3**

அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

Total : 15 PERIODS

TEXT CUM REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL — (inprint)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies
7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & TamilNadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

SEMESTER-III

23MA1304	MATHEMATICAL FOUNDATIONS FOR ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To Understand logical and mathematical concepts to enhance abstraction and problem solving skills
- To Apply foundational terminologies of computer science to solve practical problems effectively.
- To Analyze and explore the basic principles of combinatorics and graph theory.
- To Evaluate hypotheses using appropriate sampling techniques for small and large samples in real-world scenarios.
- To Apply Non-parametric tests and sampling techniques to solve problems in various fields.

UNIT I **LOGIC AND PROOFS** **9+3**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers –Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II **9+3**

COMBINATORICS

Mathematical induction – Strong induction and well ordering – The pigeonhole principle – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT III **GRAPHS** **9+3**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs-Shortest path - Dijkstra's algorithms - graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV **TESTING OF HYPOTHESIS** **9+3**

Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, F and Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit.

UNIT V **NON PARAMETRIC TESTS** **9+3**

Sign test for paired data, Mann-Whitney U test, Kruskal-Wallis H test, Run test, Kolmogorov-Smirnov test.

TOTAL :60 PERIODS

COURSE OUTCOMES

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

CO1 Apply the concept of Predicate Calculus to design computing machines, artificial intelligence systems, and evaluate the logical correctness of programs.

CO2 Demonstrate an understanding of counting principles and their applications in problem-solving.

CO3 Analyze graph terminology and apply it in the design and optimization of computer networks.

CO4 Illustrate the process of hypothesis testing for small and large samples in solving real-life problems.

CO5 Implement the concepts of Non-Parametric Testing for analyzing Non-Normal Populations effectively.

TEXT BOOKS

1. Probability and Statistics with Reliability, Queuing, and Computer Science Applications by K.S. Trivedi is the **Second Edition**, published by John Wiley & Sons in 2016.
2. Grimaldi, R.P. “Discrete and Combinatorial Mathematics: An Applied Introduction”, 5th Edition, Pearson Education Asia, Delhi, 2004.
3. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub.Co. Ltd., New Delhi, Special Indian Edition, 2011.
4. Veerarajan. T, Discrete Mathematics: with graph theory and combinatorics, McGrawHill Education (India) Pvt.Ltd. 2019.

REFERENCE BOOKS

1. Lipschutz, S. and Mark Lipson., “Discrete Mathematics”, Schaum’s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
2. Yates R.D. and Goodman. D. J., "Probability and Stochastic Processes", 3rd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
3. A. Goon, M. Gupta and B. Dasgupta, Fundamentals of Statistics, vol. I & II, World Press, 2016.
4. Tremblay, J.P. and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 35th Reprint, 2008.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	1	3	3	2	3
CO2	3	3	-	-	-	-	-	-	-	-	3	2	3	2
CO3	3	3	1	-	-	-	-	-	-	1	3	3	2	3
CO4	3	3	3	-	-	-	-	-	-	-	3	2	3	3
CO5	3			3	-	-	-	-	-	-	3	2	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1301	INTERNALS OF COMPUTER SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational and synchronous sequential circuits
- To learn the basic structure and operations of a computer
- To learn the basics of pipelined execution
- To understand the concept of various memories and I/O interfacing.

UNIT - I DIGITAL FUNDAMENTALS 9

Digital Systems – Features of Digital Systems- Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra– Standard Forms – NAND – NOR Implementation– K-Maps

UNIT - II COMBINATIONAL AND SEQUENTIAL CIRCUITS 9

Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers– Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables – Shift registers and their types – Counters.

UNIT - III COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT - IV PROCESSOR BASICS 9

Design Convention of a Processor-Instruction Execution – Building a MIPS Datapath and Designing a Control Unit – Hardwired Control and Microprogrammed Control – Pipelining – Data Hazard – Control Hazards

UNIT - V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Simplify complex Boolean functions using K-Map

CO2 Design and Analyze Combinational Circuits

CO3 Analyze the design of Sequential Circuits

CO4 State the fundamentals of computer systems and analyze the execution of an instruction

CO5 Analyze different types of control design and identify hazards .

CO6 Identify the characteristics of various memory systems and I/O communication

TEXT BOOKS

1. Digital Principles and Applications – Donald P Leach, Albert Paul Malvino, GoutamSaha, 8th edition,McGraw-Hill Education, 3rd reprint 2015.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCE BOOKS

1. Digital design, R.Anantha Natarajan, PHI Learning, 2015.
2. Principles of digital Electronics, K.Meena, PHI Learning, 2013.
3. Digital Computer Fundamentals, Thomas C. Bartee TMH 2007.
4. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**
CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**
CO3	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**
CO4	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**
CO5	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**
CO6	**3**	**1**	**1**	**-**	**-**	**-**	**-**		**-**	**-**	**-**	**2**	**3**	**2**

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1302	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	L	T	P
		3	0	0

COURSE OBJECTIVES

- To understand artificial intelligence principles, history and various Intelligent Agent.
- To learn about different problem-solving strategies using heuristic function.
- To analyze problems by identifying constraints and finding solutions that satisfy those constraints.
- To understand knowledge representation and planning.
- To introduce the concepts of Expert system and Responsible AI.

UNIT - I INTRODUCTION TO ARTIFICIAL INTELLIGENCE **9**

Definitions – Importance of AI, Foundation of AI, Intelligent Agents–Agent and Environment– Concept of Rationality– Classification of AI Systems with Respect to Environment, Problem Solving Agents, Application of AI, Future of AI.

UNIT - II PROBLEM SOLVING AGENTS **9**

Search Algorithms, Heuristic Search–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 CONSTRAINT SATISFACTION PROBLEMS AND GAME THEORY 9

Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search for CSP – Local Search for CSP –Structure of CSP–Game Playing – Mini–Max Algorithm – Optimal Decisions in Games – Alpha–Beta Search – Cutting of Search – Forward Pruning –Monte–Carlo Search for Games – Stochastic Games, Partially Observable Game, Card Game.

UNIT - IV KNOWLEDGE REPRESENTATION AND PLANNING 9

Logical Agents: Knowledge–Based Agents–Propositional Logic–Propositional Theorem, First–Order Logic: Knowledge Engineering in First order Logic– Interference, Knowledge Representation: Categories and Objects–Events–Reasoning Systems and Default Information, Planning – Algorithms– Heuristics for Planning – Hierarchical Planning – Non–Deterministic Domains – Time, schedule, and Resources – Analysis.

UNIT - V EXPERT SYSTEM AND RESPONSIBLE AI 9

Expert Systems – Stages in the Development of an Expert System – Probability Based Expert Systems –Expert System Tools – Difficulties in Developing Expert Systems – Applications of Expert Systems–Responsible AI – Ethical Decision Making–Need for Responsible AI–Approaches to Ethical Reasoning–Ensuring Responsible AI in Practice.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Analyze various Intelligent agent environment

CO2 Describe search strategies in problem solving and game playing using heuristic function

CO3 Apply the CSP concepts for a scenario.

CO4 Implement logical agents and first-order logic problems.

CO5 Create problem-solving strategies with knowledge representation mechanism for solving hard problems.

CO6 Demonstrate the basics of expert systems and responsible AI to develop models.

TEXT BOOKS

1. Russell, S. and Norvig, P, “Artificial Intelligence - A Modern Approach”, 4th edition, Prentice Hall. 2022.
2. David L. Poole and Alan K. Mackworth. A, “Artificial Intelligence: Foundations of Computational Agents”, Cambridge University Press.2023.
3. Enrique Castillo,Jose M. Gutierrez,Ali S. Hadi, “Expert Systems and Probabilistic Network Models, Springer Publishing Company”, Incorporated.ISBN:978-1-4612-7481-0, 2012
4. Virginia Dignum, Responsible Artificial Intelligence-How to Develop and use AI in a Responsible Way, Springer. ISBN: 978-3-030-30371-6, 2019.

REFERENCE BOOKS

1. Elaine Rich, Kevin Knight and B.Nair, “Artificial Intelligence 3rd Edition, McGraw Hill”, 2017.
2. Luger, G.F, “Artificial Intelligence -Structures and Strategies for Complex Problem Solving”, 6th edition, Pearson, 2008.
3. Brachman, R. and Levesque H, “Knowledge Representation and Reasoning”, Morgan Kaufmann, 2004.
4. Alpaydin, E, “Introduction to Machine Learning”, 2nd edition, 2010.
5. Sutton R.S. and Barto, A.G, “Reinforcement Learning: An Introduction”, MIT Press, 1998.

Padhy, N.P, “Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2009.

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	1	-	-	-	-	-	3	2	2
CO2	2	2	1	-	2	-	-	-	-	-	-	3	2	2
CO3	2	2	1	-	2	-	-	-	-	-	-	2	3	2
CO4	2	1	1	-	-	2	-	-	-	-	-	2	2	3
CO5	2	2	1	-	-	2	-	-	-	-	-	3	2	3
CO6	2	2	2	-	2	-	-	-	-	-	-	3	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1303	OBJECT ORIENTED PROGRAMMING PARADIGM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand basic characteristics and structure of Java.
- To implement Object Oriented Programming Concepts using Java.
- To develop Java applications using exception handling and threads.
- To design generic solutions to a problem and build simple GUI applications using Java AWT.
- To understand the dynamic web page creation using DHTML.

UNIT I INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND JAVA 9

Introduction to Object Oriented Programming concepts: Class, Object, Encapsulation, Polymorphism, Inheritance, Abstraction; Overview of Java - Difference between C and Java - Java Buzzwords – – Programming Structures in Java - Data Types, Variables and Arrays – Operators – Control Statements –– Defining classes in Java – Constructors: Types of constructors – Constructor Overloading – Constructor Chaining - Methods - Access specifiers – this keyword - Static members - Packages – Packages and Member Access – Importing Packages.

UNIT II INHERITANCE, ABSTRACT CLASSES AND INTERFACES 9

Overloading Methods - Inheritance: Basics – Types of Inheritance - Constructors and Inheritance - Super keyword - Method Overriding – Dynamic Method Dispatch – Abstract Classes and Methods – final keyword - Interfaces: Defining an interface – implementing an interface – Multiple Inheritance through interface.

UNIT III EXCEPTION HANDLING AND MULTTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User-defined Exceptions; Multithreaded Programming: Differences between multi-threading and multitasking - Thread Life Cycle – Creating Threads – Thread Priorities – Thread Synchronization – Inter-Thread Communication.

UNIT IV GENERIC PROGRAMMING AND EVENT DRIVEN PROGRAMMING 9

Introduction to Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Graphics Programming using AWT: Frame – Components - Working with Color, Font, and Image – Layout Management - Basics of event handling – Java Event classes and Listener interfaces - Adaptor classes – MouseEvent, KeyEvent, WindowEvent, ActionEvent, ItemEvent, Dialog Boxes.

UNIT V DHTML: HTML, CSS AND JAVASCRIPT 9

HTML 5: Introduction – Formatting Tags – Tables – Lists – Hyperlinks – Images – Forms; CSS3 – Introduction and core syntax – Types of Selector Strings – Types of CSS – Backgrounds – Box Model; JavaScript: An introduction to JavaScript – Functions – Built-in Objects – Document Object Model - Event Handling – Form Validation using Regular Expression.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1 Understand and write programs by applying fundamental programming structures of Java
CO2 Apply Object Oriented Programming Concepts using Java.
CO3 Inspect various runtime exceptions and handle them using exception handling mechanism.
CO4 Implement the concept of concurrency using multithreading.
CO5 Design generic structures to solve a given problem and develop interactive GUI applications using Java AWT.
CO6 Create dynamic web pages using DHTML.

TEXT BOOKS

1. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, McGraw Hill Education, 2018.
2. Paul J. Deitel, Abbey Deitel and Harvey M. Deitel, Internet and World Wide Web: How to Program, 5/e, Pearson Education, 2018.

REFERENCE BOOKS

1. Cay S. Horstmann, Gary cornell, "Core Java Volume - I Fundamentals", 9th Edition, Prentice Hall, 2013.
2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
3. UttamK.Roy, Web Technologies, Oxford University Press, 2011.

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	3	2	2
CO5	3	3	3	2	-	-	-	-	-	-	2	3	2	2
CO6	3	3	3	3	-	-	2	-	-	-	2	2	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23CS1303	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Role of a database management system, relational data model and successfully apply logical database design principles, including E-R diagrams.
- Basic concepts and the applications of database systems.
- SQL and construct queries using SQL.
- Transaction processing and concurrency control.
- Database storage structures and access techniques.

UNIT- I DATABASE FUNDAMENTALS 9

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Components and Structure, Database Users and Administrator, History of Database Systems. Data models: ER model, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Enhanced E-R Model- Mapping ER Model to Relational Model.

UNIT- II RELATIONAL DATABASE 9

Relational Data Model - Concept of Relations, Schema-Instance distinction, Keys, Referential integrity and Foreign keys, Relational algebra operators, SQL - Introduction, Data Definition in SQL, Table, Key and Foreign key definitions, Update behaviours. Querying in SQL, Notion of aggregation, Aggregation functions Group by and Having clauses, Embedded SQL, Query Processing.

UNIT- III DATABASE DESIGN 9

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Properties of Decompositions. Normalization: First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form – Multivalued Dependencies – Fourth Normal Form – Join Dependencies – Fifth Normal Form.

UNIT- IV TRANSACTION MANAGEMENT 9

Transaction Concept – State – ACID Properties – Concurrency control - Serializability – Recoverability – Locking based protocols –Timestamp Based Protocol - Deadlock handling.

UNIT- V IMPLEMENTATION TECHNIQUES AND NON-RELATIONAL MODEL 9

Data on External Storage – RAID- File Organizations – Indexing and Hashing -Trees– B+ tree and B-Tree index files. Introduction to NoSQL & MongoDB: Advantages, Architecture, Data Models MongoDB Data types and CRUD Operations-Working of NoSQL Using MONGODB/CASSANDRA.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- **CO1** Identify and Recognize the Structure of a Database
- **CO2** Construct an Entity Relational Model for a database.
- **CO3** Apply Relational and Non-Relational database concepts to design a database.
- **CO4** Analyze the importance of normalization and functional dependencies in database design.
- **CO5** Evaluate the working principles of indexing and hashing.
- **CO6** Create a database design using both Relational and Non- Relational models

TEXT BOOKS

1. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw HillIndia Private Limited, 2020.
2. Mongo DB Complete Guide by Manu Sharma, BPB Publications, ISBN: 9789389898866, July 2021.

REFERENCE BOOKS

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition, 2003
2. Fundamentals of Database System, Ramez Elmasri and Shamkant B. Navathe, Pearson Publications, 7th Edition, 2016
3. C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, Pearson Education, Eighth Edition, 2009.

CO – PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	-	-	-	2	1	1	2	2	2
CO2	3	1	1	1	1	-	-	-	2	3	3	3	2	2
CO3	3	2	3	2	1	-	-	-	2	1	1	3	3	3
CO4	1	2	3	2	-	-	-	-	3	3	3	2	3	2
CO5	1	1	3	3	2	-	-	-	1	3	3	2	2	3
CO6	2	2	3	2	1	-	-	-	2	2	2	3	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1311	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To design and implement different techniques to develop simple autonomous agents that make effective 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 the reasoning systems using backward or forward Inference mechanisms.

LIST OF EXPERIMENTS

1. Write a program to solve N Queens problem using branch and bound algorithm.
2. Implementation of Depth-First Search (DFS)
3. Implementation of Best first search.
4. Write a program to implement towers of Hanoi
5. Write a program to implement water jug problem using 3 jugs.
6. Program to implement A* algorithm.
7. Implement Minimax algorithm & Alpha-Beta pruning for game playing.
8. Write a program to implement heuristic search procedure using 8-Queens problem.
9. Write a program to implement CSP using map coloring.
10. Write a program to implement Hangman game using python.
11. Write a program to implement tic tac toe game for 0 and X.
12. Implement Unification algorithm for the given logic.
    Unify{King(x), King(John)}
13. Implement forward chaining and backward chaining using Python.
14. Implementation of rule based expert system for memory loss disease.
15. Implementation of expert system for diagnosis of influenza.
16. Write a case study to implement the code that demonstrates key principles of responsible AI- fairness and transparency using loan approval system.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Implement simple PEAS descriptions for given AI tasks

CO2 Develop programs to implement simulated annealing and genetic algorithms

CO3 Demonstrate the ability to solve problems using searching and backtracking

CO4 Ability to implement simple reasoning systems using either backward or forward Inference mechanisms

CO5 Will be able to choose and implement a suitable technic for a given AI task.

CO6 Demonstrates key principles of responsible AI

SOFTWARE

Anaconda Python Distribution.

REFERENCE BOOKS

1. Russell, S. and Norvig, P. 2022. Artificial Intelligence - A Modern Approach, 4th edition, Prentice Hall.
2. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.
3. Greg Michaelson, “ A Practical Course in Functional Programming Using Standard ML”, UCL Press,1995.
4. Richard Bosworth, “A Practical Course in Functional Programming Using Standard ML”,McGrawHill,1995.

5. Rachel Harrison, “Abstract Data Types in Standard ML”, John Wiley & Sons,1993.
6. Adnan Masood, Heather Dawe, Dr. EhsanAdeli,”Responsible AI in the Enterprise”,Packt Publishing,2023.

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**3**	**-**	-	-	-	-	-	-	-	-	3	2	2
CO2	**3**	**3**	**-**	**-**	-	-	-	-	-	-	-	3	3	3
CO3	**3**	**3**	**3**	**-**	-	-	-	-	-	-	-	3	2	3
CO4	**3**	**3**	**1**	**-**	-	-	-	-	-	-	-	3	3	3
CO5	**3**	**3**	**-**	**-**	-	-	-	-	-	-	-	3	3	3
CO6	**3**	**3**	**2**	**-**	-	-	-	-	-	-	-	2	2	3

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23AD1312	OBJECT ORIENTED PROGRAMMING PARADIGM LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To develop simple Java applications.
- To implement Object Oriented Programming Concepts using Java.
- To develop Java applications using exception handling and multithreading.
- To develop application using Java generics and GUI applications using Java AWT.
- To create dynamic web pages using DHTML.

LIST OF EXPERIMENTS

1. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa),time converter (hours to minutes, seconds and vice versa) using packages.
2. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
3. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling.
5. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
6. Write a java program to find the maximum value from the given type of elements using a generic function.
7. Develop a Java program to create a color palette for selecting foreground and background colors. Include the steps to import packages, define classes, declare buttons and checkboxes, add panels, and handle button clicks and checkbox selection to set the foreground and background colors.
8. Create a web page using the following HTML constructs: Tables, Images, Lists, Frames and Hyperlinks.
9. Create a web site using different types of Style Sheets.
10. Create a web page to display a form with the following: Name, DOB, E-mail id, Phone Number, Qualification, Hobbies. Write a JavaScript to collect and validate all the data entered in the form fields. Finally, display the entered data through alert box.
11. Mini Project.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1 Develop applications by applying basic programming structures of Java.

CO2 Implement the Object Oriented concepts like inheritance, abstract classes and interfaces.

CO3 Inspect various runtime exceptions and handle them using custom exceptions..

CO4 Develop concurrent programs using the concepts of multithreading.

CO5 Design generic structure to solve a given problem and develop interactive GUI applications using Java AWT.

CO6 Create responsive web pages using DHTML.

REFERENCE BOOKS

1. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, McGraw Hill Education, 2018.
2. Paul J. Deitel, Abbey Deitel and Harvey M. Deitel, Internet and World Wide Web: How to Program, 5/e, Pearson Education, 2018.
3. Cay S. Horstmann, Gary cornell, "Core Java Volume–I Fundamentals", 9th Edition, Prentice Hall, 2013.
4. David Flanagan, ―JavaScript: The Definitive Guide, Seventh Edition‖, O'Reilly Media, 2020.
5. UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO5	3	3	3	3	2	-	-	-	-	-	3	3	2	3
CO6	3	3	3	3	3	-	3	1	1	-	3	2	3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23CS1312	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To learn to create and use a database
- To be familiarized with a query language.
- To have hands on experience on DDL Commands.
- To understand of DML Commands and DCL Commands.
- To learn advanced SQL queries.
- To be exposed to different applications.

LIST OF EXPERIMENTS

1. Introduction SQL-SQL*Plus: DDL,DML,DCL,TCL.SQL clause :SELECT FROM WHERE GROUPBY,HAVING,ORDERBY Using SQLite/MySQL/Oracle.

2. Creation of Views, Synonyms, Sequence, Indexes, Save point

3. Creating relationship between the databases and retrieve records using joins for the below relations:
   Salesman Relation:

salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5005	Pit Alex	London	0.11
5006	Mc Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
5003	Lauson Hen	San Jose	0.12

   Customer Relation:

customer_id	cust_name	city	grade	salesman_id
3002	Nick Rimando	New York	100	5001
3007	Brad Davis	New York	200	5001
3005	Graham Zusi	London	300	5002
3004	Fabian	Paris	300	5006
3009	Geoff Cameron	Rome	100	5007
3003	Jozy	San Jose	300	5003

4. Write a PL/SQL block to specify constraints by accepting input from the user.
5. Implementation of PL/SQL Procedure (IN, OUT, INOUT) with Exception Handling.
6. Implementation of PL/SQL Function.
7. Implementation of PL/SQL Cursor.
8. Implementation of PL/SQL Trigger, Packages.
9. Implementation of NoSQL basic commands using Cassandra/Mongo DB.
10. Implementation of Data Model in NoSQL.
11. Implementation of Aggregation, Indexes in NoSQL
12. MINI PROJECT (Suggested topics, but not limited to)
    Software Requirement : Database Connectivity with Front End Tools (Python/C/C++/JAVA) and Back End Tools (MySQL/SQLite/CASSANDRA/MONGO DB)
    i) Inventory Control System.
    ii) Material Requirement Processing.
    iii) Hospital Management System.
    iv) Railway Reservation System.

v) Personal Information System.
vi) Timetable Management System.
vii) Hotel Management System

TOTAL:60 PERIODS

COURSE OUTCOMES

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

CO1 Define the relationship between databases.

CO2 Analyze SQL queries to determine how constraints, joins, sets, aggregates, triggers, and views affect execution.

CO3 Apply the basic concepts of Database Systems and Applications

CO4 Analyze stored functions, stored procedures, cursor, trigger using PL/SQL block.

CO5 Relate the different models of NoSQL databases.

CO6 Design and implement database applications on their own.

WEB REFERENCES

1. https://livesql.oracle.com/apex
2. https://www.jdoodle.com/online-mongodb-terminal

CO – PO - PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	-	-	-	-	-	2	2	2	2
CO2	2	1	1	1	-	-	-	-	-	-	2	3	3	2
CO3	2	1	1	1	1	-	-	-	-	-	2	3	2	2
CO4	2	1	1	1	1	-	-	-	-	-	2	3	3	2
CO5	2	1	1	1	1	-	-	-	-	-	2	3	3	3
CO6	2	1	1	1	2	-	-	-	-	-	2	3	3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23ES1311	TECHNICAL SKILL PRACTICES II	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To understand the concepts of Arrays, ListADT.
- To learn linear data structures–stacks and queues ADTs.
- To understand and apply Tree data structures.
- To analyze sorting and searching algorithms.
- To understand and apply Graph structures and hashing techniques.

LIST OF TOPICS

1. Arrays
2. ListADT
3. Queue ADT
4. StackADT
5. Problems on Postfix and Infix expressions
6. BinaryTreeTraversal
7. Binary Search Tree
8. B-Tree
9. Binary Heaps
10. Linear search algorithm & Binary search algorithm
11. Sorting algorithms
    i. Bubble Sort
    ii. Selection Sort
    iii. Insertion Sort
    iv. Merge Sort
    v. Quick sort
    vi. Radix Sort
    vii. Bucket Sort
    viii. Heap Sort
    ix. Shell Sort
12. Graph Traversal algorithms
    i. BFS
    ii. DFS
    iii. Topological Sorting
13. Shortest Path algorithm
    i. Dijkstra Algorithm
    ii. Bellman-Ford Algorithm
14. Minimum Spanning tree
    i. Kruskal Algorithm
    ii. Prim's Algorithm
15. All pairs shortest paths using Floyd's Algorithm
16. Hashing using open addressing technique

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1 Develop arrays and abstract data types to represent linear lists.

CO2 Solve practical problems using suitable linear data structures.

CO3 Utilize appropriate tree structures to address computational problems.
CO4 Implement standard searching and sorting algorithms for efficient data handling.
CO5 Design graph representations and apply them to solve real-world scenarios.
CO6 Perform various hashing techniques for effective data access.

SOFTWARE REQUIREMENTS

Anaconda Python Distribution/ TURBO C.

TEXT BOOKS

1. G. A. Vijayalakshmi Pai," A Textbook of Data Structures and Algorithms, Volume 1", Wiley-ISTE,January 2023.
2. G. A. Vijayalakshmi Pai,"A Textbook of Data Structures and Algorithms, Volume 2: Mastering Nonlinear Data Structures", Wiley-ISTE,February2023.
3. Dr.Harsh Bhasin,"Data Structures with Python", BPB Publications,Delhi,March2023.
4. John Canning ,Alan Broder,Robert Lafore, 'Data Structures & Algorithms in Python', Addison-Wesley Professional, October 2022.
5. Y Daniel Liang, "Introduction To Python Programming And Data Structures", Global Edition 3rd Edition ,Pearson Publications ,November 2022.

REFERENCE BOOKS

1. Dr.Basant Agarwal,"Hands-On Data Structures and Algorithms with Python",3rd Edition, Packt Publishing, July 2022.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, August 2016.
3. MichaelH.Gold wasser, Michae IT.Good rich, and Roberto Tamassia,"Data Structures and Algorithms in Python", Wiley Publications 2013.

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

SEMESTER IV

23MA1405	PROBABILITY AND STATISTICAL TECHNIQUES FOR DATA SCIENCE	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To introduce probability concepts and some standard distributions
- To introduce multi-dimensional random variables
- To find difference between treatments in the output using ANOVA
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- To mention some of the models used in Time series for forecasting

UNIT - I RANDOM VARIABLES 9+3

Discrete and continuous random variables–Moments–Moment generating functions–Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT - II TWO- DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions–Marginal and conditional distributions– Covariance–Correlation - linear regression and its applications in data science – Transformation of random variables -Central limit theorem (Without Proof).

UNIT - III DESIGN OF EXPERIMENTS 9+3

One way and Two way classifications- Completely randomized design–Randomized block design– Latin square design.

UNIT- IV STATISTICAL QUALITY CONTROL 9+3

Control charts for measurements ($\bar{X}$and R charts)–Control charts for attributes(p, c and np charts) – Tolerance limits-Acceptance sampling.

UNIT - V TIME SERIES ANALYSIS 9+3

Definition-Components-Secular trend–Least squares method –Moving averages-Exponential smoothing method-Seasonal indices-Method of simple averages-Ratio to moving average method-Ratio to trend method.

TOTAL : 60 PERIODS

COURSE OUTCOMES

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

CO1 Identify random variables, standard distributions and find simple probabilites and statistical measures like mean and variance

CO2 Analyse and find relationship between two random variables

CO3 Analyse variance between treatments in the output using ANOVA

CO4 Demonstrate stability of a process using control charts

CO5 Forecast/predict values from a given data set considering components of time series.

TEXT BOOKS:

1. Trivedi,K.S.,"Probability and Statistics with Reliability,Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons,2002.
2. T.Veerarajan, “Probability,Statistics And Random Processes”,3rdEdition, Tata McGraw-Hill Education,2008.
3. Ibe,O.C.,“Fundamentals of Applied Probability and Random Processes",Elsevier,1st Indian Reprint,2007.
4. I.R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, 8th Edition, 2011.

REFERENCE BOOKS:

1. Devore,J.L.,—Probability and Statistics for Engineering and the Sciences,8thEdition,Cengage Learning,2014.
2. Dallas E. Johnson, —Applied Multivariate Methods for Data Analysis, Thomson and Duxbury press,1998.
3. GuptaS.C. and KapoorV.K., Fundamentals of Mathematical Statistics, Sultan and Sons,NewDelhi,2001.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**3**	-	-	**2**	-	-	-	-	**2**	**3**	2	3	2
CO2	**3**	**3**	-	-	**2**	-	-	-	-	**2**	**3**	2	3	2
CO3	**3**	-	-	**3**		-	-	-	-	-	**3**	2	3	2
CO4	**3**	-	-	**3**		-	-	-	-	-	**3**	3	2	2
CO5	**3**	-	-	**3**		-	-	-	-	-	**3**	3	3	3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1401	MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the basics of Machine Learning (ML)
- Illustrate supervised Learning Models
- Build ensemble learning models
- Analyze unsupervised learning models
- Evaluate use cases of ML

UNIT - I MACHINE LEARNING BASICS 8

Introduction to Machine Learning - 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 SUPERVISED LEARNING 9

Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Bayesian Network, Bayesian Classifier

UNIT - III ADVANCED SUPERVISED AND ENSEMBLE LEARNING 10

Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non-Linear, Kernel Functions, K-Nearest Neighbors, Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, XGboost, Stacking.

UNIT - IV UNSUPERVISED LEARNING 9

Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis, Locally Linear Embedding, Factor Analysis, Fuzzy Modeling, Genetic Modeling.

UNIT - V MACHINE LEARNING IN PRACTICE AND APPLICATIONS 9

Performance Measurement, Azure Machine Learning. Applications: Image Recognition – Email spam and Malware Filtering – Online fraud detection- Medical Diagnosis.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Describe foundational concepts and techniques in machine learning.

CO2 Demonstrate the working of supervised learning models through examples.

CO3 Design and implement ensemble learning models for improved prediction accuracy.

CO4 Examine the behavior and characteristics of unsupervised learning models.

CO5 Assess performance metrics used in evaluating real-time machine learning applications.

CO6 Formulate suitable learning approaches for solving specific problems effectively.

TEXT BOOKS

1. Ameet V Joshi, “Machine Learning and Artificial Intelligence”, Springer Publications, 2020.
2. Taeho Jo “Machine Learning Foundations: Supervised, Unsupervised, and Advanced Learning”, First Edition, Publisher: Springer, 2021.
3. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.

REFERENCE BOOKS

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, Second Edition, MIT Press, 2018.
2. John Paul Muller, Luca Massaron “Machine Learning Dummies”, Wiley Publications, 2021.
3. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, “Mathematics for Machine Learning”, Cambridge University Press, 2019.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	3	2	3
CO2	3	2	2	2	2	-	-	-	-	-	1	3	3	3
CO3	1	1	1	3	1	1	-	-	-	-	-	3	3	3
CO4	3	3	1	3	1	-	-	-	-	-	-	3	3	3
CO5	2	2	2	2	3	1	1	-	-	-	-	3	3	2
CO6	2	2	2	2	3	1	1	-	-	-	-	3	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1402	BASICS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To acquire skills in data preparatory and preprocessing steps.
- To understand the mathematical concepts in statistics.
- To learn the tools and packages in Python for data science.
- To gain understanding of how the data is distributed.
- To acquire knowledge in data interpretation and visualization techniques.

UNIT - I 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 ANALYSIS 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 – Working with time series data.

UNIT - IV DESCRIBING DATA ANALYSIS II 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–Population–Analysis of variance.

UNIT - V PYTHON FOR DATA VISUALIZATION 9

Visualization with matplotlib – lineplots– scatterplots– visualizing errors– density and contour plots–histograms, binnings, and density – Customizing Plot Legends and Colorbars- three dimensional plotting – geographic data –data analysis using statmodels and seaborn–graph plotting using Plotly–interactive data visualization using Bokeh.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Apply the skills of data analysis and cleansing.

CO2 Determine the relationship between data dependencies using statistics.

CO3 Analyze to handle data using primary functions used for data science in Python.

CO4 Illustrate how to use the python concepts for data manipulation.

CO5 Represent the useful information with the concept of distributions.

CO6 Use the knowledge for describing data and visualizing data.

TEXT BOOKS

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.
3. Jake Vander Plas, “Python Data Science Handbook”,O’Reilly,2022.

REFERENCE BOOKS

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014.
2. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	1	2	3	2
CO2	2	3	1	1	1	-	-	-	-	-	-	2	3	2
CO3	2	1	1	1	2	-	-	-	-	-	1	2	3	3
CO4	2	2	1	1	2	-	-	-	-	-	1	3	3	3
CO5	2	3	1	3	1	-	-	-	-	-	-	2	3	2
CO6	3	3	1	3	3	-	-	-	-	-	1	2	3	2

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1403	SOFTWARE DEVELOPMENT AND PRACTICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the phases in a software project, estimate cost and effort.
- To describe fundamental concepts of requirements engineering and Analysis Modeling.
- To use the various software design methodologies
- To learn various testing techniques and maintenance measures.
- To analyze agile development and Devops

UNIT - I SOFTWARE PROCESS AND PLANNING 9

Introduction to Software Engineering; Objectives, Principles and Practices; The Software Development Life Cycle : Pre-development phases of the SDLC – Development specific phases of the SDLC – Post- development phases of the SDLC; Methodologies Paradigm and Practices : Process methodologies – Development paradigms – Development practices; Project Planning Process; Software Project Estimation: Decomposition techniques – Empirical estimation models – The make/buy decision – Project scheduling; Risk Management; Handling Ethical Dilemmas.

UNIT - II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and non-functional – Security requirements – User requirements – System requirements – Software requirements document; Requirement Engineering Process: Feasibility studies – Requirements elicitation and analysis – Requirements validation – Requirements Management; Classical Analysis: Structured system analysis; Requirement modelling tools

UNIT - III SOFTWARE DESIGN 9

Design Concepts: Design process – Design concepts – Modularity, Coupling and cohesion – Design model – Modeling principles; Structured Design; Architectural Design: Architectural styles; Architecture for Network based Applications – Decentralized Architectures.

UNIT - IV SOFTWARE TESTING 9

Software Testing Fundamentals; Internal and External Views of Testing: White box testing – Basis path testing – Control structure testing– Black box testing – Unit testing – Integration testing – Regression testing – Validation testing – System testing – Security testing; Testing Tool; Debugging; Software Implementation: Coding Practices and Principles; Maintenance: Types.

UNIT - V AGILE DEVELOPMENT AND DEVOPS 9

Agile Development: Agile Teams – Team and Scrum – Branches – Pull Requests – Reviews – Integration- Agile Iterations – Reporting and fixing bugs; Dev/Ops: From development to deployment – Three-Tier-Responsiveness, Service level objectives, and Apdex – Releases and feature flags – Monitoring and finding bottlenecks – Improving rendering and database performance with caching; Security: Defending customer data in application

TOTAL : 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1 Distinguish key activities in software process models and calculate project cost and effort using software engineering methodologies.

CO2 Investigate and interpret software requirements and develop corresponding models.

CO3 Follow structured methodologies to design efficient software systems.

CO4 Compare and estimate different testing strategies and maintenance tasks.

CO5 Examine principles of agile development and DevOps practices in software projects.

CO6 Recognize ethical dilemmas and implement ethical solutions in software development case studies.

TEXT BOOKS

1. Roger S Pressman, Bruce R Maxin “Software Engineering – A Practitioner’s Approach”, McGrawHill International Edition, Eighth Edition, 2015.
2. Armando Fox and David Patterson, Engineering Software as a Service: An Agile Approach UsingCloud Computing”, Strawberry Canyon LLC, Second Beta Edition, 2021.

REFERENCE BOOKS

1. Ian Sommerville, “Software Engineering”, Pearson Education Asia, Tenth Edition, 2015.
2. Stephen R Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Lim-ited,2007.
3. Brian Albee, Hands-On Software Engineering with Python, Packt Publishing, 2018.
4. Kelkar S A, “Software Engineering”, Prentice Hall of India, 2007.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	3	-	3	3	-	-	3	3	3	2	2	3
CO3	3	2	2	-	-	-	-	-	-	-	-	3	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO6	3	-	-	-	-	-	-	-	-	-	-	2	2	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1404	SYSTEM SOFTWARE AND OPERATING SYSTEMS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To understand the concepts of various system software like Assembler, Linker, Loader and Macro pre-processor.
- To demonstrate the functions and concepts of process scheduling algorithms within an operating system
- To analyze the concepts of deadlocks and the prevention methodologies.
- To explore the principles of memory management within an operating system.
- To formulate the techniques involved in storage management and file systems.

UNIT I INTRODUCTION TO SYSTEM SOFTWARE AND ASSEMBLER DESIGN OPTIONS 9

System software Vs. Application software, Different types of system software – Assembler, Linker, Loader, Debugger, Device driver, Compiler, Interpreter, Operating System (Basic Concepts only); Machine Architecture of SIC and SIC/XE – instruction format, addressing mode, instruction set; Basic functions of assembler, machine dependent assembler features, machine independent assembler features; assembler design options – one pass assembler, multi-pass assembler.

UNIT II DESIGN LOADER, LINKER AND MACROS 9

Basic loader functions – Design of an Absolute Loader – A Simple Bootstrap Loader - Machine dependent loader features – Relocation – Program Linking – Algorithm and data structures of two pass Linking Loader; Machine-independent loader features – Automatic Library Search – Loader Options – Loader design options – Linkage Editors – Dynamic Linking; Macro Instruction Definition and Expansion- One pass Macro processor Algorithm and data structures, Machine Independent Macro Processor Features, Macro processor design options.

UNIT III INTRODUCTION TO OPERATING SYSTEM AND PROCESS MANAGEMENT 9

Computer System – Organization, Basic elements - Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multi-core Organization. Operating system overview- Objectives and Functions – Evolution of Operating System - Operating System Structures – Operating System Services , Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling — Scheduling criteria, Scheduling algorithms, Multi-processor scheduling, Real time scheduling; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT IV MEMORY MANAGEMENT 9

Main Memory — Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory — Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT V STORAGE MANAGEMENT AND FILE SYSTEMS 9

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management – swap space management, File-System Interface – File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management-Efficiency and Performance, Recovery

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1 Explain how system software and assemblers facilitate translation and execution of code.
CO2 Develop and implement loader, linker and Macro processor
CO3 Distinguish various techniques involved in process management and understand scheduling algorithms.
CO4 Describe the approach towards identification, analysis, detection and prevention of deadlocks.
CO5 Demonstrate various memory management concepts.
CO6 Classify storage management and file management methodologies.

TEXT BOOKS

1. Leland L. Beck, System Software: An Introduction to Systems Programming, 3/E, Pearson Education, Asia.
2. Abraham Silberschatz (Author), Peter Baer Galvin (Author), Greg Gagne (Author), Operating
   System Concepts, 10/E John Wiley & Sons Inc,, February 2021.

REFERENCE BOOKS

1. A.A.Puntambekar,I.A.Dhotre , Rupesh Mahajan ,System Programming and Operating Systems, 1/E Technical Publications, January 2022.
2. William Stallings , Operating Systems ,Pearson Education,2018

LIST OF EXPERIMENTS **15 Hrs**

1. Write a program to insert, search and update the identifiers in the symbol table.
2. Implement a single pass assembler.
3. Implement a two pass assembler.
4. Implement Pass-I of a macro processor and generate all the required tables.
5. Implement an absolute loader.
6. Implement a relocating loader.
7. Implement a CPU scheduling algorithm
8. Implement a Page Replacement Algorithm
9. Illustrate a program for a disk scheduling algorithm.
10. Implementation of the following Memory Allocation Methods for fixed partition
11. Implementation of the various File Organization Techniques
12. Imagine you're developing an operating system that heavily relies on threads for concurrent processing. Discuss how you would enable effective communication between these threads. Compare three methods of thread communication, highlighting their strengths, weaknesses, and when each is most suitable. Additionally, propose strategies for ensuring the security and reliability of thread communication within the operating system.
13. Design an operating system for a busy computer lab. How do you plan to prevent situations where computers get stuck waiting forever for each other? Describe your strategy for creating a system that can detect and avoid these issues, ensuring smooth usage for everyone in the lab

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	-	3	3	-	-	3	3	3	3	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	2	3
CO6	3	-	-	-	-	-	-	-	-	-	-	2	2	2

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23AD1411	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- Understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis
- Illustrate supervised machine learning algorithms on standard datasets and evaluate the performance
- Develop ensemble learning techniques.
- Analyze unsupervised machine learning algorithms on standard datasets and evaluate the performance
- Evaluate ML algorithms performance for real time applications.

LIST OF EXPERIMENTS

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Write a program for detecting spam mails using Support Vector Machine.
5. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.
6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.
10. Mini Project. Students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Analyze various algorithms to identify appropriate features for data analysis.
CO2 Illustrate and Implement supervised machine learning algorithms on standard datasets and evaluate the performance.
CO3 Develop ensemble learning techniques.
CO4 Analyze unsupervised machine learning algorithms on standard datasets..
CO5 Evaluate the performance for real time applications
CO6 Construct and compare the performance of different ML algorithms and select the suitable one based on the application

WEB REFERENCES

1. https://www.geeksforgeeks.org/machine-learning/
2. https://pythongeeks.org/what-is-machine-learning/
3. https://www.simplilearn.com/10-algorithms-machine-learning-engineers-need-to-know-article

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	3	3	2
CO2	3	2	2	2	2	-	-	-	-	-	1	3	3	2
CO3	1	1	1	3	1	1	-	-	-	-	-	3	3	2
CO4	2	3	1	2	1		-	-	-	-	-	2	3	2
CO5	2	2	2	2	3	1	1	-	-	-	-	3	3	3
CO6	2	2	2	2	3	1	1	-	-	-	-	3	3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23AD1412	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To use python libraries for handling data.
- To be able to use the mathematical concepts of statistics.
- To acquire knowledge in plotting using visualization tools.
- To prepare data for data analysis through understanding its distribution.
- To learn to implement real time applications.

LIST OF EXPERIMENTS

1. Create an empty and a full NumPy array.
2. Program to remove rows in Numpy array that contains non-numeric values.
3. Program to build an array of all combinations of two NumPy arrays.
4. Program to add a border around a NumPy array.
5. Program to perform matrix operations using NumPy.
6. Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.
7. Write a Pandas program to get the first 3 rows of a given DataFrame.
8. Write a Python program to set the date column as the index and plot time series data.
9. Write a Python program to draw a line with suitable label in the x axis, y axis and a title.
10. Write a Python program to draw linecharts of the financial data of AlphabetInc. between October3,2016 to October 7,2016.
11. The table below gives the values of runs scored by ViratKohli in last 25T -20 matches. Represent the data in the form of less than type cumulative frequency distribution:

45	34	50	75	22
56	63	70	49	33
08	14	39	86	52
92	88	70	56	50
57	45	42	12	39

12. Program to find the sum and average of n integer numbers.
13. Program to find the variance and standard deviation of set of elements.
14. Program to plot a normal distribution in python.
15. Program to plot a Correlation and scatterplots.
16. Program for Linear Regression and Logistic Regression.
17. Mini project on real time applications.
18. Write a python program to load a dataset, train and visualize the results.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Understand programming skills to handle data using Numpy and pandas.
CO2 Demonstrate knowledge of statistical data analysis techniques.
CO3 Perform data exploration using Matplotlib.
CO4 Demonstrate how data is distributed and can prepare it for analysis.
CO5 Create and assess data-based models.
CO6 Apply data science concepts and methods to solve problems in real-world contexts.

REFERENCE BOOKS

1. Jake Vander Plas,“Python Data Science Handbook”,O’Reilly,2022.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	-	-	-	1	2	3	2
CO2	1	1	1	1	1	-	-	-	-	-	1	2	3	2
CO3	3	2	2	2	2	-	-	-	-	-	2	2	3	2
CO4	3	2	2	2	1	-	-	-	-	-	1	2	3	2
CO5	2	2	3	1	2	-	-	-	-	-	2	3	3	3
CO6	2	1	1	1	2	-	-	-	-	-	1	3	3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23ES1411	TECHNICAL SKILL PRACTICES III	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- Understanding Java Fundamentals.
- Develop proficiency in flow control statements and Understand the usage of arrays and var-arg types
- Exploring Object-Oriented Programming Concepts through Java Programming
- Develop programs on Exception handling through Java Programming
- Understand the usage of wrapper classes and Utilizing Standard Java Libraries

LIST OF TOPICS

1. Java Tokens- Comments, Identifiers, Keywords, Separators, Data types
2. Scoping and Parameter passing (by value & by reference)
3. Flow Control Statements
4. Arrays and Var-arg types
5. Operators & their Precedence & Associativity
6. Conversions: Narrowing & Widening Conversions
7. Access Modifiers for Class & Class Members
8. Non Access Modifiers for Class & Class Members
9. Packages with Static imports
10. Creating Classes and Instances
11. Method and Types of methods
12. Inheritance
13. Polymorphism(Method Overloading & Overriding) Abstract classes and Interfaces
14. Constructors and Initialization
15. Static data and methods
16. Exception Handling Framework- User defined Exceptions
17. Java Thread Model

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1 Describe fundamental programming elements in Java and construct programs using basic control structures.
CO2 Apply scoping rules and demonstrate an understanding of parameter passing in Java
CO3 Analyze and create effective flow control statements in Java
CO4 Evaluate the usage of arrays, var-args, and enums in Java, based on program requirements and design considerations.
CO5 Develop Java programs to implement object-oriented design principles.
CO6 Apply exception handling techniques in Java, including the creation of user-defined exceptions

TEXT BOOKS

1. Herbert Schildt, “Java The complete reference”, 12th Edition, McGraw Hill Education, 2022.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 11th Edition, Prentice Hall, 2020.

REFERENCE BOOKS

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

WEB REFERENCES

1. https://www.javatpoint.com/java-tutorial
2. https://www.tutorialspoint.com/java/index.htm

SEMESTER V

23AD1501	FORMAL LANGUAGE AND AUTOMATA THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the language hierarchy.
- To construct automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language.
- To understand Push Down Automata..
- To understand Turing machines and their capability.
- To understand undecidable problems and NP class problems.

UNIT- I AUTOMATA FUNDAMENTALS **9**

Alphabets, Strings and Languages - Finite Automata and Grammars - Deterministic Finite Automata (DFA) - Formal Definition - Simplified Notation: State Transition Graph - Transition Table - Language of DFA - Nondeterministic Finite Automata (NFA) - NFA with Epsilon Transition - Language of NFA- Equivalence of NFA and DFA.

UNIT-II REGULAR EXPRESSIONS AND LANGUAGES **9**

Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata-Myhill-Nerode Theorem.

UNIT- III CONTEXT FREE GRAMMAR AND LANGUAGES **9**

Context Free Grammar (CFG) – Derivation and its types – Derivation Trees – Ambiguity in Grammars and Languages – Unambiguous - Simplification of CFGs - Normal Forms for CFGs: CNF and GNF - Closure Properties of CFLs - Pumping lemma for CFLs

UNIT- IV PUSH DOWN AUTOMATA **9**

Introduction of Push Down Automata (PDA) - Instantaneous Description - Language of PDA - Acceptance by Final state - Acceptance by empty stack - Deterministic PDA - Non Deterministic PDA- Equivalence of PDA and CFG - CFG to PDA and PDA to CFG - Two Stack PDA

UNIT- V TURING MACHINE AND UNDECIDABILITY **9**

Introduction of Turing Machine (TM) - Basic Model, Definition and Representation, Instantaneous Description - Language acceptance by TM - Programming Techniques for TM. - TM as Computer of Integer Functions - Universal TM - Rice Theorem - Recursive and Recursively enumerable languages- Halting problem - Introduction to Undecidability - Undecidable problems about TMs- Post Correspondence Problem (PCP) - Modified PCP - Class P, NP and NP hard Problems..

TOTAL : 45 PERIODS

TEXT BOOKS

1. J.E. Hopcroft, R. Motwani and J.D. Ullman — Introduction to Automata Theory, Languages and Computations‖, Second Edition, Pearson Education, 2007

2. J.Martin, —Introduction to Languages and the Theory of Computation‖, Third Edition, TMH, 2010

3. Kamala Krithivasan and R. Rama, Introduction to Formal Languages, AutomataTheory and Computation, Pearson Education, Delhi, 2009.

REFERENCES

1. K.L.P.Mishra and N.Chandrasekaran, —Theory of Computer Science: Automata Languages and Computation‖, 3rd Edition, Prentice Hall of India, 2006.

2. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of India, 2015

3. Micheal Sipser, —Introduction of the Theory and Computation ‖, Thomson Learning,1997.

ONLINE COURSES / RESOURCES

1. https://www.iitg.ac.in/dgoswami/Flat-Notes.pdf
2. https://www.geeksforgeeks.org/theory-of-computation-automata-tutorialsCOURSE

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1 Design automata for any given pattern
CO2 Specify regular expression of string pattern
CO3 Write context free grammar for any language
CO4 Build pushdown automata to recognise a context free language
CO5 Apply Turing machine to propose computation solutions
CO6 Interpret whether a problem is decidable or not

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	1	1	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	2	3
CO5	3	2	2	-	-	-	-	-	-	-	-	3	3	3
CO6	2	1	1	-	-	-	-	-	-	-	-	3	3	3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1502	DATA COMMUNICATION AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks and the functionality of various routing protocols.
- To familiarize the functions and protocols of the Transport layer and Application layer.
- To understand the fundamentals of Cryptography and various key distribution and management schemes and to identify security issues in network.

UNIT- I FUNDAMENTALS OF COMPUTER NETWORKS AND COMMUNICATION 9

Process of Data communication and its components - Protocols and Standards - Bandwidth, Data Transmission rate, Baud rate, Bits per second Modes of Communications Networks — Network Types — Protocol Layering — TCP/IP Protocol suite — OSI Model — Physical Layer: Performance —Transmission media — Switching — Circuit-switched Networks — Packet Switching.

UNIT-II DATA-LINK LAYER 9

Introduction — Link-Layer Addressing — DLC Services — Data-Link Layer Protocols — HDLC — PPP — Media Access Control — Wired LANs: Ethernet — Wireless LANs — Introduction — IEEE 802.11, Bluetooth
— Connecting Devices.

UNIT- III NETWORK LAYER 9

Network Layer Services — IPV4 Addresses — Forwarding of IP Packets — Network Layer Protocols: IP, ICMP v4 — Unicast Routing Algorithms — Protocols — Multicasting Basics — IPV6 Addressing — IPV6 Protocol.

UNIT- IV TRANSPORT LAYER AND APPLICATION LAYER 9

Introduction - Transport-Layer Protocols — Services — Port Numbers — UDP – TCP: Connection Management – Flow control - Congestion Control - Congestion avoidance (DEC bit, RED) Application layer: WWW and HTTP — FTP — Email –Telnet –SSH — DNS — SNMP

UNIT- V PUBLIC KEY CRYPTOSYSTEM AND NETWORK SECURITY 9

Classical Cryptography-Substitution Ciphers-permutation Ciphers-Block Ciphers-DES Modes of Operation- AES-Linear Cryptanalysis, Differential Cryptanalysis- Introduction to Public key Cryptography- The RSA Cryptosystem and Factoring Integer- Attacks on RSA- Firewalls-Electronic mail security, PGP

TOTAL : 45 PERIODS

TEXT BOOKS

1. Behrouz A. Forouzan, *Data Communications and Networking*, 6th Edition, McGraw-Hill Education, 2022, ISBN: 978-0078022098. (UNIT I, UNIT-II,UNIT-III AND UNIT –IV)
2. William Stallings, Cryptography and Network Security*:* Principles and Practice, 8th Edition, Pearson Education, 2022, ISBN: 978-1292437484. (UNIT V)

REFERENCES

1. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021
2. Godbole Achyut, ―Data Communication and Networks‖, Tata McGraw Hill, New Delhi 2006, ISBN:0070472971.
3. Comer Douglas E, ―Internetworking with TCP/IP Principles, Protocols and Architectures, PHI Learning Pvt. Ltd., Delhi, ISBN: 81-203-2065-4
4. Cryptography and network Security, Third edition, Stallings, PHI/Pearson

WEB REFERENCES

1. https://w3.cs.jmu.edu/bernstdh/web/common/references/networking.php
2. https://web.njit.edu/~ansari/ECE639/ReferencesS11.pdf
3. https://www.citethisforme.com/topicideas/technology/data%20communication%20and%20networking%20references39792182

ONLINE COURSES / RESOURCES

1. https://nptel.ac.in/courses/106105082
2. https://www.studytonight.com/computer-networks/
3. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
4. https://www.geeksforgeeks.org/last-minute-notes-computer-network/
5. https://www.my-mooc.com/en/mooc/data-communications-and-network-services/

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1 Explain protocol layering and the principles of physical layer communication.
CO2 Analyze network performance and identify key performance indicators.
CO3 Describe the components involved in building different networks and the functionality of various routing protocols.
CO4 Familiarize with the functions and protocols of the Transport and Application layers.
CO5 Understand the basics of Cryptography and explore various key distribution and management schemes.
CO6 Identify and address security issues within networks.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	2	1	-	-	-	1	-	2	1	1	2
CO2	3	2	-	2	-	-	-	-	2	-	2	2	3	3
CO3	3	2	-	2	-	-	-	-	1	-	2	2	2	3
CO4	3	3	-	1	-	-	-	-	2	-	1	1	2	2
CO5	3	3	-	1	1	2	-	-	2	-	2	2	2	3
CO6	3	2	-	1	1	2	-	-	1	-	2	2	2	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1503	DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the competitive advantages of data analytics
- To understand the big data frameworks
- To learn data analysis methods
- To learn predictive analytics using R
- To learn stream computing
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig and Hive for big data analytics

UNIT I INTRODUCTION TO BIG DATA 9

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.

UNIT II HADOOP FRAMEWORK 9

Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.

UNIT III DATA ANALYSIS 9

Statistical Methods: Regression modeling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.

UNIT IV MINING DATA STREAMS 9

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V BIG DATA FRAMEWORKS 9

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Explain how to effectively use insights derived from big data analytics.
CO2 Apply the concepts of Map Reduce in various data sets
CO3 Implement classification algorithms on various data sets
CO4 Analyse data by utilizing various statistical and data mining approaches
CO5 Perform analytics on real-time streaming data
CO6 Understand the various NoSql alternative database models

REFERENCES

1. Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streamswith Advanced Analyticsǁ, Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools,Techniques, NoSQL, and Graph", 2013.
3. Michael Berthold, David J. Hand, —Intelligent Data Analysisǁ, Springer, Second Edition, 2007.
4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: EmergingBusiness Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World ofPolyglot Persistence", Addison-Wesley Professional, 2012.
6. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, O'Reilly Media, 2013.

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	-	-	-	2	-	3	2	3	2
CO2	**3**	**2**	**2**		**3**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**2**	**3**
CO3	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**1**	**-**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**3**	**2**	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**2**	**2**	**3**	**3**	**3**	**3**
CO6	**3**	**2**	**2**		**3**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**3**

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1504	KNOWLEDGE ENGINEERING AND INTELLIGENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To recall the fundamentals of Knowledge Engineering.
- To explain the Resolution process in Knowledge Engineering.
- To use logical implications in probabilistic reasoning.
- To differentiate key concepts in game theory.
- To assess various probabilistic models in machine learning.
- To design and explore techniques in Reinforcement Learning.

UNIT- I FIRST ORDER LOGIC 9

Key Concepts - Knowledge based Systems – Role of Logic - Syntax – Semantics – Interpretations – Denotation – Satisfaction and models – Pragmatics – Explicit and Implicit Beliefs - Logical Consequence – Expressing Knowledge – Knowledge Engineering - Basic and Complex Facts – Terminological Facts – Entailment – Abstract Individuals - Other Sorts of Facts.

UNIT-II RESOLUTION 9

The Propositional Case – Resolution Derivations – An Entailment Procedure - Handling Variables and Quantifiers – First Order Resolution- Answer Extraction – Skolemization – Clause Form – Equality - Dealing with Computational Intractability - The First-Order Case - Herbrand Theorem - The Propositional Case - SAT Solvers - Most General Unifiers - Other Refinements.

UNIT- III UNCERTAINTY & PROBABILISTIC REASONING 9

Acting under uncertainty – Inference using Full Joint Distributions – Naïve Bayes Models – Knowledge in Uncertain Domain - Bayesian networks - Inference in temporal models – Hidden Markov Models – Kalman filters.

UNIT- IV DECISIONS UNDER UNCERTAINTY 9

Basis of utility theory – utility functions – multi-attribute utility functions – decision networks – value of information – Sequential decision problems – MDPs – Bandit problems – partially observable MDPs - Algorithms for Solving POMDPs – Multi-agent environments – non-cooperative game theory – cooperative game theory – making collective decisions.

UNIT- V LEARNING PROBABILISTIC MODELS 9

Statistical learning theory – maximum-likelihood parameter learning – generative and descriptive models – continuous models – Bayesian parameter learning – Bayesian linear regression – learning Bayesian net structures & parameters – density estimation - EM Algorithm – Gaussian mixture models – learning HMM – Bayes net structures with hidden variables.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stuart Russel and Peter Norvig, —Artificial Intelligence: A Modern Approach, Fourth Edition, Pearson Education, 2020
2. Ronald J. Brachman and Hector J. Levesque, —Knowledge Representation and Reasoning, 1st Edition, Morgan Kaufmann Publishers, 2004.

REFERENCES

1. Dan W. Patterson, —Introduction to AI and ESǁ, Pearson Education, 2007.
2. Kevin Night, Elaine Rich, and Nair B., —Artificial Intelligenceǁ, McGraw Hill, 2008.
3. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006.

ONLINE COURSES / RESOURCES

1. https://nptel.ac.in/courses/106106140

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1 Identify the core principles of Knowledge Engineering.
CO2 Describe how Resolution works in Knowledge Engineering.
CO3 Apply logical implications to probabilistic reasoning.
CO4 Distinguish between fundamental concepts in game theory.
CO5 Evaluate different approaches to probabilistic modeling in machine learning.
CO6 Develop and experiment with techniques in Reinforcement Learning.

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	-	-	2	2	3
CO2	3	2	2	-	2	-	-	-	-	-	-	2	2	3
CO3	3	2	2	2	3	-	-	-	-	-	-	3	3	3
CO4	2	3	2	-	2	-	-	-	1	-	-	3	2	2
CO5	3	3	3	2	3	-	-	-	-	-	-	3	3	3
CO6	3	3	3	2	3	-	-	-	-	-	-	3	3	3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1505	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

- 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 in SeaBorn
- To study the integration of processing with java
- To explore the data visualization using R language
- To apply various data visualization techniques for a variety of tasks

UNIT- I INTRODUCTION TO DATA EXPLORATION 9

EDA fundamentals - 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 AND SEABORN TECHNIQUES 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 - Integrating Processing with Java. Introduction to Seaborn: Seaborn functionalities and usage, Spatial Visualizations and Analysis in Python with Folium.

UNIT- IV DATA EXPLORATION AND DATA VISUALIZATION IN R 9

Introduction to R and R Studio - The Basics of Data Exploration - Loading Data into R - Transforming Data - Creating Tidy Data- Basic Analysis- Data Visualization with ggplot2.

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 -, Creating a basemap, Adding operational data layers - R Markdown - Case Study – Wildfire Activity in the Western United States - Case Study – Single Family Residential Home and Rental Values

LIST OF EXPERIMENTS

1. Install standalone R.
2. Use R tool to explore various commands for descriptive data analytics using bench mark datasets.
3. Explore various variable and row filters in R for cleaning data.
4. Use R commands for probability distributions and probability statistics.
5. Formulate real business problems scenarios to hypothesis and solve using R statistical testing features.

6. Apply various plot features in R on sample data sets and visualize.
7. Write and execute word count, word search and pattern search problems from large text files.
8. Explore various data pre-processing options using bench mark data sets

PRACTICALS -30 PERIODS
THEORY -45 PERIODS
TOTAL -75 PERIODS

TEXT BOOKS

1. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.
2. Visualizing Data: Exploring and Explaining Data with the processing Environment, O Reily Publications, 2007.
3. Eric Pimpler, Data Visualization and Exploration with R, Geo Spatial Training service, 2017.
4. Authors: Xiang Zhou, Sean, Yong Rui, Huang, Thomas S., Exploration of Visual Data, Springer Publications, 2003
5. Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, O'Reily Publications, 2019
6. Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics by Eric Goh Ming Hui, Apress

ONLINE COURSES / RESOURCES

1. https://www.coursera.org/projects/fifa20-data-exploration-using-python?
2. The Comprehensive R Archive Network- https://cran.r-project.org
3. https://seaborn.pydata.org/

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1 Recall the fundamental concepts of Data Exploration.

CO2 Analyze Univariate and Multivariate data for effective exploration.

CO3 Explain different methods of Data Visualization.

CO4 Illustrate the integration process of Processing with Java.

CO5 Evaluate various datasets using Data Visualization techniques.

CO6 Create data visualizations using R language on different datasets.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	3	-	-	-	2	3	3	3	2	2	2
CO2	2	2	2	1	1	-	-	3	2	3	1	2	3	3
CO3	2	1	2	1	1	-	-	3	2	1	2	2	3	3
CO4	2	2	2	1	-	-	-	1	2	1	3	2	2	2
CO5	3	1	1	2	1	-	-	3	2	1	2	3	3	3
CO6	2	1	2	2	1	-	-	2	2	2	2	3	3	3

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23AD1511	DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- 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 logistic regression models
- To analyze big data using machine learning techniques such as SVM / Decision tree classification and clustering
- To visualize data using plotting framework

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
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.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon Completion of this course, the students will be able to:

CO1 Utilize the Hadoop framework to process big data.
CO2 Implement storage solutions for big data using HBase and MongoDB.
CO3 Develop and implement linear regression models.
CO4 Develop and implement logistic regression models.
CO5 Conduct data analysis using machine learning methods.
CO6 Analyze data using graphical methods.

LIST OF SOFTWARE

Hadoop
R Package

REFERENCES

1. Alan Gates and Daniel Dai, "Programming Pig – Dataflow scripting with Hadoop", O'Reilley, 2nd Edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer Publications, 2nd Edition, 2021
3. Hadley Wickham,‖ggplot2–Elegant Graphics for Data Analysis‖, Springer Publications,2nd Edition, 2016
4. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer Publications, 2nd Edition, 2021.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2015.
6. Tom White,‖Hadoop: The Definitive Guide – Storage and Analysis at Internet Scale‖, O'Reilley, 4th Edition, 2015.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	3	-	-	-	-	-	-	3	2	3
CO2	3	2	-	-	3	-	-	-	-	-	-	2	2	3
CO3	3	3	2	2	3	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	3	-	-	-	-	-	-	3	3	3
CO5	3	3	2	3	3	-	-	-	-	-	-	3	3	3
CO6	2	2	2	2	3	-	-	-	-	-	-	2	3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23AD1512	KNOWLEDGE ENGINEERING AND INTELLIGENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To gather knowledge about Artificial Intelligence.
- To understand the main abstractions and reasoning for intelligent systems.
- To understand various AI algorithms.
- To understand HMM Models.
- To understand various learning methods.
- To solve real world problems using Intelligent systems.

LIST OF EXPERIMENTS

1. To implement Knowledge representation and Logic programming
2. To implement Bayesian Belief network with and without inference
3. To implement Bayes and Naïve Bayes Theorem
4. To implement decision problems for various real-world applications
5. To learn various Bayesian parameters
6. To implement Hidden Markov Models
7. Implement EM algorithm for HMM
8. Implement the Reinforcement learning for various reward-based applications
9. Solve Robot (traversal) problem using means End Analysis
10. Mini-Project

TOTAL: 60 Periods

COURSE OUTCOMES

CO1 Implement Knowledge representation in program.
CO2 Solve basic AI-based problems.
CO3 Implement the concept of Bayesian Network.
CO4 Apply AI algorithms to real-world problems.
CO5 Implement HMM for real-world application.
CO6 Use various Learning methods to implement intelligent systems.

Software:

Python with Machine Learning Packages

REFERENCES

1. aimacode · GitHub (https://github.com/aimacode)
2. GitHub (https://github.com/martinmogusu)
3. GitHub (https://github.com/sushantnair)
4. GitHub (https://github.com/vangj)
5. GitHub (https://github.com/MohammadRanjbar)

CO- PO-PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	-	1	1	2	3	2	3
CO2	3	3	3	2	3	-	-	-	1	1	2	3	2	3
CO3	3	2	3	2	3	-	-	-	1	1	2	3	3	3
CO4	3	3	3	3	3	-	-	-	2	2	2	3	3	3
CO5	3	2	3	2	3	-	-	-	1	1	2	3	3	3
CO6	3	3	3	2	3	-	-	-	2	2	2	3	3	3

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ES1511	TECHNICAL SKILL PRACTICES IV	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To impart essential problem solving skills through generalproblem solving concepts.
- To provide basic knowledge on programming essentialsusing python
- To introduce various programming methods using C.

LIST OF TOPICS

1. Data Types, Variables, Operators
2. Create, Append, and Remove list
3. Conditional Statements, Switch Statements
4. Working with dictionaries
5. Arrays indexing such as slicing, integer array indexing
6. Demonstrate various ways of accessing the string.
7. Lambda functions in Python
8. Print date, time using date and time functions
9. Searching and Sorting techniques
10. File Handling & Exception Handling.
11. Find word and lines in command line argument
12. Compute summary statistics such as mean, median, mode, standard deviation and variance
13. To create a package(Engg), subpackage(years),modules (sem) and create staff and student function.
14. Sort list of elements using bubble sort
15. Sort list of elements using insertion sort
16. Program using Class and Object
17. Regression analysis with pie, bar and line chart
18. Naïve Bayesian classifier
19. K-Means clustering algorithm
20. Decision tree-based ID3 algorithm

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1 Propose solutions for a given problem

CO2 Infer the fundamental programming elements in Python language and learn to apply basic control structures in Python

CO3 Demonstrate the applications of tuple, array and dictionaries.

CO4 Visualize the various dataset in python

CO5 Understand the basic principles of clustering and Naïve Bayesian classifier

SEMESTER VI

23AD1601	DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basics of Neural Networks
- To gain an in-depth understanding in Convolution Neural Network.
- To acquire knowledge on basics concepts of Recurrent Neural Networks
- To enrich knowledge on new advancements and models in deep learning.
- To be familiar with recent trends in real time applications

Unit I INTRODUCTION **9**

Feed forward Neural networks – Gradient descent and the back propagation algorithm - Activa function and Unit Saturation – Optimization Algorithm: SGD & Adaptive Gradient Algorith Regularization –Dataset Augmentation.

Unit II CONVOLUTION NEURAL NETWORK **9**

Convolution Neural Network - ConvNet Architecture -CNN operation – Pooling – Types of CNN architecture: LeNet - Alex Net - ResNet - EfficientNet – Comparison of CNN & RNN - Sequential Modelling.

Unit III RECURRENT NEURAL NETWORKS **9**

Recurrent Neural Network **–** - LSTM - GRU – BiRNN - Limations of RNN and transition to Attention Model - Encoder Decoder architectures - Auto encoders - DBM – Attention model - memory models - Dynamic Memory Models – Vanishing Gradient

Unit IV ADVANCED NEURAL NETWORKS **9**

Transfer Learning – Transfer Learning model -Variational Auto encoders - Generative Adversarial Network - CycleGAN – StyleGAN - Transformer model – BERT – GPT - LLM

Unit V APPLICATIONS OF DEEP LEARNING **9**

Image Classification, Localization, Object Detection using CV, Image generation with Generative adversarial networks - Video to text with LSTM models- Named Entity Recognition using NLP, Continuous Skip-Gram Model & Continuous Bag-of-Words model(CBOW) using NLP - Sentiment Analysis using Recurrent Neural Networks

TOTAL : 45 PERIODS

TEXT BOOKS

1. F. Chollet, "Deep Learning with Python (2nd edition)", Manning Publications Co., USA, 2021
2. A. Zhang, Z. C. Lipton, M. Li, and A. J. Smola, "Dive into Deep Learning", 2020
3. Deep Learning, Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press, 2023

REFERENCE BOOKS

1. Deep Learning Step by Step with Python, N D Lewis, 2016
2. Deep Learning: A Practitioner's Approach, Josh Patterson, Adam Gibson, O'Reilly Media, 2017
3. Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks, Umberto Michelucci, Apress, 2018.
4. Deep Learning with TensorFlow: Explore neural networks with Python, Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy, Packt Publisher, 2017.
5. Amit kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti —Deep Learning"', Pearson Education, 2022.

WEB REFERENCES

1. http:// neuralnetworksanddeeplearning.com/index.html
2. https: //cs.stanford.edu/~quocle/tutorial1.pdf, https://cs.stanford. edu/~quocle/tutorial2.pdf, and http://www.trivedigaurav.com/ blog/quoc-les-lectures-on-deep-learning/
3. http://deeplearning.net/reading-list/
4. https://github.com/terryum/awesome-deep-learning-papers
5. https://karpathy.github.io/2015/05/21/rnn-effectiveness/

ONLINE COURSES / RESOURCES

1. https://nptel.ac.in/courses/108103192

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1 Explore the fundamental concepts of Neural Networks

CO2 Analyse the in-depth knowledge on Convolution Neural Network.

CO3 Develop knowledge on basics concepts of Recurrent Neural Networks

CO4 Evaluate the understandings on new advancements and models in deep learning.

CO5 Apply the idea in recent trends of real time application

CO6 Implement powerful and challenging Deep Learning applications across various domains

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	–	–	–	–	1	1	2	2	3
CO2	3	3	2	3	2	–	–	–	–	1	1	3	2	3
CO3	3	3	2	2	2	–	–	–	–	1	1	3	2	3
CO4	3	3	3	3	2	1	–	–	1	2	2	3	3	3
CO5	3	3	3	3	3	1	1	–	1	2	2	3	3	3
CO6	3	3	3	3	3	1	1	1	2	3	2	3	3	3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1602	COMPUTER VISION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To understand the fundamental concepts related to Image formation and processing.
- To Illustrate feature detection, matching and detection
- Apply feature based alignment and motion estimation
- Analyze 3D reconstruction and to understand image based rendering and recognition
- Evaluate real world applications of computer vision algorithms

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

Computer Vision - Low-level, Mid-level, High-level ;-Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization - Scattered data interpolation - Markov

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Points and patches - Edges and Contours-Contour tracking.-Lines and vanishing point - Image Segmentation -Region Growing - Edge Based approaches to segmentation - Graph- Cut - Mean-Shift – MRFs - Texture Segmentation.

UNIT III FEATURE-BASED ALIGNMENT AND MOTION ESTIMATION 9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline- based motion - Optical flow - Layered motion - Optical Flow with Semantic Segmentation

UNIT IV 3D RECONSTRUCTION AND IMAGE-BASED RENDERING 9

Shape from X - 3D scanning - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos - View interpolation Layered depth images - Videobased rendering

UNIT V COMPUTER VISION APPLICATIONS 9

Applications: Photo album – Face detection – Face recognition - Document Image Analysis – Biometrics - Object Recognition – Tracking - Medical Image Analysis - In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Comprehend the foundational concepts, theories, and methods in computer vision.

CO2 Illustrate feature detection, matching, and detection.

CO3 Apply 2D feature-based image alignment, segmentation, and motion estimations.

CO4 Analyze 3D reconstruction and understand image-based rendering and recognition.

CO5 Evaluate the effectiveness of computer vision algorithms in real-world scenarios.

CO6 Develop and implement computer vision solutions for practical problems.

TEXT BOOKS

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Texts in er Science, Second Edition, 2022.
2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education, Second 2015.

REFERENCE BOOKS

1. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012
2. Reinhard Klette Concise Computer Vision: An Introduction into Theory and Algorithms, 2014.

CO-PO-PSO MAPPING

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	2	2	3
CO2	3	3	2	2	2	1	-	-	-	-	1	3	2	3
CO3	3	3	2	2	2	1	-	-	-	-	-	3	3	3
CO4	2	3	3	2	2		-	-	-	-	-	3	3	3
CO5	2	2	2	2	2	1	-	-	-	-	-	3	3	3
CO6	2	2	3	2	2	2	1		1	-	-	3	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1603	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the Analytics Life Cycle.
- 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
- To apply visualization tools for Business Analytics

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 – Validating and verifying analytical results, Communicating and presenting results to clients and Driving organizational change and assessing impact– 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 - Data Mining and Predictive Analysis Modeling -Linear Regression, Cluster, CART and Neural Network model– Data Visualization and Analytics- Charts(Bars-Pie-Line-Scatter-Map-Bubble-Box & Whisker-Tree map - Heat map-Circle and Area) -Worksheet, Dashboard and Story Board creation

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 - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT- V MARKETING AND SALES ANALYTICS 9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Analyze real-world business challenges and model them with analytical solutions.
CO2 Demonstrate business processes to extract Business Intelligence.
CO3 Utilize predictive analytics for business forecasting.
CO4 Examine analytics in supply chain and logistics management.
CO5 Assess analytics in marketing and sales.
CO6 Employ analytics for visualization techniques.

REFERENCES

1. R. Evans James, Business Analytics, 2021 3rd edition
2. R N Prasad , Seema Acharya , Fundamentals of Business Analytics
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education, 2018.

CO-PO-PSO MAPPING

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1		-	-	-	-	-	3	3	3
CO2	3	3	2	2	1	1	-	-	-	-	1	3	3	3
CO3	3	3	2	2	2	1	-	-	-	-	-	3	3	3
CO4	2	3	3	2	2		-	-	-	-	-	3	3	3
CO5	2	2	2	2	2	1	-	-	-	-	-	3	3	3
CO6	2	2	3	2	1	2	1		1		-	2	3	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23AD1604	DIGITAL IMAGE PROCESSING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- 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
- To become familiar with image segmentation.

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- Edge-Based Segmentation- Threshold-Based Segmentation- Region-Based Segmentation- Cluster-Based Segmentation-Watershed Segmentation.

UNIT V IMAGE COMPRESSION AND RECOGNITION 9

Need for data compression, the two types of image compression, the basic flow of image 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.

LIST OF EXPERIMENTS

1. Simulation and Display of an Image, Negative of an Image (Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters (Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters

10. Image Compression by DCT, DPCM, HUFFMAN coding
11. Implementation of image restoring techniques
12. Implementation of Image Intensity slicing technique for image enhancement
13. Canny edge detection Algorithm

Theory: 45 PERIODS
Practical: 30 PERIODS
Total: 75 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1 Comprehend the fundamentals of digital image processing, including digitization, sampling, quantization, and 2D transforms.
CO2 Apply image processing techniques such as smoothing, sharpening, and enhancement.
CO3 Analyze restoration concepts and filtering techniques in image processing.
CO4 Explore the basics of segmentation, feature extraction, compression, and recognition methods for color models.
CO5 Investigate the concepts and techniques of image segmentation.
CO6 Evaluate the fundamental image processing techniques and image restoration methods.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, Fourth Edition, 2018.
2. 2.Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education India, First Edition, 2015.

REFERENCES

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, 1990.
4. William K. Pratt, ‗Digital Image Processing', John Wiley, New York, 2002
5. Milan Sonka et al ‗Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	-	-	-	2	2	2	2	2	3
CO2	3	3	2	2	3	-	-	-	2	2	2	3	3	3
CO3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
CO4	3	2	2	2	3	-	-	-	2	2	2	3	3	3
CO5	2	3	2	3	3	-	-	-	3	2	2	3	3	3
CO6	3	2	3	3	3	-	-	-	3	3	3	3	3	3

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23AD1611	DEEP LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To implement the basic concepts of deep neural networks.
- To put into practice and examine the fundamentals concepts underlying CNN and RNN
- To apply into action and investigate the core of advanced deep learning concepts.
- To find solutions using deep learning in NLP for given applications.
- Design solutions for real world problems using deep learning applications.

LIST OF EXPERIMENTS

1. Write a program to build fully connected Feed Forward Neural Network and test the same using appropriate data sets
2. Write a program to build an ANN by implementing the backpropagation algorithms and calculate the weight gradients.
3. Write a program to implement CNN model (with two layers of convolutions) for handwritten recognition images using MNIST dataset.
4. Design and implement a CNN model to classify multi category image datasets. Record the accuracy corresponding to the number of epochs. Use the CIFAR-10 datasets
5. Train U-NET on a dataset for image segmentation to visualize input images and to segment outputs.
6. Write a program to implement RNN model with LSTM/GRU for sentimental analysis for movie reviews.
7. Write a program for text generation using LSTM for character or word level predictions and generate new text sequences.
8. Write a program to use pretrained BERT model for sentiment analysis in Email communication.
9. Write a program for realistic image generation using Generative Adversarial Network.
10. Write a program to implement Continuous Bag of Words Model and Skip gram model using NLP applications.
11. Write a program to build a model that takes an image as input and determines whether the image contains a picture of a dog or a cat.
12. Write a program to build a Chabot to identify the context the user is asking and then provide it with the relevant answer.
13. Mini project on real time applications of deep learning models

TOTAL : 45 PERIODS

Software: Windows : Microsoft Visual Studio Code / Anaconda Navigator/ PyCharm Ubuntu : Microsoft Visual Studio Code / Docker

Tools and Libraries Required:

- **Frameworks:** TensorFlow, PyTorch
- **Datasets:** CIFAR-10, MNIST, IMDB Reviews, SST-2, custom datasets
- **Utilities**: Hugging Face for transformers, torchvision, TensorFlow datasets

COURSE OUTCOMES

CO1 Comprehend the basic concepts of deep neural networks.

CO2 Develop the fundamental concepts underlying CNN and RNN.

CO3 Analyze and implement the advanced deep learning concepts into practice.

CO4 Apply the NLP concepts in deep learning applications.

CO5 Generate solutions for real-world problems using deep learning applications.

CO6 Implement and evaluate deep learning solutions for practical applications.

TEXT BOOKS

1. F. Chollet, "Deep Learning with Python (2nd edition)", Manning Publications Co., USA, 2021
2. A. Zhang, Z. C. Lipton, M. Li, and A. J. Smola, "Dive into Deep Learning", 2020
3. Deep Learning, Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press, 2023

REFERENCE BOOKS

1. Deep Learning Step by Step with Python, N D Lewis, 2016
2. Deep Learning: A Practitioner's Approach, Josh Patterson, Adam Gibson, O'Reilly Media, 2017
3. Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks, Umberto Michelucci, Apress, 2018.
4. Deep Learning with TensorFlow: Explore neural networks with Python, Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy, Packt Publisher, 2017.
5. Amit kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti —Deep Learning"', Pearson Education, 2022.

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	2	2	2	3
CO2	3	2			2	-	-	-	-		2	3	2	3
CO3	3	3	2	2	3	-	-	-	-	1	3	3	3	3
CO4	2	3	2	2	2	-	-	-	-	1	3	3	3	3
CO5	2	3	3	2	3	2		1	1	2	3	3	3	3
CO6	3	3	3	3	3	2	2	2	2	2	3	3	3	3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23AD1612	COMPUTER VISION LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To understand the various filtering techniques.
- To implement image annotations.
- To implement image enhancement techniques.
- Identification of objects.
- To develop real time applications.

LIST OF EXPERIMENTS

1. Implementation of various Filter Technique.
2. Implementation of Image Annotations.
3. Write a program for Edge Detection, Corner Detection and Line Detection.
4. Write a program to implement Histogram equalization..
5. Write a program to implement object labelling.
6. Implementation of face reorganization system.
7. Licence plate identification.
8. Implementation of various segmentation Algorithm.
9. Face Recognition using Colour Model Representation.
10. Authorized Face recognition system using Feature matching
11. Human Pose Estimation

TOTAL: 60 PERIODS

COURSE OUTCOMES

On successful completion of the course student will be able to

CO1 Apply filtering techniques for images.

CO2 Implement image annotations on images.

CO3 Implement image enhancement techniques.

CO4 Object identification.

CO5 Develop real time applications.

CO6 Implement 3D Reconstruction method.

WEB REFERENCES

1. https://www.ibm.com/topics/computer-vision
2. https://www.geeksforgeeks.org/computer-vision/
3. docs.opencv.org

CO-PO-PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	-	-	2	2	3
CO2	2	2	2	-	3	-	-	-	2	-	-	3	2	3
CO3	3	2	-	-	3	-	-	-	-	-	-	3	2	3
CO4	3	3	2	2	3	-	-	-	2	-	-	3	3	3
CO5	3	2	3	2	3	-	-	2	2	2	2	3	3	3
CO6	3	2	3	3	3	-	-	2	2	2	3	3	3	3

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23ES1611	TECHNICAL SKILL PRACTICES V	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- Develop the logical design of the database using data modeling concepts such as Relational model.
- Infer the data models and use of queries in retrieving the data.
- Create a relational database using a relational database package.
- Manipulate a database using SQL.
- Render the concepts of database system structure.

LIST OF TOPICS

1. Introduction to DDL Commands of SQL
2. DML Commands of SQL
3. DCL Commands of SQL
4. TCL Commands of SQL
5. Constraints
6. SQL Aggregate Functions, Group by clause, Having clause
7. SQL Functions
8. Nested Queries
9. SQL Operators and Order by Clause
10. Introduction to Views, Destroying / Altering Tables and Views
11. Sub query
12. Joins, Set Operators
13. High Level Language Extensions - Procedures, Functions.
14. Cursors, Triggers and Active Databases
15. Normalization

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1 Construct the schema of the database and modify it

CO2 Compile a query to obtain the aggregated result from the database.

CO3 Speculate the concepts of various database objects.

CO4 Compare the use of procedure and function in database.

CO5 Use triggers and packages to create applications in the database

TEXT BOOKS

1. A. Silberschatz, H. F. Korth & S. Sudarshan, Database System Concepts, McGraw Hill,7th Edition 2019.
2. R. Elmasri & S. B. Navathe, Fundamentals of Database Systems, Pearson, 7th Edition, 2017

REFERENCE BOOKS

1. Gerardus Blokdyk, NoSQL Databases A Complete Guide, 5STARCooks, 2021
2. Raghu Ramakrishnan, Database Management Systems, Mcgraw-Hill, 4th Edition, 2018.
3. C.J.Date, A.Kannan, S.Swamynathan," An Introduction to Database Systems", Pearson, Eighth Edition, 2006.
4. The Complete Reference,3rd edition by James R.Groff, Paul N.Weinberg, AndrewJ. Oppel
5. SQL & PL/SQL for Oracle10g, Black Book,Dr.P.S.Deshpande.

WEB REFERENCES

1. https://leetcode.com/studyplan/top-sql-50/
2. https://www.guvi.in/blog/sql-queries-with-examples/
3. https://learnsql.com/blog/basic-sql-query-examples/
4. https://www.codechef.com/learn/course/sql

SEMESTER VII

23AD1701	AUGMENTED REALITY AND VIRTUAL REALITY WITH AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamental principles and technologies underlying Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI).
- To understand the framework of AR and VR.
- To explore and understand the concept of 3D modeling and positioning of objects.
- To understand the need and significance of AR/VR and its collaboration with AI.
- To interpret cross platform of AR/VR with a futuristic vision along with real-time impact an disuses.
- To provide a foundation to the fast growing field of AR/VR with its real-time applications.

UNIT I INTRODUCTION 9

Introduction to Virtual Reality – Definition – Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics–Benefits of Virtual Reality–Components of VR System–Introduction to AR – System Structure of Augmented Reality – Key Technology in AR – 3D Vision – Approaches to Augmented Reality – Alternative Interface Paradigms – Spatial AR – Input Devices – 3D Position Trackers–Performance Parameters– Types Of Trackers– Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Large Volume Displays – Sound Displays– Human Auditory System, Machine Learning Vs AR & VR

UNIT II AR/VR COMPUTING ARCHITECTURE 9

Computing Architectures of VR – Rendering Principle – Personal Graphics Displays - Graphics and Haptics Rendering –PC Graphics Architecture – Graphics Accelerators – Graphics Benchmarks – Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures –Multi-pipeline Synchronization – Collocated Rendering Pipelines – Distributed Virtual Environments – AR Architecture

UNIT III 3D MODELING 9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling–Transformation Matrices–Object Position–Transformation Invariants– Object Hierarchies–Viewing The 3D World–Physical Modeling–Collision Detection– Surface Deformation – UV mapping and unwrapping - Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management

UNIT IV CREATING CROSS-PLATFORM AR/VR 9

AI-based tools for Augmented Reality/Virtual Reality - Creating Cross-Platform Augmented Reality and Virtual Reality-Cross-Platform, Image and object recognition Game Engines– Understanding 3D graphics–Virtual Camera- Degree of Freedom –Virtual Reality Toolkit–Best Practices.

UNIT V REAL-TIME APPLICATIONS 9

Artificial Intelligence Reshaping AR,VR, and MR Technologies-Medical Applications of VR– Education, Arts, and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing –Applications in Retail and E-commerce - Applications of VR in Robotics –AI and AR/VR: A Perfect Fit?

TOTAL:45 PERIODS

COURSE OUTCOMES

On completion of the course, learner will be able to

CO1 Analyze how AR/VR systems function and identify their applications.

CO2 Examine the design and architecture of AR and VR systems.

CO3 Comprehend 3D modeling techniques and graphics in AR/VR.

CO4 Develop cross-platform applications in AR and VR.

CO5 Describe the key applications of AR and VR.

CO6 Demonstrate AR/VR toolkits and apply best practices.

TEXTBOOKS

1. GrigoreC.Burdea,PhilipCoiffet,“VirtualRealityTechnology”,SecondEdition,WileyI ndia.
2. ErinPangilinan,SteveLukas,andVasanthMohan,—CreatingAugmentedandVirtualR ea lities Theory & Practice for Next-Generation Spatial Computing‖, O’Reilly 2019

REFERENCES

1. WilliamR.Sherman,AlanB.Craig,“UnderstandingVirtualRealityInterface,Application,And Design”,2003
2. Steve Aukstakalnis, “Practical Augmented Reality - A Guide to the Technologies,Applications, and Human Factors for AR andVR”,2016
3. Alan B. Craig., “Understanding Augmented Reality Concepts and Applications”, Morgan Kaufmann,Elsevier,2013.
4. Charles Palmer, John Williamson, “Virtual Reality Blueprints : Create Compelling VR Experiences for Mobile”, PacktPublisher,2018.
5. JohnVince,“IntroductiontoVirtualReality”,Springer-Verlag,2004.

WEB REFERENCES

1. https://arpost.co/2022/01/04/artificial-intelligence-reshape-ar-vr-mr/
2. https://aithority.com/technology/virtual-reality-technology/ai-based-tools-or-sdks- for-augmented-reality-virtual-reality/
3. https://business.adobe.com/blog/basics/how-aipowered-augmented-reality- transforms-digital-experiences

4. https://appen.com/blog/augmented-and-virtual-reality/
5. https://www.smartindustry.com/articles/2021/incorporating-3d-artificial-intelligence- with-ar-and-vr-technology/
6. https://digital-matrix.org/ml-arvr/
7. https://conceptartempire.com/uv-mapping-unwrapping/

ONLINE COURSES & RESOURCES

1. https://www.coursera.org/learn/introduction-virtual-reality
2. https://nptel.ac.in/courses/106106138

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	3	-	-	-	-	3	3	2	3
CO2	3	3	-	2	-	3	-	-	-	-	3	3	2	3
CO3	3	3	-	2	-	3	-	-	-	-	3	2	2	3
CO4	3	3	-	3	-	3	-	-	-	-	3	3	2	3
CO5	3	3	-	3	-	3	-	-	3	-	3	3	2	2
CO6	3	3	-	2	-	3	-	-	-	-	3	3	2	3

Internal Assessment				**End Semester Examinations**
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23ML1702	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the fundamentals of natural language processing.
- To understand word level and syntactic analysis.
- To understand the syntax analysis and parsing.
- To understand the role of information retrieval and lexical resources.
- To explore various applications of NLP.

UNIT I OVERVIEW OF NLP AND LANGUAGE MODELLING 9

Overview: History of NLP – Generic NLP System – Levels of NLP – Stages in NLP - Processing Indian Languages – Challenges of NLP – Applications of NLP. Basics of Language Modelling: Various Grammar- based Language Models - Statistical Language Model.

UNIT II WORD LEVEL ANALYSIS AND MORPHOLOGY 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing – Laplace Smoothing; Part-of-Speech Tagging – Tag Set - Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging; Hidden Markov and Maximum Entropy models - Morphological analysis and generation using Finite State Automata and Finite State transducer.

UNIT III SYNTACTIC ANALYSIS 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing - Ambiguity in Natural Language - Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CKY, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV INFORMATION RETRIEVAL AND LEXICAL RESOURCES 9

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net - Frame Net –Stemmers -POS Tagger - Research Corpora.

UNIT V APPLICATIONS IN NLP 9

Question Answering with SQUAD – Dependency Parsing – Machine Translation – Coreference Resolution – Text Summarization - PropBank – FrameNet - Brown Corpus - British National Corpus (BNC).

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Comprehend the basics of Natural Language Processing and analyze its challenges.
2. Extract information from text using the concepts of NLP and Language Models.
3. Examine the syntax, and semantics of a natural language statement.
4. Analyze the Information Retrieval models for retrieving the information.
5. Examine the various applications of NLP.
6. Adapt the various databases used for Natural Language Processing.

TEXTBOOKS

1. Sharvari Govilkar, Sagar Kulkarni and Dhiraj Amin, “Natural Language Processing”, Staredu Solutions, ISBN Number: 9789386765383, 2022.
2. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition with Language Models", 3rd Edition, Online Manuscript, 2025
3. Christopher Manning, “Foundations of Statistical Natural Language Processing”, MIT Press, 2009

REFERENCE BOOKS

1. Nitin Indurkhya and Fred J. Damerau, “Handbook of Natural Language Processing”, Second Edition, Chapman & Hall/CRC Press, 2010.
2. Deepti Chopra, Nisheeth JoshiItiMathur, “Mastering Natural Language Processing with Python”, First Edition, Packt Publishing Limited, 2016.
3. Mohamed ZakariaKurdi, “Natural Language Processing and Computational Linguistics 1: Speech, Morphology and Syntax”, First Edition, ISTE Ltd. Wiley, 2016.
4. Atefeh Farzindar, DianaInkpen, “Natural Language Processing for Social Media”, Second Edition, Morgan and Claypool Life Sciences, 2015.

CO-PO-PSO MAPPING

CO’S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	3
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	3
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	3
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	-	1	-	-	-	-	-	2	3	2	3
CO6	3	3	2	-	1	-	-	1	-	-	2	2	2	3

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		**Assessment II (100 Marks)**		
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Individual Assignment / Case Study / Seminar / Mini Project**	**Written Test**	**Written Examinations**
40	60	40	60	100
40%				**60 %**

23AD1702	AI IN ROBOTICS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

- To study the Robot Locomotion and types of robots and their sensor requirements.
- 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.
- To understand the simulation for robot Localization.

UNIT- I ROBOT LOCOMOTION 9

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

Sensor technologies – IR Sensor – RF Module – Accelerometer – PIR Sensor – Camera Module – Gas Sensor – Smoke Sensor – Ultrasonic Sensor

UNIT-II MOBILE ROBOT KINEMATICS 9

Kinematic models and constraints – mobile robot maneuverability (a mobile robot with a steerable wheel and two passive casters) – different types of kinematics in robotics - kinematics used in robotics - mobile robot workspace –advanced kinematics – motion control - Understanding Mobile Robot Kinematics using degrees of freedom.

UNIT- III ROBOT PERCEPTION 9

Sensors for mobile robots – sensing and perception in robotics - 4 Characteristics of robots - computer vision for robots – image processing for robotics – place recognition – range data.

UNIT- IV MOBILE ROBOT LOCALIZATION 9

Introduction to localization – 4 basic parts of a mobile robot - localization in mobile robot - noise and aliasing – localization-based navigation – Exploring Mobile Robot Localization Techniques - belief representation – map representation – probabilistic map-based localization – autonomous map building.

UNIT- V ROBOT PLANNING AND NAVIGATION 9

Planning and navigation – 3 types of navigation - purpose of navigation - planning and reacting – path planning – obstacle avoidance – navigation architectures - Robot Planning and navigation - The benefits of navigation.

LIST OF EXPERIMENTS

1. The design of the printed circuit using Easy EDA Speed Line Follower Robot V4
2. To perform certain hand Gesture controlled bot
3. To implements a robotic arm with four degrees of freedom (4 DOF) Robotic Arm
4. Home Security System using Node MCU
5. RF Controlled or Wi-Fi controlled Navigation bot
6. Pick and place bot with Object Detection
7. To perform wall following robot must be capable of detecting and avoiding obstacles in Wall Following bot
8. Maze solving Robot using Arduino ADC
9. Forward and reverse kinematics based experiment using open source platforms
10. Write a program to implement Computer Vision based robotic tasks execution
11. Building an easy Line Follower Robot using Arduino Uno
12. To determine the motion of a robot to reach a desired position in Inverse kinematics
13. To calibrate the camera using the same image when the position tracker is reassembled

PRACTICALS -30 PERIODS
THEORY -45 PERIODS
TOTAL -75 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1 Discuss the different types of robots, their classifications, and the sensor technologies used in robotics.
CO2 Describe the kinematic principles governing robotic systems.
CO3 Implement basic image processing algorithms for robotic vision.
CO4 Design localization algorithms for accurate robot positioning.
CO5 Develop path planning methods for efficient robot navigation.
CO6 Apply line tracing algorithms in robotic movement and control.

TEXT BOOKS

1. R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza, —Introduction to Autonomous Mobile Robots‖, Second Edition, MIT Press, 2011.
2. Stuart Russel and Peter Norvig, —Artificial Intelligence: A Modern Approach‖, Fourth Edition, Pearson Education, 2020.

REFERENCES

1. D.M. Dhamdhere, Systems Programming and Operating Systems, Second Revised Edition, Tata
2. Artificial Intelligence and Robotics (Studies in Computational Intelligence Book 752) 1st ed. 2018 Edition, Kindle Edition by Huimin Lu, Xing Xu
3. Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques Paperback – 30 August 2018 by Francis X Govers

ONLINE COURSES / RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_me38/preview

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**2**	-	2	1	2	-	-	1	-	**3**	**2**	**2**	**3**
CO2	**3**	**3**	-	2	-	2	-	-	2	-	**3**	**2**	**2**	**3**
CO3	**3**	**2**	-	2	-		-	-	1	-	**2**	**2**	**2**	**3**
CO4	**3**	**2**	-	1	-	2	-	-	3	-	**3**	**3**	**3**	**3**
CO5	**3**	**2**	-	1	-	2	-	-	2	-	**2**	**3**	**3**	**3**
CO6	**3**	**3**	-	1	-	-	-	-	1	-	**2**	**3**	**2**	**3**

Assessment (40% weightage) (Theory Component)		**Assessment** (60% weightage) (Laboratory Component)		**End Semester Examination**
Individual Assignment / Case Study / Seminar / Mini Project	**Written Test**	**Evaluation of Laboratory Observation, Record**	**Test**	**Written Examination**
40	**60**	**75**	**25**	
100				**100**
50 %				**50 %**

23AD1711	AUGMENTED REALITY AND VIRTUAL REALITY WITH AI LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To explore and interpret Unity software.
- To design and model game objects.
- To understand the scripting in Unity.
- To analyze and experiment Marker-based AR.
- To set up VR environment.
- To develop AR/VR mini project.

LIST OF EXPERIMENTS

1. Installing Unity and navigating the Scene view
2. Creating game objects (Rotate – Transform – Scale)
3. Models – Applying Textures, Shaders, and Materials to Models
4. Scripting in Unity (Object rotation via C# script)
5. Experimenting with Colliders
6. Creating the animation (Object Spinning & Timing)
7. Creating a Timeline Asset
8. Adding Audio in the Scene View
9. Marker based AR :2D – 2D video mapping
10. Marker based AR : 2D – 3D mapping
11. Virtual buttons in AR (Creating Virtual buttons on Image target)
12. Creating AR app using Unity and Vuforia (Projecting 3D Model on Image Target).
13. Setting up a VR environment
14. Design a simple VR environment with a few interactive objects
15. Mini Projects:

    i. Build a Gaming environment using VR
    ii. Export an Android app with AR

SOFTWARE

Software – Blender and Unity

TOTAL PERIODS: 60

COURSE OUTCOMES

Upon completion of this course, the students should be able to

CO1 Operate and navigate Unity software for game development.
CO2 Construct 3D game objects using Unity tools.
CO3 Implement scripting functionalities within Unity projects.
CO4 Analyze the functionality of marker-based Augmented Reality.
CO5 Develop applications using Augmented Reality technology.
CO6 Examine and configure Virtual Reality environments effectively.

TEXT BOOKS

1. Unity 2018 Game Development,Mike Garg, O'Reilly.

2. C# SCRIPTING -Unity Game Development Cookbook, Paris Buttfield-Addison, Jon Manning, Tim Nugent O'Reilly.

REFERENCES

1. Unity Animation Essentials, Packt, 2015

2. Building AR Applications with Unity and Vuforia, Daniel Wise,Packt.

3. Unity AR & VR by tutorials, First edition, Jimmy, Matt Larson, Jonathan.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	1	-	-	-	-	-	-	3	2	2	3
CO2	3	3	-	2	-	-	-	-	-	-	3	2	2	3
CO3	3	3	-	3	-	3	-	-	-	-	3	2	2	3
CO4	3	3	-	2	-		-	-	-	-	3	3	2	3
CO5	3	3	-	3	-	3	2	-	-	2	3	3	2	3
CO6	3	3	-	2	-	3		-	3	2	3	3	2	3

Internal Assessment		**End Semester Examination**
Evaluation of Laboratory Observation, Record	**Test**	**Practical**
75	**25**	**100**
60 %		**40%**

23AD1712	INNOVATION PRACTICES AND MINI PROJECT	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

- To explore the culture of Innovation.
- To understand the importance of innovation in digital revolution.
- To understand how innovation is applied.
- To transform innovative problem-solving ideas into viable solutions.
- To demonstrate how innovators, conceive and implement impactful solutions for problems as mini projects.

PROCEDURE

1. Select an area of interest and Topic.
2. State an objective.
3. Collection of Journal Papers for literature survey (at least 25 journal papers)
4. Preparation of working outline.
5. Implement the working outline with real time algorithms.
6. Test the obtained result with various real time scenarios.
8. Preparing conclusions based on the worked test cases.
9. Preparation of final presentation on the completed work.

COURSE OUTCOMES

CO1 Explore the fundamentals and scope of innovation in various domains
CO2 Identify real-world problems and discover potential innovative solutions
CO3 Generate creative ideas and apply problem-solving techniques
CO4 Examine various innovation strategies and their applications
CO5 Implement chosen strategies to transform ideas into viable outcomes
CO6 Demonstrate innovation through the execution of mini projects and case-based solutions

SOFTWARE

Java / Python with Machine Learning Packages, JavaScript

TOTAL: 60 Periods

VERTICAL I - DATA SCIENCE AND OPTIMIZATION

23AD1901	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- 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.

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II DATA MINING – INTRODUCTION 9

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques - Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III 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 – DensityBased 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: 45 PERIODS

COURSE OUTCOMES

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

CO1 Design a data warehouse system and perform business analysis using OLAP tools
CO2 Apply suitable data pre-processing and visualization techniques for analysis
CO3 Apply frequent pattern and association rule mining techniques for data analysis
CO4 Apply appropriate classification methods for extracting analytical insights
CO5 Apply clustering techniques to discover data patterns and groupings
CO6 Integrate multiple data mining techniques for comprehensive data analysis

TEXT BOOK

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

REFERENCES

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.

23AD1902	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To outline an overview of exploratory data analysis.
- To learn T-test.
- To perform univariate data exploration and analysis
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data
- To implement data visualization using advanced techniques

UNIT - I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques- Case study - attack for tampering with recommender systems.

UNIT - II 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 - III UNIVARIATE ANALYSIS 9

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality**-** Medical Statistics

UNIT - IV BIVARIATE ANALYSIS 9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines**-** Regression Analysis.

UNIT - V MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Timebased indexing – Visualizing – Grouping – Resampling- COVID 19**.**

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the fundamentals of exploratory data analysis

CO2 Use T-test in analysis Process.

CO3 Perform univariate data exploration and analysis.

CO4 Apply bivariate data exploration and analysis.

CO5 Evaluate Data exploration and visualization techniques for multivariate and time series data.

CO6 Build models for data visualization using advanced techniques.

TEXT BOOKS

1.Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020.

2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.

3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017

2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019

3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive DataVisualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

23AD1903	SOFT COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing
- To make students to implement real time applications

UNIT - I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems **-**Case study : Analytic Hierarchy Process Approach.

UNIT - II NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks – Convolutional NeuralNetwork.

UNIT - III GENETIC ALGORITHMS 9

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function- Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function – maximizing afunction program - Case study: Job scheduling.

UNIT - IV NEURO FUZZY MODELING 9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling– Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of AdaptiveLearning Capability- Three input non-linear function**.**

UNIT - V APPLICATIONS 9

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction- Hybrid Approach**.**

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the fundamentals of fuzzy logic operators and inference mechanisms

CO2 Understand neural network architecture for AI applications such as classification and clustering.

CO3 Learn the functionality of Genetic Algorithms in Optimization problems

CO4 Use hybrid techniques involving Neural networks and Fuzzy logic

CO5 Apply soft computing techniques in real world applications

CO6 Build real time applications.

TEXT BOOKS

1. Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence , Jang, J.-S. R., Sun, C.-T., & Mizutani, E., Upper Saddle River, NJ, Prentice Hall January 2015
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020

REFERENCES

1.Roj Kaushik and Sunita Tiwari, Soft Applications, 1st Edition, McGraw Hill, 2018. Computing-Fundamentals Techniques

2.S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”,PHI,2003

3.Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.

4.S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd,2019.

23AD1904	TEXT ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the methods for keyword extraction from documents
- To learn clustering methods for grouping of documents
- To explore the methods for classification of documents and E-mails
- To explore text visualization techniques and anomaly detection.
- To learn about Events and trends in text streams
- To learn about advanced text visualization techniques

UNIT - I TEXT EXTRACTION 9

Introduction- Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords-Benchmark evaluation: precision and recall, efficiency, stoplist generation, Evaluation on new articles, Intelligent Text extraction.

UNIT - II DOCUMENT CLUSTERING 9

Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments; Constrained clustering with k-means type algorithms, Document Clustering vs Topic Models : A case study.

UNIT - III CONTENT BASED CLASSIFICATION 9

Classification algorithms for Document Classification, Content-based spam email classification, Utilizing nonnegative matrix factorization for email classification problems, Development of content based SMS classification.

UNIT - IV ANOMALY AND TREND DETECTION 9

Text visualization techniques: Visualization in text analysis, Tag clouds, tag clouds, authorship and change tracking, Data Exploration and the search for noval patterns, sentiment tracking, visual analytics and FutureLens, scenario discovery. adaptive threshold setting for novelty mining: Introduction, adaptive threshold for anomaly detection, Experimental study.

UNIT - V TEXT STREAMS 9

Events and trends in text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions. Embedding semantics in LDA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding, Dynamic sampling of text streams and its application in text analysis**.**

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Design text extraction techniques.

CO2 To apply clustering methods for grouping of documents.

CO3 Design classification techniques for text mining

CO4 Apply visualization techniques and perform anomaly & trend detection.

CO5 Perform Event operations in Text streams

CO6 Apply advanced text visualization techniques.

TEXT BOOKS

1. Michael W. Berry & Jacob Kogan,"Text Mining Applications and Theory", Wiley publications, 2010.
2. Aggarwal, Charu C., and ChengXiangZhai, eds., “Mining text data”, Springer Science & Business Media, 2012.

REFERENCES

1. Gary Miner, John Elder, Thomas Hill, Dursun Deller, Andrew Fast, Robert A. Nisbet, “Practical text mining and statistical analysis for non-structured text data applications”,Academic Press, 2012.
2. Srivastava, Ashok N., and MehranSahami, “Text mining: Classification, clustering, and applications”, Chapman and Hall/CRC, 2009.
3. Buitelaar, Paul, Philipp Cimiano, and Bernardo Magnini, eds., “Ontology learning from text: methods, evaluation and applications”, Vol. 123. IOS press, 2005.

23AD1905	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT I INTRODUCTION 9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 9

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III COLLABORATIVE FILTERING 9

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT V EVALUATING RECOMMENDER SYSTEMS 9

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the basic concepts of recommender systems.

CO2 Implement machine-learning and data-mining algorithms in recommender systems data sets.

CO3 Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.

CO4 Design and implement a simple recommender system.

CO5 Build a system to implement advanced topics of recommender systems.

TEXTBOOKS

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. "Recommender Systems Handbook" by Francesco Ricci, Lior Rokach, and Bracha Shapira, published by Springer, 2nd edition, 2015
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

23AD1906	ENGINEERING PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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 – Case study: Churn prevention**.**

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- Hospital Readmission.

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- Case study: predictive web Analytics

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: 45 PERIODS

COURSE OUTCOMES

CO1 Explain terminology, technology and applications of predictive analysis

CO2 Apply data preparation techniques to effectively interpret big data

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

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

CO5 Illustrate the features and applications of text mining.

CO6 Apply advanced text visualization techniques.

TEXT BOOKS

1. Dean Abbott, “Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst”, Wiley, 2014
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition,Elsevier, 2012

REFERENCES

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

23AD1907	ETHICS AND AI	L	T	P	C
		3	0	0	3

OBJECTIVES

- 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
- To understand ethics in all AI applications

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**,** Ethics of AI and big data**.**

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, Trust and Transparency.

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, Deep learning values.

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, Chatbots.

TOTAL: 45 PERIODS

OUTCOMES:

CO1 Understand the ethical issues in the development of AI agents

CO2 Learn the ethical considerations of AI with perspectives on ethical values

CO3 Apply the ethical policies in AI based applications and Robot development

CO4 To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights

CO5 Analyse the evil genesis in the concepts of AI.

CO6 Apply ethics in all AI applications

TEXT BOOKS

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

REFERENCES

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”. In W. M. Ramsey and
K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.

3. Wallach, W., & Allen, C, “Moral machines: ceaching robots right from wrong”, Oxford University Press, 2008.

23AD1908	BIG DATA MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand about big data
- To learn and use NoSQL big data management
- To learn mapreduce analytics using Hadoop and related tools.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics
- To implement real time applications

UNIT - I UNDERSTANDING BIG DATA 9

What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – Introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT - II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations- Case study: Apache Cassandra.

UNIT - III BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures- installing Hadoop.

UNIT - IV MAPREDUCE APPLICATIONS 9

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats- Implement Matrix Multiplication.

UNIT - V HADOOP RELATED TOOLS 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries, Installation of Hive.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Define big data and use cases from selected business domains
CO2 Explain NoSQL big data management
CO3 Explain the steps involved in install, configuration, and run Hadoop and HDFS
CO4 Perform map-reduce analytics using Hadoop.

CO5 Explain Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

CO6 Implement real time applications.

TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

2.Tom White, Hadoop The Definitive Guide, O"Reilly, 4th Edition, 2015.

REFERENCES

1.E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012

2.Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

3.Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.

VERTICAL II: FULL STACK DEVELOPMENT

23IT1901	NEXTGEN WEB DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the core concepts of modern web development and architecture.
- Apply front-end development techniques using HTML, CSS, and JavaScript.
- Design and implement RESTful APIs and backend services using Node.js and Express.js.
- Evaluate the integration of front-end and back-end systems in full-stack development.
- Build responsive and secure web applications using modern frameworks like React, Angular, and Vue.
- Analyze web optimization techniques, such as lazy loading and caching strategies.

UNIT - I INTRODUCTION TO WEB DEVELOPMENT AND MODERN WEB ARCHITECTURE 9

Overview of Web Development -Traditional vs Next-Gen Web-Client-Server Architecture-Web 2.0, Web 3.0-HTTP/HTTPS Protocol-Request/Response cycle, Methods, Status codes-Web Servers and Frameworks- Apache, Nginx, Node.js-Responsive Web Design-Mobile-first design, Progressive Web Apps (PWA)-Introduction to Web Security-Common security threats (XSS, CSRF)

UNIT - II FRONT-END DEVELOPMENT 9

HTML5 & CSS3-Structure, semantics, forms, and multimedia-CSS Frameworks- Bootstrap, Materialize-JavaScript-ES6, DOM manipulation, and event handling-Front-End Libraries- React.js, Vue.js, Angular -Web Accessibility-WCAG standards, ARIA-Cross-Browser Compatibility-Debugging, tools, and techniques

UNIT - III BACK-END DEVELOPMENT AND DATABASES 9

Node.js Overview-Setting up a Node.js environment, Express.js framework Backend Frameworks-Django (Python), Spring Boot (Java), Flask (Python)-APIs-RESTful API design, GraphQL-Database Management-SQL (MySQL, PostgreSQL), NoSQL (MongoDB, Firebase)-Authentication & Authorization: JWT, OAuth-Deployment- Docker, Kubernetes, Serverless architecture

UNIT - IV Full-Stack Development 9

Connecting Front-End to Back-End- REST API calls, AJAX, Fetch API, and WebSockets-Full-Stack JavaScript-MEAN/MERN stack (MongoDB, Express, Angular/React, Node.js)-State Management-Redux, Context API-GraphQL-Introduction, Queries, Mutations, and Subscriptions-Session Management- cookies, Tokens, Sessions-WebSockets-Real-time communication

UNIT - V Web Development Tools & Advanced Concepts 9

Version Control with Git-GitHub, GitLab, Git commands, Branching-CI/CD and DevOps- Jenkins, Travis CI, Docker containers, Kubernetes-Progressive Web Apps (PWA)-Service Workers, Web App Manifests, Caching strategies-WebAssembly (WASM)-Introduction and use cases-Web Optimization-Lazy loading, code splitting, performance tuning-Advanced Web Security- HTTPS, Content Security Policy (CSP), Web Security Best Practices

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Recall key principles of web security and common web vulnerabilities.

CO2 Demonstrate understanding of back-end frameworks like Django, Flask, and Spring Boot.

CO3 Develop and deploy web applications using the MERN or MEAN stack.

CO4 Assess the performance and scalability of full-stack applications.

CO5 Implement version control and CI/CD pipelines for web development projects.

CO6 Evaluate advanced web security measures such as HTTPS and Content Security Policy

(CSP).

TEXT BOOKS

1. Jon Duckett, HTML and CSS: Design and Build Websites, Wiley, 2021.
2. Benjamin Listwon, Node.js Web Development, Packt Publishing, 2022.
3. David Mark Clements, Microservices in Action, Manning Publications, 2021.
4. Bradley Meck, React.js Essentials, Packt Publishing, 2022.
5. William S. Vincent, Django for Professionals, William S. Vincent, 2022.

REFERENCE BOOKS

1. Peter Morgan, Learning JavaScript Design Patterns, O'Reilly Media, 2022.
2. Mosh Hamedani, Mastering Node.js, Code With Mosh, 2021.
3. Ethan Brown, Web Development with Node and Express, O'Reilly Media, 2022.
4. Packt Publishing, Hands-On Full-Stack Development with WebAssembly, Packt Publishing, 2022.
5. Ben Lesh, RxJS in Action, Manning Publications, 2021.

WEB REFERENCES

1. https://developer.mozilla.org/en-US/
2. https://www.w3.org/WAI/
3. https://guides.github.com/activities/hello-world/
4. https://webassembly.org/
5. https://nodejs.org/docs/latest/api/

ONLINE COURSES / RESOURCES

1. https://www.coursera.org/specializations/full-stack-react
2. https://www.linkedin.com/learning/learning-full-stack-development
3. https://developer.mozilla.org/en-US/docs/Learn

23IT1902	OPEN SOURCE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the core concepts of Open-Source Software (OSS) and its principles.
- Examine the differences between Free Software and Open-Source Software.
- Apply Open-Source principles and methodologies in real-world scenarios.
- Analyze the structure and development process of an Open-Source project.
- Utilize Open-Source software tools such as GitHub for collaboration and code contributions.
- Assess the impact of Open-Source software on the technology ecosystem and society.

UNIT - I INTRODUCTION 9

Introduction to Open-Source: Open Source, Need and Principles of OSS, Open- Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open- Source Software, Public Domain. History of free software, Proprietary Vs Open- Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.

UNIT - II OPEN-SOURCE PRINCIPLES AND METHODOLOGY 9

Open-Source History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization - Licensing: What is a License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - III OPEN SOURCE PROJECT 9

Starting and maintaining own Open-Source Project, Open-Source Hardware, Open- Source Design, Open-source Teaching, Open-source media.Collaboration: Community and Communication, Contributing to OpenSource Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student's choice

UNIT - IV UNDERSTANDING OPEN-SOURCE ECOSYSTEM 9

Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies.

UNIT -V OPEN SOURCE ETHICS & CASE STUDIES 9

Open Source Ethics – Open Vs Closed Source – Government – Ethics – Impact of Open source Technology – Shared Software – Shared Source.

Example Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, wordpress, GCC, GDB, github, Free BSD, Open Solaris, Open Office. Open Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, debuggers, Programming languages, LAMP, Open Source database technologies.

Study: Understanding the developmental models, licensing, mode of funding, commercial/non- commercial use.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of the course student will be able to:

CO1 Identify and describe key Open-Source licenses, such as Apache and BSD.

CO2 Explain how Open-Source operating systems and tools function and contribute to software development.

CO3 Demonstrate the ability to start and maintain an Open-Source project.

CO4 Compare and contrast different Open-Source licensing models and their implications.

CO5 Contribute code to a prominent Open-Source project and understand community collaboration.

CO6 Evaluate the ethical implications of Open-Source development versus proprietary software.

TEXT BOOKS

1. FLOSS Manuals, The Open Source Way, O'Reilly Media, 2023.
2. Eric S. Raymond, The Cathedral and the Bazaar, O'Reilly Media, 2022.
3. Karl Fogel, Producing Open Source Software, O'Reilly Media, 2021.
4. Daniel J. Barrett, Linux Pocket Guide, O'Reilly Media, 2021.
5. Radhika S. Rathi, Introduction to Open Source Software, Wiley, 2023.

REFERENCES

1. Michael K. Johnson, Linux from Scratch, Linux From Scratch, 2022.
2. Chris DiBona, Mark Stone, Danese Cooper, Open Sources: Voices from the Open Source Revolution, O'Reilly Media, 2021.
3. Bryan Beecham, Open Source Software Development, Addison-Wesley, 2022.
4. Sam Williams, Free as in Freedom: Richard Stallman's Crusade for Free Software, O'Reilly Media, 2023.
5. Jesse Liberty, Programming Open Source, 2nd Edition, O'Reilly Media, 2021.

23IT1903	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Recall the fundamental concepts of mobile and web application development.
- Explain the differences between Native, Hybrid, and Cross-Platform applications.
- Apply front-end technologies like HTML, CSS, and JavaScript for app development.
- Analyze the architecture and tools required for Native, Hybrid, and Cross-Platform development.
- Evaluate various frameworks such as React Native, Flutter, and Xamarin for cross-platform development.
- Design responsive, secure, and optimized applications using modern app development frameworks.

UNIT - I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 9

Basics of Web and Mobile application development, Native App, Hybrid App, Cross- platform App, What is Progressive Web App, Responsive Web design

UNIT - II NATIVE APP DEVELOPMENT USING JAVA 9

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT - III HYBRID APP DEVELOPMENT 10

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

UNIT - IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE 8

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT - V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Identify the key components and characteristics of web and mobile applications.

CO2 Describe the differences between Native, Hybrid, and Cross-Platform app development.

CO3 Develop basic mobile applications using Java/Kotlin and React Native.

CO4 Integrate front-end and back-end components in app development.

CO5 Assess the performance and security aspects of different app development frameworks

CO6 Compare non-functional characteristics like performance, maintainability, and UI/UX across app development frameworks.

TEXT BOOKS

1. Paul J. Deitel & Harvey Deitel, Android How to Program, Pearson, 2023.
2. Jonathan Levin, Mac OS and iOS Internals: To the Apple's Core, Wiley, 2023.
3. Donn Felker, Android Application Development For Dummies, Wiley, 2023.
4. Adam Boduch, Roy Derks, React and React Native: A Complete Hands-On Guide to Modern Web and Mobile Development, Packt Publishing, 2023.
5. David Griffiths & Dawn Griffiths, Head First Kotlin: A Brain-Friendly Guide, O'Reilly Media, 2023.

REFERENCE BOOKS

1. Eric Freeman & Elisabeth Robson, Head First Design Patterns, O'Reilly Media, 2023.
2. Raywenderlich Team, Flutter Apprentice: Beginning App Development for Android and iOS, Razeware LLC, 2023.
3. Josh Skeen & David Greenhalgh, Kotlin Programming: The Big Nerd Ranch Guide, Pearson, 2023.
4. Stephen Grider, The Complete React Native and Hooks Course, Packt Publishing, 2023.
5. Manning Publications, Progressive Web Apps: The Complete Guide, Manning, 2023.

23IT1904	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Define the fundamental concepts of UI and UX design.
- Explain the principles of user interface (UI) and user experience (UX) design.
- Implement various research methods to gather user insights for UX design.
- Utilize industry-standard tools for wireframing, prototyping, and testing UI/UX designs.
- Analyze user needs and business goals to create user-centered designs.
- Evaluate usability testing results to refine and enhance user interfaces.

UNIT - I FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT - II FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT - III FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT - IV WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT - V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Recall the principles and methodologies of UI and UX design.
CO2 Describe the significance of research in UX design and its impact on user experience.
CO3 Apply wireframing and prototyping techniques using industry-standard tools.
CO4 Develop interactive mockups based on user stories and information architecture.
CO5 Assess and improve the usability of digital interfaces through testing methods.
CO6 Compare different design thinking approaches to optimize user experience.

TEXT BOOKS

1. Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, About Face: The Essentials of Interaction Design, Wiley, 2023.
2. Joel Marsh, UX for Beginners: A Crash Course in 100 Short Lessons, O'Reilly Media, 2023.
3. Don Norman, The Design of Everyday Things: Revised and Expanded Edition, Basic Books, 2023.
4. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Pearson, 2023.

5. Jesmond Allen, James Chudley, Smashing UX Design: Foundations for Designing Online User Experiences, Wiley, 2023.

REFERENCE BOOKS

1. Steve Krug, Don't Make Me Think: A Common Sense Approach to Web Usability, New Riders, 2023.
2. Jeff Gothelf, Josh Seiden, Lean UX: Designing Great Products with Agile Teams, O'Reilly Media, 2023.
3. Frank Spillers, UX Design and Usability Mentor Book, CRC Press, 2023.
4. Scott Hurff, Designing Products People Love: How Great Designers Create Successful Products, O'Reilly Media, 2023.
5. Will Grant, UX Storytellers: Connecting the Dots in User Experience, UX Book Club, 2023.

23IT1905	DEVOPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Define the core concepts and tools involved in DevOps, including AWS, GCP, Azure, Git, and Jenkins.
- Explain the principles behind version control systems, continuous integration, and continuous delivery.
- Demonstrate the use of Maven, Gradle, and Ant for building and compiling projects.
- Assess the role of Jenkins and Ansible in automating workflows and configuration management.
- Critique the process of creating and managing DevOps pipelines using Azure DevOps.
- Develop end-to-end CI/CD pipelines using Jenkins, Ansible, and Azure DevOps.

UNIT - I INTRODUCTION TO DEVOPS 9

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github - Gerrit Code review.

UNIT - II COMPILE AND BUILD USING MAVEN , GRADLE & ANT 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle – Introduction to ANT- Installation of ANT – Understand and Build using ANT.

UNIT - III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT - IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT - V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file - Testing and Monitoring - Selenium, Jira, ELK

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 List and describe DevOps tools and platforms such as AWS, GCP, Azure, Jenkins, and Git.
CO2 Illustrate how continuous integration and build tools like Maven and Gradle work together in a DevOps environment.
CO3 Execute basic commands and configure Jenkins and Ansible for project automation.
CO4 Differentiate between different DevOps tools and explain their impact on software development processes.
CO5 Assess the efficiency and scalability of CI/CD pipelines using Jenkins and Azure.
CO6 Design and implement automated DevOps pipelines for a sample project using appropriate tools and platforms.

TEXT BOOKS

1. Gene Kim, Jez Humble, Patrick Debois, John Willis, The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, IT Revolution Press, 2023.
2. Nicole Forsgren, Jez Humble, Gene Kim, Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations, IT Revolution Press, 2023.
3. Adora Nwodo, Beginning Azure DevOps: Planning, Building, Testing, and Releasing Software Applications on Azure, Wiley, 2023.
4. Luke Kysow, Consul: Up and Running: Service Mesh for Any Runtime or Cloud, O'Reilly Media, 2023.
5. Eric Chow, Mastering Python Networking: Utilize Python Packages and Frameworks for Network Automation, Monitoring, Cloud, and Management, Packt Publishing, 2023.

REFERENCE BOOKS

1. Jez Humble, David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Addison-Wesley Professional, 2023.
2. Gene Kim, The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win, IT Revolution Press, 2023.
3. Patrick Debois, John Willis, The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, IT Revolution Press, 2023.
4. Nicole Forsgren, Jez Humble, Gene Kim, Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations, IT Revolution Press, 2023.
5. Adora Nwodo, Beginning Azure DevOps: Planning, Building, Testing, and Releasing Software Applications on Azure, Wiley, 2023.

23IT1906	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Define the principles, techniques, and processes of software testing and automation.
- Explain different testing strategies, methodologies, and automation tools.
- Implement functional and non-functional testing using automated tools like Selenium.
- Develop and execute test cases for web, mobile, and enterprise applications.
- Analyze defect tracking, bug lifecycle, and root cause identification.
- Evaluate test automation frameworks for CI/CD integration in Agile environments.

UNIT - I FOUNDATIONS OF SOFTWARE TESTING 9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT - II TEST PLANNING 9

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT - III TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, ModelDriven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT - IV ADVANCED TESTING CONCEPTS 9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT - V TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Recall key concepts, types, and levels of software testing.
CO2 Describe test planning, design techniques, and automation processes.
CO3 Execute software testing using manual and automated approaches.
CO4 Develop automated test scripts for validating application functionalities.
CO5 Assess software quality by applying performance, security, and usability testing.
CO6 Compare different testing tools and techniques for effective defect detection.

TEXT BOOKS

1. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, CRC Press, 2023.
2. Rex Black, Advanced Software Testing – Vol. 1: Guide to the ISTQB Certification, Rocky Nook, 2023.
3. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, Wiley, 2023.
4. Aditya Garg, Hands-On Test Management with JIRA, Packt Publishing, 2023.
5. Patanjali Nayak, Navin Kumar, Software Testing and Quality Assurance for Beginners, BPB Publications, 2023.

REFERENCE BOOKS

1. Dorothy Graham, Mark Fewster, Experiences of Test Automation: Case Studies of Software Test Automation, Addison-Wesley, 2023.
2. Ajay Kumar Jena, Automation Testing with Selenium and JUnit, BPB Publications, 2023.
3. Arnon Axelrod, Complete Guide to Test Automation: Techniques, Practices, and Patterns for Building and Maintaining Effective Software Test Automation, Apress, 2023.
4. Rahul Shende, Selenium WebDriver 3 Practical Guide: End-to-End Automation Testing for Web and Mobile Browsers with Selenium WebDriver, Packt Publishing, 2023.
5. Naveen Kumar T, Mastering Software Testing with JUnit and Selenium, BPB Publications, 2023.

23IT1907	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To impart Knowledge on the following topics:

- Define the fundamental concepts and importance of web application security.
- Explain secure development and deployment practices for web applications.
- Implement secure authentication, authorization, and encryption techniques in web applications.
- Develop and integrate secure APIs with access control mechanisms.
- Assess web applications for vulnerabilities using penetration testing tools.
- Evaluate hacking techniques and mitigation strategies for web security threats.

UNIT – I FUNDAMENTALS OF WEB APPLICATION SECURITY **9**

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT – II SECURE DEVELOPMENT AND DEPLOYMENT **9**

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT – III SECURE API DEVELOPMENT **9**

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT –IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING **9**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT –V HACKING TECHNIQUES AND TOOLS **9**

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of the course student will be able to:

CO1 Understanding the basic concepts of web application security and the need for it

CO2 Be acquainted with the process for secure development and deployment of web applications

CO3 Acquire the skill to design and develop Secure Web Applications that use Secure APIs

CO4 Be able to get the importance of carrying out vulnerability assessment and penetration testing

CO5 Using the acquired knowledge into practice for testing the vulnerabilities and identifying threats.

CO6 Using the acquired knowledge into practice for testing the vulnerabilities and identifying threats.

TEXT BOOKS

1. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Wiley, 2022.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginner's Guide, McGraw-Hill, 2023.
3. Andrew Hoffman, Web Security for Developers: Real Threats, Practical Defense, O'Reilly Media, 2023.
4. John Viega, Gary McGraw, Building Secure Software: How to Avoid Security Problems the Right Way, Addison-Wesley, 2022.
5. Neil Madden, API Security in Action, Manning Publications, 2023.

REFERENCES

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

23IT1908	PROJECT MANAGEMENT AND AGILE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of project management and agile practices.
- To gain knowledge of Agile methodologies and frameworks like Scrum, Kanban, and Extreme Programming (XP).
- To learn project estimation, planning, and advanced practices in Agile project management.
- To explore emerging trends in project management and Agile applications in different domains.
- To analyze real-world case studies to understand the successful implementation of Agile and traditional project management.

UNIT - I Fundamentals of Project Management 9

Introduction to Project Management: Definition, Importance, and Scope-Project Lifecycle: Phases and Processes-Project Constraints: Scope, Time, Cost, Quality, Risk, and Resources Project Stakeholders and Communication Management-Tools for Project Planning and Scheduling.

UNIT - II Agile Project Management 9

Introduction to Agile Methodology: Principles and Values (Agile Manifesto)-Agile vs. Traditional Project Management-Key Agile Frameworks: Scrum, Kanban, Lean, Extreme Programming (XP)-Roles in Agile Teams: Product Owner, Scrum Master, Development Team-Iterative and Incremental Delivery: Sprints, Backlogs, and Retrospectives.

UNIT - III Tools and Techniques in Agile 9

Project Estimation Techniques: Planning Poker, T-Shirt Sizing-Agile Metrics: Velocity, Burnup, Burndown Charts-Risk Management in Agile Projects-Collaboration and Communication in Agile Teams-Agile Tools: Jira, Trello, Asana, and MS Project

UNIT - IV Advanced Agile Practices 9

Scaling Agile: SAFe, LeSS, and Disciplined Agile-DevOps Integration with Agile-Continuous Integration and Continuous Delivery (CI/CD)-Agile Quality Assurance and Testing Strategies-Challenges and Best Practices in Agile Adoption

UNIT - V Emerging Trends in Project Management 9

Hybrid Project Management Models-Artificial Intelligence and Machine Learning in Project Management-Agile in Non-Software Domains (Construction, Healthcare, Education)- Sustainability and Ethical Practices in Project Management-Case Studies of Successful Agile and Traditional Projects.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the fundamentals of project management, including lifecycle and tools.
CO2 Learn Agile principles, values, and frameworks for efficient project execution.
CO3 Apply Agile tools and techniques for estimation, collaboration, and risk management.
CO4 Explore advanced Agile practices like scaling Agile, DevOps integration, and CI/CD.
CO5 Identify and analyze emerging trends and case studies in Agile and project management.

TEXT BOOKS

1. Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Harold Kerzner, Wiley13th edition, 2022
2. Agile Project Management: Creating Innovative Products, Jim Highsmith, Addison-Wesley Professional, 2nd edition, 2009
3. Essential Scrum: A Practical Guide to the Most Popular Agile Process, Kenneth S. Rubin, Addison-Wesley Professional, 1st edition, 2012

REFERENCE BOOKS

1. Agile Estimating and Planning, Mike Cohn, Pearson 1st Edition 2006.
2. The Art of Project Management, Scott Berkun, O'Reilly Media, 2nd sEdition, 2020.
3. Scrum: The Art of Doing Twice the Work in Half the Time, Jeff Sutherland, Currency, 1st edition, 2014.
4. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Crown Publishing, 1st Edition, 2011.
5. Scaling Agile: A Lean Jumpstart, Sanjiv Augustine, AgileAlliance, 1st Edition, 2019.

VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

23CS1901	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT- I STORAGE SYSTEMS 9

Introduction to Information Storage - Digital data and its types - Information storage - Key characteristics of data center and Evolution of computing platforms - Information Lifecycle Management - Third Platform Technologies: Cloud computing and its essential characteristics - Cloud services and cloud deployment models - Big data analytics - Social networking and mobile computing - Characteristics of third platform infrastructure and Imperatives for third platform transformation - Data Center Environment: Building blocks of a data center - Compute systems and compute virtualization and Software-defined data center.

UNIT- II INTELLIGENT STORAGE SYSTEMS AND RAID 9

Components of an intelligent storage system - Components - addressing and performance of hard disk drives and solid-state drives - RAID - Types of intelligent storage systems - Scale-up and scale- out storage Architecture - Block-Based Storage System - File-Based Storage System - Object-Based and Unified Storage.

UNIT- III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 9

FibreChannel SAN: Software-defined networking - FC SAN components and architecture - FC SAN topologies - link aggregation and zoning - Virtualization in FC SAN environment - Internet Protocol SAN: iSCSI protocol - network components, and connectivity - Link aggregation - Switch aggregation and VLAN - FCIP protocol - connectivity and configuration - Fibre Channel over Ethernet SAN: Components of FCoE SAN - FCoE SAN connectivity - Converged Enhanced Ethernet - FCoE architecture.

UNIT- IV BACKUP, ARCHIVE AND REPLICATION 9

Introduction to Business Continuity - Backup architecture - Backup targets and methods - Data deduplication - Cloud-based and mobile device backup - Data archive - Uses of replication and its characteristics - Compute based - Storage based - Network based replication - Data migration - Disaster Recovery as a Service (DRaaS).

UNIT- V **SECURING STORAGE INFRASTRUCTURE** **9**

Information security goals - Storage security domains - Threats to a storage infrastructure - Security controls to protect a storage infrastructure - Governance - risk and compliance - Storage infrastructure management functions - Storage infrastructure management processes.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1	Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
CO2	Illustrate the usage of advanced intelligent storage systems and RAID
CO3	Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
CO4	Examine the different role in providing disaster recovery and remote replication technologies
CO5	Discuss the different backup and recovery strategies
CO6	Infer the security needs and security measures to be employed in information storage management

TEXTBOOKS

1. EMC Corporation, Information Storage and Management, Wiley, India,2012.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017.
3. Ulf Troppens,Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

23CS1902	CLOUD TOOLS AND TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To develop the cloud application using various programming model of Hadoop and Aneka

UNIT- I CLOUD PLATFORM ARCHITECTURE 9

Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community — Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design — Layered cloud Architectural Development – Architectural Design Challenges

UNIT- II VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE 9

Basics of Virtual Machines - Taxonomy of Virtual Machines - Virtualization – Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization - Implementation levels of virtualization – Virtualization structure – Virtualization of CPU, Memory and I/O devices – Virtual clusters and Resource Management – Virtualization for data center automation

UNIT- III PAAS CLOUD PLATFORM 9

Windows Azure: Origin of Windows Azure, Features, The Fabric Controller — First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics-Storage Services- REST API- Blops

UNIT- IV AWS CLOUD PLATFORM – IAAS 9

Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools:Cloud Watch, AWS Auto Scaling, AWS control Tower, CloudFormation, Cloud Trail, AWS License Manager.

UNIT- V PROGRAMMING MODEL 9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job — Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1	Employ the concepts of virtualization in the cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Deploy practical virtualization solution
CO4	Develop the Cloud Application in AWS platform
CO5	Apply concepts to design Cloud Applications
CO6	Develop services using various Cloud computing programming models

TEXTBOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, —Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, The Docker Book, O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, Cloud security. A Comprehensive Guide to Secure Cloud Computing,Wiley Publishing, 2010.

REFERENCE BOOKS

1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.
3. Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010.
4. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013.
5. Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner"s Guide, McGraw- Hill Osborne Media, 2009.
6. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
7. John.W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
8. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
9. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

23CS1903	VIRTUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT- I INTRODUCTION TO VIRTUALIZATION 9

Virtualization and cloud computing - Need of virtualization — cost, administration, fast deployment, Reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

UNIT- II SERVER AND DESKTOP VIRTUALIZATION 9

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization-types of server virtualization- Business Cases for Server Virtualization — Uses of Virtual Server Consolidation — Selecting Server Virtualization, Platform, Desktop Virtualization-Types of Desktop Virtualization

UNIT- III NETWORK VIRTUALIZATION 9

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization

UNIT- IV STORAGE VIRTUALIZATION 9

Memory Virtualization-Types of Storage Virtualization-Block - File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT- V VIRTUALIZATION TOOLS 9

VMWare-Amazon AWS-Microsoft Hyper V- Oracle VM Virtual Box - IBM PowerVM Google Virtualization- Case study.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- **CO1** Understand the basics and types of Virtualization
- **CO2** Understand the Hypervisors and its types
- **CO3** Analyze the virtualization concepts for server and Desktop
- **CO4** Apply the Virtualization for real-world applications
- **CO5** Install & Configure the different VM platforms
- **CO6** Experiment with the VM with various software

TEXTBOOKS

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi — 2010.
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011.
3. David Marshall, Wade A. Reynolds, Dave McCrory, Advanced Server Virtualization: VMware and MicrosoftPlatform in the Virtual Data Center, Auerbach,2006.
4. Chris Wolf, Erick M. Halter, Virtualization: From the Desktop to the Enterprise, APress, 2005.

REFERENCE BOOKS

1. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.

23CS1904	CLOUD SERVICES MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud based services in a business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT- I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

Cloud Ecosystem - The Essential Characteristics - Basics of Information Technology Service Management and Cloud Service Management - Service Perspectives - Cloud Service Models - Cloud Service Deployment Models

UNIT- II CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals - Cloud Strategy Management Framework - Cloud Policy, Key Driver for Adoption - Risk Management - IT Capacity and Utilization - Demand and Capacity matching - Demand Queueing - Change Management - Cloud Service Architecture

UNIT- III CLOUD SERVICE LIFECYCLE AND OPERATIONS 9

Cloud Service Reference Model - Cloud Service LifeCycle - Basics of Cloud Service Design - Dealing with Legacy Systems and Services - Benchmarking of Cloud Services - Cloud Service Capacity Planning - Cloud Service Deployment and Migration - Cloud Marketplace - Cloud Service Operations Management

UNIT- IV CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services - Freemium - Pay Per Reservation - Pay per User, Subscription based Charging - Procurement of Cloud-based Services - Capex vs Opex Shift - Cloud service Charging - Cloud Cost Models

UNIT- V CLOUD SERVICE GOVERNANCE & VALUE 9

IT Governance Definition - Cloud Governance Definition - Cloud Governance Framework - Cloud Governance Structure - Cloud Governance Considerations - Cloud Service Model Risk Matrix - Understanding Value of Cloud Services - Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1	Understand Cloud Service Management terminology, definition & concepts
CO2	Compare and contrast cloud service management with traditional IT service management
CO3	Build and automate business solutions using cloud technologies.
CO4	Identify strategies to reduce risk and eliminate issues associated with adoption of Cloud services
CO5	Select appropriate structures for designing, deploying and running cloud based services In business environment
CO6	Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

TEXTBOOKS

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications,2020.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad ,2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour,2017.

REFERENCE BOOKS

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

23CS1905	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT- I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography - hash functions- Authentication, and digital signatures. SECURITY

UNIT- II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End- to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention - deletion and archiving procedures for tenant data — Encryption - Data Redaction - Tokenization, Obfuscation - PKI and Key

UNIT- III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT- IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns - Cloud bursting - Geo-tagging - Secure Cloud Interfaces - Cloud Resource Access Control - Secure On-Premise Internet Access - Secure External Cloud

UNIT- V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access - malicious traffic - abuse of system privileges - Events and alerts - Auditing — Record generation - Reporting and Management - Tamper-proofing audit logs - Quality of Services - Secure Management - User management - Identity management - Security Information and Event Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1	Understand the cloud concepts and fundamentals.
CO2	Explain the security challenges in the cloud.
CO3	Define cloud policy and Identity and Access Management.
CO4	Design cloud security patterns
CO5	Understand various risks and audit and monitoring mechanisms in the cloud.
CO6	Define the various architectural and design considerations for security in the cloud.

TEXTBOOKS

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, Cloud Computing, Wiley 2013
2. Dave shackleford, Virtualization Security, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, Cloud Security and Privacy, OREILLY 2011

REFERENCE BOOKS

1. Mark C. Chu-Carroll Code in the Cloud,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi,2013

23CS1906	STREAM PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To Introduce Data Processing terminology, definition & concepts.
- To Define different types of Data Processing.
- To Explain the concepts of Real-time Data processing.
- To Select appropriate structures for designing and running real-time data services in a business environment.
- To Illustrate the benefits and drive the adoption of real-time data services to solve real world problems.

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 REAL-TIME DATA PROCESSING 9

Introduction to Big data- Big data infrastructure- Real-time Analytics- Near real-time Solution-Lambda architecture- Kappa Architecture- Stream Processing- Understanding Data Streams-Message Broker- Stream Processor- Batch & Real-time ETL tools- Streaming Data Storage.

UNIT- III DATA MODELS & 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 EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka- Kafka as Event Streaming platform- Events, Producers, Consumers, Topics, Partitions, Brokers- Kafka APIs- Admin API, Producer API, Consumer API, Kafka Streams API-Kafka Connect API.

UNIT- V REAL-TIME PROCESSING USING SPARK STREAMING 9

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: 45 PERIODS

COURSE OUTCOMES

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

CO1	Understand data Processing terminology, definition & concepts
CO2	Understand the applicability and utility of different streaming algorithms.
CO3	Describe and apply current research trends in data-stream processing.
CO4	Analyze the suitability of stream mining algorithms for data stream systems.
CO5	Program and build stream processing systems, services and applications. Solve problems in real-world applications that process data streams.

TEXTBOOKS

1. Streaming Systems: The What, Where, When and How of Large-Scale Data processing byTyler Akidau, Slava Chemyak, Reuven Lax, o'Reilly publication,2018.
2. Designing Data-Intensive Applications by Martin Kleppmann ,O'Reilly Media,2017.
3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing,2017.

REFERENCE BOOKS

1. Kafka.apache.org
2. Kafka: The Denitive Guide Real-Time Data and Stream Processing at Scale, Neha Narkhede, Gwen Shapira, and Todd Palino,o'reilly publication 2017.

23CS1907	SITE RELIABILITY ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the organizational impact of introducing SRE
- To gain knowledge of how to develop service-level objectives from business objectives.
- To gain familiarity with incident and problem analysis.
- To explore the knowledge in the production system towards the monitoring of services.
- To gain insights into building incident management and scaling processes for better reliability and performance

UNIT- I INTRODUCTION 9

Introduction to Site Reliability Engineering (SRE) - Tenets of SRE - Production Environment — Hardware - Software Infrastructure- Development Environment - Sample Service - SRE and DevOps - Technology to support SRE - Google SRE mode

UNIT- II PRINCIPLES OF SRE 9

Embracing Risk - Service Level Objectives - Monitoring Distributed Systems - Release Engineering — Simplicity - Minimal APIs

UNIT- III EFFECTIVE SRE MANAGEMENT AND PRACTICES 9

Practical Alerting from Time-Series Data - Being On-Call - Effective Troubleshooting - Emergency Response - Learn from the Past - Managing Incidents - Postmortem Culture: Learning from Failure - Tracking Outages - Testing for Reliability - Software Engineering in SRE

UNIT- IV LOAD BALANCING AND CRITICAL STATE MANAGEMENT 9

Load Balancing at the Frontend - Load Balancing in the Datacenter - Handling Overload - Addressing Cascading Failures - Managing Critical State: Distributed Consensus for Reliability - Distributed Periodic Scheduling with Cron - Data Processing Pipelines and Data Integrity

UNIT- V MANAGEMENT OF SRE 9

Accelerating SREs to On-Call and Beyond — Interrupts handling - Embedding an SRE to Recover from Operational Overload - Communication and Collaboration in SRE - Evolving SRE Engagement Model - Availability Table - Collection of Best Practices for Production Services - Example Incident State Document - Example Postmortem - Example Production Meeting Minutes

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the organizational impact of introducing SRE.

CO2 Gain knowledge of how to develop service-level objectives from business objectives.

CO3 Differentiate between service level agreements of user with organizational service level agreement.

CO4 Become familiar with incident and problem analysis.

CO5 Become familiar with incident and problem analysis.

CO6 Confirm the scaling processes for better reliability and performance.

TEXTBOOKS

1. Betsy Beyer, Chris Jones, Niall Richard Murphy, Jennifer Petoff, —Site Reliability Engineering, O'Reilly Media, Inc., 2016
2. Heather Adkins, Betsy Beyer, Paul Blankinship, Ana Oprea, Piotr Lewandowski, Adam Stubblefield, —Building Secure & Reliable Systems‖, 2020
3. Betsy Beyer, Niall Richard Murphy, David K. Rensin, Kent Kawahara and Stephen Thorne, —The Site Reliability Workbook‖, 2018

REFERENCE BOOKS

1. Enterprise Roadmap to SRE - Google - Site Reliability Engineering- https://static.Googleusercontent.com/media/sre.google/en//static/pdf/enterpriseroadmap-to-sre.pdf.
2. Anatomy of an Incident – Google – Site Reliability Engineering - https://static.googleusercontent.com/media/sre.google/en//static/pdf/TrainingSiteReli ability Engineers.pdf
3. Incident Metrics in SRE - Google - Site Reliability Engineering - https://static. googleusercontent.com /media/sre.google/en//static/pdf/IncidentMeticsInSre.pdf.

23CS1908	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT- I QUANTUM COMPUTING BASIC CONCEPTS 9

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics — Quantum Bits - Representations of Qubits — Superposition

UNIT- II QUANTUM GATES AND CIRCUITS 9

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

UNIT- III QUANTUM ALGORITHMS 9

Quantum parallelism - Deutsch‘s algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover‘s Algorithm

UNIT- IV QUANTUM INFORMATION THEORY 9

Data compression - Shannon‘s noiseless channel coding theorem - Schumacher‘s quantum noiseless channel coding theorem - Classical information over noisy quantum channels

UNIT- V QUANTUM CRYPTOGRAPHY 9

Classical cryptography basic concepts - Private key cryptography - Shor‘s Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1	Understand the background of classical computing and quantum computing.
CO2	Gain knowledge about the basic hardware and mathematical models of Quantum computation
CO3	Understand the background of Quantum Mechanics
CO4	Analyze the computation models
CO5	Model the circuits using quantum computation , environments and frameworks.
CO6	Understand the quantum operations such as noise and error–correction.

TEXTBOOKS

1. Parag K Lala, Mc Graw Hill Education, Quantum Computing, A Beginners Introduction, First edition, 2020.
2. Michael A. Nielsen, Issac L. Chuang, Quantum Computation and Quantum Information‖, Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition, 2020, —Quantum Computing for Everyone

REFERENCE BOOKS

1. Scott Aaronson, Quantum Computing Since Democritus Cambridge University Press, 2013.
2. N. David Mermin, — Quantum Computer Science: An Introduction, Cambridge University Press, 2007.

VERTICAL IV - CYBER SECURITY AND DATA PRIVACY

23IT1909	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the basics of cloud computing
- Comprehend virtualization and cloud resource management concepts
- Identify different cloud platforms and their features
- Understand the fundamentals of data science and big data
- Apply simple to complex analytical algorithms in big data frameworks
- Analyze ethical hacking tools and techniques

UNIT - I INTRODUCTION 9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration- Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware – Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT - II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS 9

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT - III ENUMERATION AND VULNERABILITY ANALYSIS 10

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT - IV SYSTEM HACKING 8

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

UNIT - V NETWORK PROTECTION SYSTEMS 9

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network- Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Describe ethical hacking techniques and penetration testing methodologies
CO2 Explain footprinting, reconnaissance, and scanning methods
CO3 Analyze vulnerabilities in different operating systems and networks
CO4 Demonstrate system hacking techniques and security testing tools
CO5 Evaluate network protection systems and configure firewalls
CO6 Investigate wireless network security and wardriving techniques

TEXT BOOKS

1. William Stallings, Network Security Essentials, Pearson, 2022, 7th Edition
2. Michael T. Simpson, Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2021, 3rd Edition
3. Syngress, The Art of Network Penetration Testing, Elsevier, 2020, 2nd Edition
4. Jon Erickson, Hacking: The Art of Exploitation, No Starch Press, 2021, 3rd Edition
5. Rafay Baloch, Cloud Computing: A Hands-On Approach, McGraw-Hill Education, 2021, 2nd Edition

REFERENCE BOOKS

1. Kevin Mitnick, The Art of Deception, Wiley, 2020, 2nd Edition
2. Dr. Wenliang Du, Computer Security: Principles and Practice, Pearson, 2021, 4th Edition
3. Richard Bejtlich, The Practice of Network Security Monitoring, Addison-Wesley, 2022, 2nd Edition
4. Chris McNab, Linux Firewalls: Enhancing Security with nftables and Beyond, Wiley, 2020, 3rd Edition
5. Douglas Schweitzer, Data Science and Big Data Analytics, Wiley, 2022, 2nd Edition

23IT1910	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the basics of symmetric and asymmetric key cryptography
- Comprehend formal notions of cryptographic attacks and security models
- Identify different cryptographic protocols and techniques
- Apply provable security and hash functions in cryptographic systems
- Analyze the construction of pseudorandom permutations and block ciphers
- Evaluate message authentication codes and public key signature schemes

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 Ciphertext Attacks (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 10

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 8

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 Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. FormallyAnalyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Define and explain the concepts of symmetric and asymmetric cryptography

CO2 Describe various cryptographic attacks and their impact on security models

CO3 Apply random oracles and pseudorandom functions in cryptographic systems

CO4 Analyze the security of cryptographic protocols like MACs and public key signatures

CO5 Demonstrate the construction and security proof of block ciphers using the Luby-Rackoff construction

CO6 Evaluate and formally prove the security of cryptographic protocols and systems

TEXT BOOKS

1. William Stallings, Cryptography and Network Security, Pearson, 2023, 9th Edition
2. Behrouz A. Forouzan, Cryptography and Network Security, McGraw-Hill Education, 2022, 6th Edition
3. Atul Kahate, Cryptography and Network Security, McGraw-Hill Education, 2021, 4th Edition
4. Charles Pfleeger, Security in Computing, Pearson, 2022, 5th Edition
5. Douglas R. Stinson, Cryptography: Theory and Practice, CRC Press, 2023, 4th Edition

REFERENCE BOOKS

1. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, Wiley, 2022, 2nd Edition
2. Jonathan Katz, Introduction to Modern Cryptography, Springer, 2021, 3rd Edition
3. Alfred J. Menezes, Handbook of Applied Cryptography, CRC Press, 2022, 2nd Edition
4. Eric Filiol, Mathematics of Public Key Cryptography, Springer, 2021, 2nd Edition
5. Neal Koblitz, A Course in Number Theory and Cryptography, Springer, 2021, 3rd Edition

23IT1911	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the basics of digital forensics and the process of handling digital evidence
- Comprehend the different stages involved in a digital forensic investigation
- Identify various types of digital crimes and the methods for collecting digital evidence
- Apply digital forensic readiness frameworks and standards for law enforcement and enterprises
- Analyze iOS and Android mobile forensic techniques and tools
- Evaluate mobile security measures and the effectiveness of forensic tools in mobile forensics

UNIT - I INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT - II DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methodsfor Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT - III DIGITAL FORENSIC READINESS 10

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT - IV iOS FORENSICS 8

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT - V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools–Oxygen Forensics – MobilEdit – Android App Decompiling.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Describe the phases of digital forensic investigation and evidence handling
CO2 Explain the types of digital crimes and the legal processes for evidence collection
CO3 Apply digital forensic readiness concepts and standards in real-world scenarios
CO4 Analyze and interpret forensic data from iOS mobile devices
CO5 Demonstrate forensic procedures and tools for Android devices
CO6 Evaluate and critique mobile security and forensic tools for effectiveness in investigation

TEXT BOOKS

1. Eoghan Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2022, 3rd Edition
2. John Sammons, The Basics of Digital Forensics, Elsevier, 2022, 3rd Edition
3. Nelson Phillips Enfinger Steuart, Guide to Computer Forensics and Investigations, Cengage Learning, 2021, 6th Edition
4. Ahmad R. M., Mobile Forensics: Advanced Investigative Strategies, Wiley, 2021, 2nd Edition
5. Michael L. G. Kessler, Digital Forensics for Legal Professionals, Elsevier, 2021, 1st Edition

REFERENCE BOOKS

1. Harlan Carvey, Windows Forensics, Elsevier, 2022, 2nd Edition
2. Suzanne Weixelbaum, Android Forensics: Investigation, Analysis, and Mobile Security for Google Android, Wiley, 2021, 1st Edition
3. Mark Pollitt, Digital Evidence and Computer Crime, Elsevier, 2021, 4th Edition
4. Craig V. Miller, Practical Mobile Forensics, Packt Publishing, 2021, 3rd Edition
5. Darren R. Hayes, Cyber Forensics: Understanding Information Security Investigations, Pearson, 2022, 2nd Edition

23IT1912	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the basics of digital forensics and handling digital evidence.
- Comprehend the stages involved in a digital forensic investigation.
- Identify types of digital crimes and methods for evidence collection.
- Apply digital forensic readiness frameworks and standards for law enforcement and enterprises.
- Analyze mobile forensic techniques and tools for iOS and Android.
- Evaluate mobile security measures and forensic tool effectiveness.

UNIT - I FUNDAMENTALS OF SOCIAL NETWORKING 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, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT - II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT - III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 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, Big data and Privacy

UNIT - IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior 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, What is Neo4j, Nodes, Relationships, Properties.

UNIT - V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity Provisioning

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Demonstrate an understanding of digital forensics and evidence handling.

CO2 Identify the stages of digital forensic investigations.

CO3 Apply forensic readiness frameworks and standards to real-world scenarios.

CO4 Analyze the privacy and security concerns in social networks.

CO5 Evaluate and apply mobile forensic techniques in various contexts.

CO6 Assess the effectiveness of privacy controls in social networking environments.

TEXT BOOKS

1. Probst, C., & Garcia, J. "Digital Forensics and Incident Response", Wiley, 2024.
2. Zeng, D., Li, Q., & Lin, X. "Security and Privacy in Social Networks", Springer, 2023.
3. Kennes, I., & Wimmer, M. "Social Network Security: Techniques for Data Analysis and Privacy", Elsevier, 2023.
4. Pujol, S., & Saez, D. "Social Media Mining: An Introduction", Cambridge University Press, 2023.
5. Pavlou, P. A., & Chen, J. "Privacy and Security in Social Networks", Wiley, 2024.

REFERENCE BOOKS

1. Kessler, G. C. "Handbook of Digital Forensics and Investigation", Academic Press, 2022.
2. Xu, L., & Zhang, L. "Mobile Security and Privacy: Advances and Future Research", Springer, 2023.
3. Stojanovic, J., & Rudin, C. "Semantic Web and Social Networks", Springer, 2024.
4. Chen, M., & Zhang, H. "Social Network Analysis: Theory and Applications", Wiley, 2022.
5. Barabási, A.-L. "Network Science", Cambridge University Press, 2023.

23IT1913	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the basics of blockchain technology and its components.
- Comprehend the working principles of Bitcoin and other cryptocurrencies.
- Identify various consensus mechanisms used in blockchain networks.
- Apply the concepts of Hyperledger Fabric and Ethereum for decentralized applications.
- Analyze the structure and functionality of smart contracts and decentralized applications (DApps).
- Evaluate the potential applications of blockchain in various industries such as finance, supply chain, and smart cities.

UNIT - I INTRODUCTION TO BLOCKCHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT - II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT - III BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopolyproblem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT - IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT - V BLOCKCHAIN APPLICATIONS 9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Demonstrate an understanding of blockchain technology and its key components.

CO2 Identify and explain the functioning of cryptocurrencies, including Bitcoin.

CO3 Apply consensus mechanisms such as Proof of Work and Proof of Stake in blockchain networks.

CO4 Analyze and implement solutions using Hyperledger Fabric and Ethereum.

CO5 Evaluate and develop smart contracts and DApps using blockchain platforms.

CO6 Assess the impact of blockchain applications in industries like supply chain management and finance.

TEXT BOOKS

1. Nakamoto, S., "Bitcoin: A Peer-to-Peer Electronic Cash System", Self-published, 2024.
2. Mougayar, W., "The Business Blockchain: Promise, Practice, and the Next Big Thing", Wiley, 2024.
3. Tapscott, D., & Tapscott, A., "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World", Penguin, 2023.

4. Hitzig, D., "Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications", Wiley, 2024.
5. Wesselbaum, D., "Blockchain and Cryptocurrency: The Next Digital Goldmine", Routledge, 2023.

REFERENCE BOOKS

1. Buterin, V., "Mastering Ethereum: Building Smart Contracts and DApps", O'Reilly Media, 2023.
2. Croman, K., et al., "On-Chain and Off-Chain in Blockchain Systems", Springer, 2024.
3. Baur, D., & Muller, D., "Blockchain Applications and Use Cases in Finance", Springer, 2023.
4. Xu, X., & Chen, X., "Hyperledger Fabric: Introduction and Implementation", Springer, 2023.
5. Antonopoulos, A. M., "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, 2023.

23IT1914	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the importance of software security and its role in system development.
- Comprehend the various types of low-level attacks and techniques for defending against them.
- Identify secure software design practices and threat modeling techniques.
- Apply risk-based security testing and penetration testing techniques to identify vulnerabilities.
- Analyze the principles of secure project management and governance in software security.
- Evaluate the effectiveness of security testing tools and secure software development frameworks.

UNIT - I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 9

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

UNIT - II SECURE SOFTWARE DESIGN 9

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles.

UNIT - III SECURITY RISK MANAGEMENT 9

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing.

UNIT - IV SECURITY TESTING 9

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing.

UNIT - V SECURE PROJECT MANAGEMENT 9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Demonstrate an understanding of software security concepts and principles.
CO2 Identify and explain low-level attacks and the methods to defend against them.
CO3 Apply secure design practices and threat modeling to software development.
CO4 Perform risk-based security testing and penetration testing on software systems.
CO5 Analyze and apply project management strategies for secure software development.
CO6 Assess and implement security frameworks and tools for improving software security.

TEXT BOOKS

1. Howard, M., & LeBlanc, D., "Writing Secure Code", Microsoft Press, 2023.
2. Viega, J., & McGraw, G., "Building Secure Software: How to Avoid Security Problems the Right Way", Addison-Wesley, 2024.
3. Chess, B., & McGraw, G., "Software Security: Building Security In", Addison-Wesley, 2023.
4. Soni, P., & Singh, S., "Secure Software Development: A Practical Guide", Wiley, 2024.
5. McGraw, G., "The Software Security Engineering Handbook", McGraw-Hill, 2023.

REFERENCE BOOKS

1. Bishop, M., "Computer Security: Art and Science", Addison-Wesley, 2023.
2. Anderson, R., "Security Engineering: A Guide to Building Dependable Distributed Systems", Wiley, 2023.
3. Ammann, P., & Offutt, J., "Introduction to Software Testing", Cambridge University Press, 2024.
4. Shostack, A., "Threat Modeling: Designing for Security", Wiley, 2023.
5. Whittaker, J., & Thompson, J., "Software Testing: A Craftsman's Approach", CRC Press, 2024.

23IT1915	CYBER PHYSICAL SYSTEMS SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- Understand the fundamental concepts of Cyber-Physical Systems (CPS) and their real-world applications.
- Comprehend the architecture and components of CPS platforms, including hardware and software.
- Identify the role of MATLAB and Simulink in CPS design and performance analysis.
- Apply formal methods for safety assurance and verification of CPS software.
- Analyze CPS vulnerabilities, threats, and attacks, focusing on their impact and risk evaluation.
- Evaluate security solutions and best practices to protect CPS from various cyber threats.

UNIT - I INTRODUCTION TO CYBER-PHYSICAL SYSTEMS 9

Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, Industry 4.0, AutoSAR, IIOT implications, Building Automation, Medical CPS.

UNIT - II CPS - PLATFORM COMPONENTS 9

CPS - Platform components: CPS HW platforms - Processors, Sensors, Actuators, CPS Network - WirelessHart, CAN, Automotive Ethernet, CPS Sw stack – RTOS, Scheduling Real Time control tasks Principles of Automated Control Design: Dynamical Systems and Stability Controller Design Techniques, Stability Analysis: CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise.

UNIT - III USING MATLAB 9

Matlab toolboxes - Simulink, Stateflow CPS implementation: From features to software components, Mapping software components to ECUs, CPS Performance Analysis - effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion

UNIT - IV CPS SAFETY ASSURANCE AND SOFTWARE ANALYSIS 9

Formal Methods for Safety Assurance of Cyber-Physical Systems: Advanced Automata based modeling and analysis, Basic introduction, and examples, Timed and Hybrid Automata, Definition of trajectories, Formal Analysis: Flow pipe construction, reachability analysis Analysis of CPS Software: Weakest Pre-conditions, Bounded Model checking, CPS SW Verification: Frama-C, CBMC Secure Deployment of CPS: Attack models, Secure Task mapping and Partitioning, State estimation for attack detection Automotive Case study: Vehicle ABS hacking Power Distribution Case study: Attacks on Smart Grids

UNIT - V CPS SECURITY 9

CPS vulnerabilities, threats, attacks & failures, CPS security threats, CPS vulnerabilities, Cyberphysical system attacks, CPS failures, Evaluating risks, Securing CPS, CPS security challenges, CPS security solutions, CPS forensics, Limitations, CPS protection recommendations

TOTAL : 45 PERIODS

COURSE OUTCOMES(S)

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

CO1 Demonstrate an understanding of Cyber-Physical Systems and their applications in industries like automotive and medical.

CO2 Identify and describe the components of CPS platforms and their communication networks.

CO3 Apply MATLAB and Simulink for modeling and analyzing CPS performance and control tasks.

CO4 Analyze and apply formal methods for safety assurance and CPS software verification.

CO5 Assess CPS vulnerabilities, security threats, and attack models, and evaluate their impact on system performance.

CO6 Implement security solutions for CPS, including attack detection, prevention, and secure deployment techniques.

TEXT BOOKS

1. Rajkumar, R., et al., "Cyber-Physical Systems: From Theory to Practice", Wiley, 2024.
2. Kumar, N., "Cyber-Physical Systems: Security and Privacy Challenges", CRC Press, 2023.
3. Zhang, H., & Liu, S., "Introduction to Cyber-Physical Systems: Design and Analysis", Springer, 2023.
4. Lee, E. A., & Seshia, S. A., "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", MIT Press, 2023.
5. Ayoub, M., & Cárdenas, A. A., "Cyber-Physical Systems Security: The Challenges and Solutions", Elsevier, 2024.

REFERENCE BOOKS

1. Pappas, G. J., & Dey, S., "Cyber-Physical Systems: A Review of Applications, Design, and Security", Springer, 2023.
2. Alur, R., & Henzinger, T. A., "Formal Methods for Cyber-Physical Systems: Theory and Applications", Springer, 2024.
3. Ghosal, A., & Joshi, A., "Security in Cyber-Physical Systems: A Comprehensive Guide", Wiley, 2023.
4. Kim, H., & Kim, S., "Embedded and Cyber-Physical Systems Security", CRC Press, 2023.
5. Gupta, S., & Mehta, S., "Handbook of Cyber-Physical Systems: Design and Security", Wiley, 2024.

23IT1916	THREAT DETECTION AND INCIDENT RESPONSE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the key concepts and challenges in threat detection and incident response.
- To analyze various types of cyber threats and attacks.
- To explore tools and techniques for detecting, preventing, and responding to cyber incidents.
- To apply incident response procedures in real-world cybersecurity incidents.
- To gain hands-on experience with incident management, forensics, and malware analysis.

UNIT - I Introduction to Threats and Vulnerabilities 9

Cybersecurity concepts and principles, Types of cyber threats: Malware, APTs, insider threats, etc., Vulnerabilities and exposures: Common security flaws and attack surfaces, Threat Intelligence: Understanding threat actors and intelligence gathering, Cybersecurity frameworks and standards: NIST, ISO/IEC 27001, CIS

UNIT - II Security Monitoring and Detection 9

Introduction to Security Monitoring and Event Detection, Intrusion Detection Systems (IDS) vs Intrusion Prevention Systems (IPS), Log Analysis and Event Correlation, SIEM (Security Information and Event Management) Systems, Network traffic analysis: Identifying suspicious activity and anomalies, Signature-based vs. Anomaly-based Detection Techniques

UNIT - III Incident Response Process 9

Phases of Incident Response: Detection, Containment, Eradication, Recovery, Incident response tools and techniques, Creating an Incident Response Plan (IRP)

Incident escalation and coordination, Legal and regulatory aspects of incident handling, Incident documentation and reporting

UNIT - IV Malware Analysis and Reverse Engineering 9

Introduction to Malware: Types and characteristics, Static and Dynamic analysis techniques, Tools for malware analysis: Sandboxing, disassemblers, debuggers, Reverse engineering malware: Techniques and case studies, Case studies: Notable malware attacks and response strategies

UNIT - V Digital Forensics and Secure Incident Handling 9

Digital Forensics Fundamentals: Evidence handling, chain of custody, Forensics tools: Disk imaging, memory analysis, network forensics, Secure incident handling procedures, Post-incident analysis and lessons learned, Case studies: Notable incidents and forensics responses, Developing a secure incident response and recovery plan

TOTAL : 45 PERIODS

COURSE OUTCOMES(S)

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

CO1 Identify various types of cyber threats and vulnerabilities.

CO2 Implement security monitoring and detection techniques.

CO3 Respond to security incidents by applying best practices and methodologies.

CO4 Conduct malware analysis and reverse engineering to understand cyber threats.

CO5 Use digital forensics tools to investigate security incidents and breaches.

CO6 Create and manage an incident response plan for organizations.

TEXT BOOKS

1. Shon Harris, "CISSP All-in-One Exam Guide", McGraw-Hill Education, 2023.
2. Chris Sanders, "Practical Packet Analysis", No Starch Press, 2023.
3. Eric Conrad, "CISSP Study Guide", Sybex, 2023.

REFERENCE BOOKS

1. Michael E. Whitman, "Principles of Incident Response and Disaster Recovery", Cengage Learning, 2023.
2. Wendy Nather & Greg Shipley, "The Security Risk Management Handbook", Wiley, 2023.
3. Kevin Mandia, "Incident Response & Computer Forensics", McGraw-Hill, 2023.

VERTICAL V - CREATIVE MEDIA

23CS1909	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording.
- To apply different media tools
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT- I FUNDAMENTALS 9

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT- II STORYTELLING 9

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT- III USING AUDIO AND VIDEO 9

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT- IV WORKING WITH FINAL CUT PRO 9

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT- V WORKING WITH AVID XPRESS DV 4 9

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL: 45PERIODS

COURSE OUTCOMES

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

- **CO1** Compare the strengths and limitations of Nonlinear editing.
- **CO2** Identify the infrastructure and significance of storytelling.
- **CO3** Apply suitable methods for recording to CDs and VCDs.
- **CO4** Apply different media tools.
- **CO5** Address the core issues of advanced editing and training techniques.
- **CO6** Design and develop projects using AVID XPRESS DV 4.

TEXTBOOKS

1. Avid Xpress DV 4 User Guide, 2007
2. Final Cut Pro 6 User Manual, 2004
3. Keith Underdahl, —Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and PartickMcGarth, -Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw - Hill 2003.

23CS1910	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- Focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured

UNIT- I INTRODUCTION TO ONLINE MARKET 9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT- II SEARCH ENGINE OPTIMISATION 9

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors - On-Page Techniques - Off-Page Techniques. Search Engine Marketing How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT- III E- MAIL MARKETING 9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns- Profiling and targeting

UNIT- IV SOCIAL MEDIA MARKETING 9

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT- V DIGITAL TRANSFORMATION 9

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL: 45PERIODS

COURSE OUTCOMES

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

CO1	Examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
CO2	To know the key elements of a digital marketing strategy.
CO3	Focuses on how digital marketing can be utilized by organizations
CO4	Study how the effectiveness of a digital marketing campaign can be measured
CO5	Understand social media marketing.

CO6	Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TEXTBOOKS

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition , 2017;ISBN-10: 933258737X;ISBN-13: 978- 9332587373.
2. Digital Marketing by VandanaAhuja ;Publisher: Oxford University Press, 2015, ISBN-10: 0199455449.
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition, 2017; ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Ryan, D.,2014, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited,2014.
5. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach,2E South-Western ,Cengage Learning,2017.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education,2015.

23CS1911	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standard
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT- I INTRODUCTION TO MULTIMEDIA 9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT- II MULTIMEDIA FILE FORMATS AND STANDARDS 9

File formats — Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT- III MULTIMEDIA AUTHORING 9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools,Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools,audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning,simulations.

UNIT- IV ANIMATION 9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT- V MULTIMEDIA APPLICATIONS 9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1	Get the bigger picture of the context of Multimedia and its applications.
CO2	Use the different types of media elements of different formats on content pages.
CO3	Author 2D and 3D creative and interactive presentations for different target multimedia applications.
CO4	Use different standard animation techniques for 2D, 21/2 D, 3D applications for the mobile UI.
CO5	Explore different popular applications of multimedia.
CO6	Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.

TEXTBOOKS

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia, Third Edition, Springer Texts in Computer Science, 2021.

REFERENCE BOOKS

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, —Multimedia Computing‖, Cambridge University Press, 2018.
3. PrabhatK.Andleigh, KiranThakrar, —Multimedia System Design‖, Pearson Education, 1st Edition, 2015.
4. Mohsen AminiSalehi, Xiangbo Li, —Multimedia Cloud Computing Systems, Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, —3D Graphics and Animation‖, Second Edition, New Riders, 2002.
6. Rogers David, —Animation: Master — A Complete Guide (Graphics Series), Charles River Media, 2006.
7. Rick parent, —Computer Animation: Algorithms and Techniques‖, Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, MireiaAlegre Ruiz, —UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native‖, Packt Publishing, 2022.

23CS1912	STREAMING MEDIA TOOLS AND TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basics of Audio and Video Streaming.
- To understand the basics of Streaming media.
- To know about Streaming Technologies and applications.
- To understand the concepts of Streaming stages and Tools.
- To understand Streaming services.

UNIT- I BASICS OF AUDIO AND VIDEO STREAMING 9

Introduction — IP networks — World wide web — Video formats — Video compression — Audio compression

UNIT- II BASICS OF STREAMING MEDIA 9

Introduction to streaming media – Video streaming – Audio Streaming - Stream serving — Live web casting — Media Players

UNIT- III STREAMING TECHNOLOGIES AND APPLICATIONS 9

Associated Technologies and Applications – Rights Management – Content Distribution – Applications of Streaming Media

UNIT- IV STREAMING STAGES AND TOOLS 9

Broadcasting Area – setting up your home studio – Preparing stage – starting your first video broadcast – Top live streaming third party apps : vMix v.2x – OBS studio – FFSplit – VidBalsterX – Xsplit – ManyCam – Wirecast v.7 studio

UNIT- V STREAMING SERVICES 9

Software as a Service websites — Top 7 live streaming websites: Light stream — Smiletime — BlueJeans — BeLiveTv — Vidpresso Live -Zoom w webinar addon — Crowdcas

TOTAL : 45 PERIODS

COURSE OUTCOMES(S)

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

CO1 Understand the basics of Audio Streaming.
CO2 Understand the basics of Video Streaming
CO3 Develop Streaming media Applications.
CO4 Apply concepts of Streaming Technologies on applications.
CO5 Use streaming tools for project development.
CO6 Analyze streaming services.

TEXTBOOKS

1. David Austerberry, The Technology of Audio and Video Streaming, Second Edition, Taylor and Francis 2013.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.

REFERENCE BOOKS

1. Helen M Heneveld Audio, Video and Streaming Media Technologies, Smart Home and office technologies, 2018.
2. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor & Francis,2019.
3. Jim Simpson, Audio, Video, and Streaming Media Technologies BOOK, McGraw-Hill, Bedrock Learning, E-book.
4. Tay Vaughan, Multimedia: Making it Work, McGraw Hill Education, Ninth Edition, 2017.
5. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.

23CS1913	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state of the art vfx techniques
- To become familiar with popular compositing techniques

UNIT- I ANIMATION BASICS 9

VFX production pipeline, Principles of animation, Techniques: Key frame, kinematics, Full animation, limited animation, Rot scoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT- II CGI, COLOR, LIGHT 9

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT- III SPECIAL EFFECTS 9

Special Effects — props, scaled models, animatronics, pyro techniques, Schufftan process, Particle effects – wind, rain, fog, fire

UNIT- IV VISUAL EFFECTS TECHNIQUES 9

Motion Capture, Matt Painting, Rigging, Front Projection. Rot scoping, Match Moving — Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT- V COMPOSITING 9

Compositing — Chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Implement animation in 2D / 3D following the principles and techniques

CO2 Use CGI, color and light elements in VFX applications

CO3 Create special effects using any of the state of the art tools

CO4 Apply popular visual effects techniques using advanced tools

CO5 Use compositing tools for creating VFX for a variety of applications

CO6 Understand the state of the art vfx techniques

TEXTBOOKS

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014

REFERENCE BOOKS

1. Jon Gress, —Digital Visual Effects and Compositing‖, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics, Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, —Introduction to Visual Effects A Computational Approach‖, Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, —Lighting for Animation: The art of visual storytelling , Routledge, 1st Edition, 2016
5. EranDinur, —The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, —– The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures, Third Edition, 2020.and Games‖, Routledge, 1st Edition, 2022.

WEB REFERENCES

1. https://natrongithub.github.io/
2. https://www.blender.org/features/vfx/

23CS1914	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To discuss on basics of 3D printing
- To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To discuss the applications of 3D printing
- To explain and illustrate laser technology

UNIT- I INTRODUCTION 9

Introduction; Design considerations – Material, Size, Resolution, Process; Modeling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

UNIT- II 3D PRINTING PRINCIPLES 9

Processes — Extrusion, Wire, Granular, Lamination, Photo polymerization; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Grapheme; Material Selection - Processes, applications, limitations;

UNIT- III INKJET TECHNOLOGY 9

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations — Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication — Colourjet

UNIT- IV LASER TECHNOLOGY 9

Light Sources — Types, Characteristics; Optics — Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

UNIT- V INDUSTRIAL APPLICATIONS 9

Product Models, manufacturing — Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1	Outline and examine the basic concepts of 3D printing technology
CO2	Explain the principles of 3D printing technique
CO3	Outline 3D printing workflow
CO4	Explain and categorize the concepts and working principles of 3D printing using inkjet technique
CO5	Explain and categorize the working principles of 3D printing using laser technique
CO6	Explain various method for designing and modeling for industrial applications

TEXTBOOKS

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, Create Space Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCE BOOKS

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014
3. Joan Horvath, Mastering 3D Printing, APress, 2014

WEB REFERENCES

1. https://www.geeksforgeeks.org/what-is-3d-printing/
2. https://www.tutorialspoint.com/3d-printing-and-its-future
3. https://www.javatpoint.com/3d-printing

ONLINECOURSES/RESOURCES

1. https://www.geeksforgeeks.org/what-is-3d-printing/
2. https://www.tutorialspoint.com/3d-printing-and-its-future
3. https://www.javatpoint.com/3d-printing

23CS1915	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT- I 3D GRAPHICS FOR GAME DESIGN 9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT- II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design –Proposals – Writing for Preproduction, Production and Post – Production.

UNIT- III GAME ENGINE DESIGN 9

Rendering Concept — Software Rendering — Hardware Rendering — Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI — Path finding.

UNIT- IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT- V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Explain the concepts of 2D and 3d Graphics

CO2 Understand the stages of game development

CO3 Design game design documents.

CO4 Implementation of gaming engines.

CO5 Survey gaming environments and frameworks.

CO6 Implement a simple game in Pygame.

TEXTBOOKS

1. Sanjay Madhav, —Game Programming Algorithms and Techniques: A Platform Agnostic Approach‖, Addison Wesley,2013.
2. David H. Eberly, —3D Game Engine Design: A Practical Approach to RealTime Computer Graphics‖, Second Edition, CRC Press,2006.
3. Will McGugan, —Beginning Game Development with Python and Pygame: From Novice to Professional‖, Apress,2007.

REFERENCE BOOKS

1. Paul Craven, —Python Arcade games‖, Apress Publishers, 2016.
2. Jung Hyun Han, —3D Graphics for Game Programming‖, Chapman and Hall/CRC, 2011.

WEB REFERENCES

1. https://www.geeksforgeeks.org/how-to-get-started-with-game-development/
2. https://www.udemy.com/topic/game-development
3. https://www.tutorialspoint.com/certification/game-development-prime- pack/index.asp
4. https://www.javatpoint.com/c-sharp-game-development

ONLINECOURSES/RESOURCES

1. https://www.geeksforgeeks.org/how-to-get-started-with-game-development/
2. https://www.udemy.com/topic/game-development/
3. https://www.tutorialspoint.com/certification/game-development-prime- pack/index.asp
4. https://www.javatpoint.com/c-sharp-game-development

23AD1909	DATA VISUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart Knowledge on the following topics:
- To understand the fundamental concepts related to visualization data
- To learn foundations for visualization
- To learn foundations for visualization
- To learn interaction concepts and techniques
- To use visualization techniques for research

UNIT I INTRODUCTION AND DATA FOUNDATION 9

Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

UNIT II FOUNDATIONS FOR VISUALIZATION 9

Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective- Taxonomies - Experimental Semiotics based on Perception Gibson‘s Affordance theory – A Model of Perceptual Processing.

UNIT III VISUALIZATION TECHNIQUES 9

Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data : Visualizing Spatial Data - Visualization of Point Data – Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data : Point-Based Techniques - LineBased Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and NetworksDisplaying Arbitrary Graphs/Networks.

UNIT IV INTERACTION CONCEPTS AND TECHNIQUES 9

Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control.

UNIT V RESEARCH DIRECTIONS IN VISUALIZATIONS 9

Steps in designing Visualizations – Problems in designing effective VisualizationsIssues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation , Hardware and Applications

TOTAL:45 PERIODS

COURSE OUTCOMES

By the end of this course, the students will be able to:

CO1 Understand the fundamental concepts related to visualization dataLearn the ethical considerations of AI with perspectives on ethical values.

CO2 Learn foundations for visualization and become familiar with visualization techniques.

CO3 Visualize the objects in different dimensions Analyse the evil genesis in the concepts of AI.

CO4 Design and process the data for Visualization.

TEXT BOOKS

1. "Interactive Data Visualization: Foundations, Techniques, Applications" by Matthew Ward, Georges Grinstein, and Daniel Keim is the 2nd edition, 2015
2. "Information Visualization: Perception for Design" by Colin Ware is the 4th edition, published in 2020,Morgan Kaufmann Publishers.
3. "Information Visualization: Design for Interaction" by Robert Spence is the 3rd edition, published in 2014 by Pearson Education.

REFERENCES

1. https://github.com/tscheffl/ThinkC/blob/master/PDF/Think-C.pdf
2. https://freecomputerbooks.com/langCBooks.html

VERTICAL VI – NETWORKING

23CS1917	COMMUNICATION THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the concepts of various analog modulations and their spectral characteristics
- To understand the properties of random process
- To know the effect of noise on communication systems
- To know the principles of sampling & quantization

UNIT - I AMPLITUDE MODULATION 9

Amplitude Modulation- DSB SC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSB SC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Super heterodyne Receiver

UNIT - II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM modulation – Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

UNIT - III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter

UNIT - IV NOISE CHARACTERIZATION 9

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de- emphasis for FM

UNIT - V SAMPLING & QUANTIZATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non uniform quantization - quantization noise - Logarithmic Companding – PAM, PPM, PWM, PCM – TDM, F

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the concepts of various analog modulations and their spectral characteristics

CO2 Design AM communication systems

CO3 Design Angle modulated communication systems

CO4 Apply the concepts of Random Process to the design of Communication systems App

CO5 Analyze the noise performance of AM and FM systems

CO6 Gain knowledge in sampling and quantization

TEXT BOOKS

1. J.G.Proakis, M.Salehi, Fundamentals of Communication Systems, Pearson Education 2014
2. Simon Haykin, Communication Systems, 4th Edition, Wiley, 2014

REFERENCE BOOKS

1. B.P.Lathi, —Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press, 2007.
2. D.Roody, J.Coolen, —Electronic Communication.
3. Edition PHI 2006A.Papoulis, —Probability, Random variables and Stochastic Processes McGraw Hill, 3rd edition, 1991.
4. B.Sklar, —Digital Communications Fundamentals and Applications, 2nd Edition Pearson Education 2007.
5. H P Hsu, Schaum Outline Series - —Analog and Digital Communications, TMH 2006.
6. Couch.L. "Modern Communication Systems", Pearson, 2001.

23CS1918	NETWORK DESIGN AND PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basic networking principles
- To explore various networking devices and protocols required for network design and management
- To study two novel networking technologies: SDN and DTN
- To learn network programming in UNIX C

UNIT - I AMPLITUDE MODULATION 9

Amplitude Modulation- DSB SC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSB SC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Super heterodyne Receiver

UNIT - II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM modulation – Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

UNIT - III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter

UNIT - IV NOISE CHARACTERIZATION 9

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de- emphasis for FM

UNIT - V SAMPLING & QUANTIZATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non uniform quantization - quantization noise - Logarithmic Companding – PAM, PPM, PWM, PCM – TDM, F

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the concepts of various analog modulations and their spectral characteristics

CO2 Design AM communication systems

CO3 Design Angle modulated communication systems

CO4 Apply the concepts of Random Process to the design of Communication systems App

CO5 Analyze the noise performance of AM and FM systems

CO6 Gain knowledge in sampling and quantization

TEXT BOOKS

1. J.G.Proakis, M.Salehi, Fundamentals of Communication Systems, Pearson Education 2014
2. Simon Haykin, Communication Systems, 4th Edition, Wiley, 2014

REFERENCE BOOKS

1. B.P.Lathi, —Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press, 2007.
2. D.Roody, J.Coolen, —Electronic Communication.
3. Edition PHI 2006A.Papoulis, —Probability, Random variables and Stochastic Processes McGraw Hill, 3rd edition, 1991.
4. B.Sklar, —Digital Communications Fundamentals and Applications, 2nd Edition Pearson Education 2007.
5. H P Hsu, Schaum Outline Series - —Analog and Digital Communications, TMH 2006.
6. Couch.L. "Modern Communication Systems", Pearson, 2001.

23IT1917	NETWORK MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the key concepts and principles of network management models.
- Comprehend the structure and functioning of broadband network management.
- Identify and explain the components and processes of Simple Network Management Protocol (SNMP).
- Apply SNMP protocols for configuration, fault, performance, and security management in networks.
- Analyze network management tools and systems used in enterprise environments.
- Evaluate web-based network management systems and their integration with other management interfaces.

UNIT - I OSI NETWORK MANAGEMENT 9

OSI Network management model - Organizational model - Information model, Communication model. Abstract Syntax Notation - Encoding Structure, Macros Functional Model CMIP/CMIS.

UNIT - II BROADBAND NETWORK MANAGEMENT 9

Broadband networks and services, ATM Technology - VP, VC, ATM Packet, Integrated service, ATM LAN emulation, Virtual LAN, ATM Network Management-ATM Network reference model, Integrated local Management Interface. ATM Management Information base, Role of SNMP and ILMI in ATM Management, M1, M2, M3, M4 interface. ATM Digital Exchange Interface Management.

UNIT - III SIMPLE NETWORK MANAGEMENT PROTOCOL 9

SNMPv1 Network Management: Communication and Functional Models. The SNMP Communication Model, Functional model. SNMP Management SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base,SNMPv2 Protocol, Compatibility With SNMPv1.Configuration management, Fault management, Performance management, Event Correlation Techniques 168
security management, Accounting management, Report Management, Policy Based Management, Services Level Management.

UNIT - IV NETWORK MANAGEMENT SYSTEMS 9

Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Commercial Network management Systems, System Management and Enterprise Management Solutions.

UNIT - V WEB-BASED MANAGEMENT 9

NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web- Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network.

TOTAL : 45 PERIODS

COURSE OUTCOMES(S)

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

CO1 Demonstrate knowledge of OSI network management models and their components.

CO2 Identify and describe various broadband network management systems and their applications.

CO3 Implement SNMP for managing network devices and troubleshooting network issues.

CO4 Analyze and troubleshoot network performance using network management tools.

CO5 Apply enterprise network management solutions for monitoring and securing networks.

CO6 Evaluate and design web-based management interfaces for network systems.

TEXT BOOKS

1. Stallings, W., "SNMP, SNMPv2, SNMPv3, and RMON 1 and 2", Pearson Education, 2023.
2. Tanenbaum, A. S., & Wetherall, D. J., "Computer Networks", Pearson Education, 2024.
3. Forouzan, B. A., "Data Communications and Networking", McGraw-Hill Education, 2023.
4. Comer, D. E., "Computer Networks and Internets", Pearson Education, 2023.
5. Beasley, J., & Chanson, P., "Broadband Network Architectures", McGraw-Hill, 2023.

REFERENCE BOOKS

1. Jacobson, V., "The SNMP Application Programming Interface (API)", Addison-Wesley, 2023.
2. Casey, R., "Web-Based Management of Networks", CRC Press, 2023.
3. Badr, A., "Network Management and Security", Wiley, 2024.
4. O'Neill, M., "Enterprise Network Management", McGraw-Hill Education, 2023.
5. Heikkinen, K., "Managing Broadband Networks", Wiley, 2023.

23IT1918	WIRELESS TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the fundamental concepts and technical issues of wireless LAN and PAN.
- Comprehend the architecture and operation of wireless internet, including mobile IP and security.
- Identify and analyze the components and protocols used in Ad-Hoc sensor networks.
- Apply concepts of 3G networks and their evolution from GSM to UMTS, HSPA, and CDMA technologies.
- Analyze the key features, architecture, and protocols of LTE and 4G networks.
- Evaluate the applications and security protocols in wireless technologies, including the integration of Cognitive Radio networks.

UNIT - I WIRELESS LAN and PAN 9

Introduction, fundamentals of WLAN –technical issues, network architecture, IEEE 802.11- physical layer, Mac layer mechanism, CSMA/CA,RTS/CTS, Polling, Bluetooth- User scenarios, Architecture, Radio layer, Baseband layer, Link manager protocol, L2CAP, Security, SDP, IEEE 802.15.3. 19

UNIT - II WIRELESS INTERNET 9

Introduction – Wireless Internet, address mobility, inefficiency of transport layer and Application layer protocol, mobile IP – simultaneous binding, route optimization, mobile IP variations, handoffs, IPv6 advancements, IP for wireless domain, security in mobile IP, TCP in wireless domain – TCP over wireless , TCPs -traditional, snoop, indirect, mobile, transaction- oriented, impact of mobility.

UNIT - III AD-HOC SENSOR NETWORK 9

Wireless Sensor Network – Applications, design Challenges, Protocol stack, comparisons with MANET node architecture, network architecture, MAC protocols-requirements, IEEE 802.15.4 MAC protocol, Routing Protocol – energy aware routing, Location based routing, clustering, aggregation, QoS, security protocol, Zigbee standard.

UNIT - IV 3G NETWORKS 9

Evolution from GSM, 3G Services and Applications - UMTS network structure - Core network - UMTS Radio access - HSPA – HSUPA- HSDPA- CDMA 1X - EVDO Rev -0, Rev- A, Rev-B, Rev-C Architecture- Protocol stack, Cognitive Radio network, Spectrum Sensing.

UNIT - V 4G - LTE 9

Overview of LTE Networks - Need for LTE- From LTE to LTE-Advanced SAE :- LTE Architecture, Radio Protocol stack , Interfaces, Concept of HetNET, Quality of Service and Bandwidth Reservation - QoS metrics, Signaling for Bandwidth Requests and Grants, Bandwidth Allocation and Traffic Handling, Mobility Management, Security Protocols

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Explain the working principles of WLAN and PAN technologies, including IEEE 802.11 and Bluetooth.

CO2 Demonstrate understanding of mobile IP, TCP issues in wireless domains, and security in mobile IP.

CO3 Design and evaluate wireless sensor networks, including energy-efficient routing and Zigbee standard applications.

CO4 Describe the architecture and protocols used in 3G networks, including UMTS, HSPA, and CDMA technologies.

CO5 Assess the architecture, signaling, and mobility management of LTE and its advancements in 4G networks.

CO6 Apply security measures and evaluate quality of service protocols in modern wireless network systems.

TEXT BOOKS

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2023.
2. T.S. Rappaport, "Wireless Communications: Principles and Practice", Pearson Education, 2023.
3. William Stallings, "Wireless Communications and Networks", Pearson Education, 2023.
4. Jochen Schiller, "Mobile Communications", Pearson Education, 2023.
5. Rappaport, T. S., "Wireless Communications: Principles and Practice", Prentice Hall, 2023.

REFERENCE BOOKS

1. K. Pahlavan & P. Krishnamurthy, "Networking Fundamentals: Wireless Networking", Wiley, 2023.
2. C.K. Toh, "Ad Hoc Mobile Wireless Networks", Prentice Hall, 2023.
3. Schiller, J., "Mobile Communications", Addison-Wesley, 2023.
4. William C. Y. Lee, "Mobile Cellular Telecommunications", McGraw-Hill, 2023.
5. Mischa Schwartz, "Mobile Wireless Communications", Pearson Education, 2023.

23CS1919	WIRELESS AD HOC AND SENSOR NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To impart Knowledge on the following topics:
- To learn about the issues and challenges in the design of wireless ad hoc networks.
- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
- To understand various security issues in ad hoc and sensor networks and the corresponding solutions.

UNIT- I MAC & ROUTING IN AD HOC NETWORKS 9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple- Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues–Proactive, Reactive and Hybrid Routing Protocols.

UNIT- II TRANSPORT & QOS IN AD HOC NETWORKS 9

TCP's challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions –QoS Model.

UNIT- III MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9

Protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols. Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention- Based protocols – Schedule-Based

UNIT- IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples.

UNIT- V SECURITY IN AD HOC AND SENSOR NETWORKS 9

Security Attacks — Key Distribution and Management — Intrusion Detection — Software based Anti-tamper techniques — Watermarking techniques — Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.

TOTAL : 45 PERIODS

COURSE OUTCOMES(S)

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

CO1	Identify different issues and challenges in the design of wireless ad hoc and sensor networks.
CO2	Understand the working of MAC and Routing Protocols for ad hoc and sensor networks.
CO3	Understand the Transport Layer protocols.
CO4	Analyze the QoS for ad hoc and sensor networks.

CO5 Analyze protocols developed for ad hoc and sensor networks.

CO6 Identify and understand security issues in ad hoc and sensor networks.

TEXTBOOKS

1 C.Siva Ram Murthy and B.S.Manoj, —Ad Hoc Wireless Networks – Architectures and Protocols, Pearson Education, 2006.

2 Holger Karl, Andreas Willing, —Protocols and Architectures for Wireless Sensor Networks‖, JohnWiley & Sons, Inc., 2005.

REFERENCE BOOKS

1 Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, —AdHoc Mobile Wireless Networks Publications, 2008.

2 Carlos De Morais Cordeiro, Dharma Prakash Agrawal, —Ad Hoc and Sensor Networks: Theory And Applications (2nd Edition), World Scientific Publishing, 2011.

3 Waltenegus Dargie, Christian Poellabauer, —Fundamentals of Wireless Sensor Networks Theory And Practice, John Wiley and Sons, 2010.

4 Xiang-Yang Li , —Wireless Ad Hoc and Sensor Networks: Theory and Applications,Cambridge university Press,2008.

WEB REFERENCES

1 https://www.geeksforgeeks.org/differences-between-wireless-adhoc- network-and-wireless-sensor-network/

2 https://www.tutorialspoint.com/what-is-ad-hoc-network

ONLINE COURSES/RESOURCES

1 ps://www.geeksforgeeks.org/differences-between-wireless-adhoc- network-and-wireless-se nsor-network/

2 ps://www.tutorialspoint.com/what-is-ad-hoc-network

23IT1919	PROTOCOLS AND ARCHITECTURES FOR WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Learn the basics of wireless sensor networks and their architecture.
- Understand data link layer protocols used in wireless sensor networks.
- Study different routing and data aggregation methods in sensor networks.
- Apply transport protocols for data transfer and control in sensor networks.
- Explore tools and software used to program and simulate sensor networks.
- Understand short-range communication standards like IEEE 802.15.4 and Zigbee for sensor networks.

UNIT - I WIRELESS SENSOR NETWORK ARCHITECTURE 9

Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT - II DATA LINK LAYER 9

MAC protocols – fundamentals, low duty cycle protocols and wakeup concepts, contention- based protocols, Schedule-based protocols - SMAC, BMAC,TRAMA, Link Layer protocols – fundamentals task and requirements, error control, framing, link management, Naming and addressing – address assignment, unique, Content-based and geographical addressing.

UNIT - III NETWORK LAYER 9

Routing protocols – Requirements, Taxonomy - Data-centric routing – SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing – COUGAR, ACQUIRE, Hierarchical Routing – LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques, Localization and positioning – Properties, Approaches, Mathematical basics for single hop and multi-hop environment.

UNIT - IV TRANSPORT LAYER 9

Transport Protocol, Coverage and deployments - Sensing models, Coverage measures, Random deployments: Poisson model, Boolean sensing model, general sensing model, Coverage determination, grid deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control, Time synchronization – Issues and protocol – Sender/Receiver, Security – protocols and KeyDistribution Techniques.

UNIT - V TOOLS FOR WSN 9

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Explain the key elements of wireless sensor networks.

CO2 Understand and describe MAC and link layer protocols in wireless sensor networks.

CO3 Compare different routing protocols and data aggregation methods.

CO4 Use transport protocols to manage data in sensor networks.

CO5 Program and simulate wireless sensor networks using tools like TinyOS and Contiki.

CO6 Understand and apply communication standards like IEEE 802.15.4 and Zigbee in sensor networks.

TEXT BOOKS

1. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2023.
2. Ian F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks", Wiley, 2023.
3. Shiwen Mao, Yi Pan, "Wireless Sensor Networks: Applications and Protocols", CRC Press, 2023.
4. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", Wiley, 2023.
5. C.S. Raghavendra, Krishna M. Sivalingam, "Wireless Sensor Networks", Springer, 2023.

REFERENCE BOOKS

1. Nita R. D., "Wireless Sensor Networks: A Networking Perspective", Wiley, 2023.
2. J. C. S. Lui, H. K. Lee, "Wireless Sensor Networks: Fundamentals, Design and Applications", Springer, 2023.
3. Carlos de Morais Cordeiro, Dharma Prakash Agarwal, "Ad Hoc and Sensor Networks: Theory and Applications", World Scientific, 2023.
4. Laxmi Bhuyan, Nita R. D., "Wireless Sensor Network Architectures and Protocols", CRC Press, 2023.
5. Wei Xiao, Bo Liu, "Wireless Sensor Networks: Design and Protocols", Elsevier, 2023.

23IT1920	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the fundamentals and architecture of Software Defined Networking (SDN).
- Explore the data plane and control plane functions and protocols used in SDN.
- Learn about SDN applications and their role in traffic engineering, security, and data center networking.
- Comprehend the concepts of Network Function Virtualization (NFV) and its role in modern networks.
- Apply SDN controllers and protocols, such as OpenFlow, to manage network resources.
- Analyze the integration of SDN and NFV in enhancing network performance and flexibility.

UNIT - I SDN: INTRODUCTION 9

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Controlplane and Application Plane

UNIT - II SDN DATA PLANE AND CONTROL PLANE 9

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT - III SDN APPLICATIONS 9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT - IV NETWORK FUNCTION VIRTUALIZATION 9

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT - V NFV FUNCTIONALITY 9

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Explain the architecture of Software Defined Networking and its key components.
CO2 Describe the functions and protocols of the SDN data plane and control plane.
CO3 Identify and implement SDN applications, including traffic engineering and network security.
CO4 Understand and explain the concepts and benefits of Network Function Virtualization (NFV).
CO5 Utilize SDN controllers like Ryu, OpenDaylight, and ONOS to manage network functions.
CO6 Evaluate the synergy between SDN and NFV for optimizing network performance and scalability.

TEXT BOOKS

1. Sonia C. P. Sahu, Sandeep S. S., "Software Defined Networking: Design and Deployment", Wiley, 2023.
2. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2023.
3. Fei Hu, "Software Defined Networking: A Comprehensive Approach", CRC Press, 2023.
4. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, 2023.

5. P. K. Sahu, S. K. Patra, "Introduction to Software Defined Networks", CRC Press, 2023.

REFERENCE BOOKS

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud", Pearson, 2023.
2. Bruce S. Davie, Larry Peterson, "Computer Networks: A Systems Approach", Morgan Kaufmann, 2023.
3. Raj Jain, Sudhir R. Soni, "Network Function Virtualization: Concepts, Architecture, and Design", Wiley, 2023.
4. Ihab S. Ilyas, Khaled R. El-Azouzi, "Software Defined Networking (SDN): Concepts and Applications", Springer, 2023.

23CS1920	NEXT GENERATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the technical, economic and service advantages of next generation networks.
- To learn the evolution of technologies of 4G and beyond.
- To learn Software defined Mobile Network issues and integrating challenges with LTE.
- To explore the NGN framework catering the services of end user with QoS provisioning.
- To learn about the NGM management and standards.

UNIT- I INTRODUCTION 9

Evolution of public mobile services -motivations for IP based services, Wireless IP network architecture — 3GPP packet data network architecture. Introduction to next generation networks - Changes, Opportunities and Challenges, Technologies, Networks, and Services, Next Generation Society, future Trends.

UNIT- II 4G and BEYOND 9

Introduction to LTE-A –Requirements and Challenges, network architectures — EPC, E-UTRAN architecture-mobility management, resource management, services, channel - logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT- III SDMN-LTE INTEGRATION 9

SDN paradigm and applications, SDN for wireless-challenges, Leveraging SDN for 5G networks- ubiquitous connectivity-mobile cloud-cooperative cellular network- restructuring mobile networks to SDN- SDN/LTE integration benefits.

UNIT- IV NGN ARCHITECTURE 9

Evolution towards NGN-Technology requirements, NGN functional stratum, service stratum, service/ content layer and customer terminal equipment function. NGN entities, Network and Service evolution -fixed, mobile, cable and internet evolution towards NGN.

UNIT- V NGN MANAGEMENT AND STANDARDIZATION 9

NGN requirements on Management-Customer, third party, Configuration, Accounting, performance, device and information management. Service and control management- End-to-End QoS and security. ITU and GSI-NGN releases, ETSI-NGN concept and releases, NGMN alliance and NGMN.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the technical, economic and service advantages of next generation networks.

CO2 Understand the issues and challenges of wireless domain in future generation network design.

CO3 Understand the evolution of technologies of 4G and beyond.

CO4 Explore the LTE concepts and technologies.

CO5 Understand the integration of SDN with LTE.

CO6 Understand the NGN management and standardizations.

TEXTBOOKS

1. Jingming Li Salina,Pascal Salina "Next Generation Networks- perspectives and potentials" Wiley,January 2008.
2. Martin Sauter,"3G,4G and Beyond bringing networks, devices and web together", Wiley, 2nd edition- 2013.
3. Thomas Plavyk, —Next generation Telecommunication Networks, Services and Managementll,Wiley IEEE Press Publications, 2010.

REFERENCE BOOKS

1. Madhusanga Liyanage, Andrei Gurtov, Mika Ylianttila, "Software Defined Mobile Networks beyondLTE Network Architecture", Wiley, June 2015.
2. Savo G Glisic," Advanced Wireless Networks- Technology and Business models", Wiley, 3rd edition- 2016.

WEB REFERENCES

1. https://www.geeksforgeeks.org/next-generation-network-ngn/

ONLINE COURSES/RESOURCES

1. https://www.academyeurope.org/courses/engineering-technology/next- generation-networks/

VERTICAL VII- INTELLIGENT ANALYTICS

23AD1910	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- 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.
- To implement real time applications.

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- T-pyramid of an image- the quad tree representation of an image using the homogeneity criterion of equal intensity

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 – Geometric transformations -Case study of MNIST.

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 - motion analysis using moving edges - Case study: Geospatial object detection.

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 – Implementation of Facial Detection and Recognition - static hand gesture.

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. Case study: Airport Projects - event detection in video surveillance system

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the basics of image processing techniques for computer vision and video analysis.

CO2 Explain the techniques used for image pre-processing.

CO3 Develop various object detection techniques

CO4 Understand the various face recognition mechanisms

CO5 Elaborate on deep learning-based video analytics.

CO6 Implement in real time applications.

TEXT BOOKS

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4nd edition, Thomson Learning, 2013
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited,2011
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012
3. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003

23AD1911	SPEECH PROCESSING AND ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand natural language processing basics
- To apply classification algorithms to text documents
- To build question-answering and dialogue systems
- To develop a speech recognition system
- To develop a speech synthesizer

UNIT-I INTRODUCTION TO SPEECH PROCESSING **9**

Human and machine speech production: Models for speech production. Various types of speech sounds and their characteristics, Speech hearing: Mechanism for human hearing: Learning to recognize human sounds, acquired knowledge vs vocabulary - based methods.

UNIT-II ANALYSIS OF SPEECH **9**

Frequency and time domain based methods: FFT, computation of pitch, spectrograms, LPC, cepstrum, ZCR, etc. Representation of acoustic events. Components of a Speech recognition system: Input, feature analysis, modelling and decision rule, vocabulary.

UNIT-III DATA COMPRESSION **9**

Vector Quantization, codebook design, Lloyd's quantizer design, K-means algorithm, LBG algorithm for speech. Speech modelling: Stochastic processes: Markov processes, Hidden Markov modelling.

UNIT-IV SPEECH AUTOMATION METHODS **9**

Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a* (stack) decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans.

UNIT-V SPEECH RECOGNITION SYSTEM **9**

Implementation of a speech recognition system: Time/space consideration, designing the interface, self-learning mechanism.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the students will be able to

CO1 Explain existing and emerging deep learning architectures for text and speech processing

CO2 Apply deep learning techniques for NLP tasks, language modelling and machine translation

CO3 Explain co-reference and coherence for text processing

CO4 Build question-answering systems, chat bots and dialogue systems

CO5 Apply deep learning models for building speech recognition and text-to-speech systems

TEXTBOOKS

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCES

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O’REILLY.

23AD1912	HEALTH CARE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

BayesTheorem, 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: 45 PERIODS

COURSE OUTCOMES

CO1 Use machine learning and deep learning algorithms for health data analysis

CO2 Apply the data management techniques for healthcare data

CO3 Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications

CO4 Design health data analytics for real time applications

CO5 Design emergency care system using health data analysis

TEXT BOOKS

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.

REFERENCES

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.

23AD1913	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The objective of this course is to enable the student to

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

UNIT I DEVELOPMENT OF O.R AND ALLOCATION 9

Introduction of Operations Research - Types of operation research models, mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two-Phase method, big-M method,

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS 9

Integer programming: Branch and bound method- Degeneracy; Assignment problem, formulation, optimal solution, variants of assignment problem- Traveling salesman problem.

UNIT III SEQUENCING AND REPLACEMENT 9

Sequencing: Introduction, flow, shop sequencing, n jobs through two machines, n jobs through three machines, job shop sequencing, and two jobs through “m” machines. Replacement: Introduction: Replacement of items that deteriorate with time, when money value is not counted and counted, replacement of items that fail completely, group replacement.

UNIT IV THEORY OF GAMES AND INVENTORY 9

Theory Of Games: Introduction – Terminology, Solution of games with saddle points and without saddle points, 2×2 games, dominance principle, m X 2 & 2 X n games, Graphical method. Inventory: Introduction, Single item, Deterministic models, Purchase inventory models with one price break and multiple price breaks, Stochastic models, demand may be discrete variable or continuous variable, Single period model and no setup cost.

UNIT V WAITING LINES, DYNAMIC PROGRAMMIMG AND SIMULATION 9

Waiting Lines: Introduction, Terminology, Single Channel, Poisson arrivals and exponential service times with infinite population and finite population models, Multichannel, Poisson arrivals and exponential service times with infinite population. Dynamic Programming: Introduction, Terminology, Bellman‟s Principle of optimality, Applications of dynamic programming, shortest path problem, linear programming problem. Simulation: Introduction, Definition, types of simulation models, steps involved in the simulation process - Advantages and Disadvantages, Application of Simulation to queuing and inventory

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1: Formulate and solve linear programming problems (LPP)

CO2: Evaluate Integer Programming Problems, Transportation and Assignment Problems.

CO3: Obtain a solution to network problems using CPM and PERT techniques.

CO4: Able to optimize the function subject to the constraints.

CO5: Identify and solve problems under Markovian queuing models

TEXT BOOKS

1. Mykel Kochenderfer and Tim Wheeler, “Algorithm for Optimization”, MIT Press, 2019.
2. Xin-She Yang, “Optimization Techniques and Applications with Examples”, 2018 John Wiley & Sons, Inc.

REFERENCES

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.
2. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
3. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
4. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

23AD1914	BIO INSPIRED OPTIMIZATION COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Understand the basics of biological underpinnings and compare with the neural networks and methods
- To understand latest trends and apply mathematical models
- To learn bio inspired algorithms
- To apply and evaluate the system based on energy efficiency.
- To identify the challenges and gaps in the recent trends and apply the technology to solve the issues.

UNIT-I EVOLUTION **9**

Biological Underpinnings- Applications in computing and engineering- Evolutionary computation and genetic programming- Mathematical Models, Search spaces and biased sampling- Multiplicative weights update algorithm for recombination- selection and mutation, Novelty Search, Automatically evolving neural network architectures.

UNIT-II IMMUNOLOGY **9**

Computer Security- Probabilistic models- Differential equation models- Current research.

UNIT-III SOCIAL INSECTS **9**

Applications to computing and engineering- Ant Colony Optimization (ACO) algorithms-Partical swarm optimization- Multi-agent systems, Computational models and theory

UNIT-IV METABOLIC SCALING **9**

Biological underpinnings- Predicting power consumption on chips- Internet topology- Current research- Novelty Search.

UNIT-V EPIDEMIOLOGY AND ECOLOGY **9**

Network topology and susceptibility to attack- Red Queen dynamics and arms races in cybersecurity- Epidemic spreading- Predator/prey models- SIR and SIS- Current research- TBD

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1 Remember the basics of biological underpinnings and compare with the neural networks and methods.

CO2 Understand the latest trends and apply mathematical models

CO3 Analyse and optimise the problems based on bio inspired algorithms

CO4 Evaluate the system based on energy efficiency

CO5 Identify the challenges and gaps in the recent trends and apply the technology to solve the issues.

TOTAL: 45 PERIODS

TEXTBOOKS

1. Nancy Arana-Daniel, Carlos Lopez-Franco, Alma Y. Alanis, “Bio-inspired Algorithms for Engineering”, Butterworth-Heinemann; Illustrated edition, 2018.
2. S. Balamurugan, Anupriya Jain, Sachin Sharma, Dinesh Goyal, Sonia Duggal, Seema Sharma, “Nature- Inspired Algorithms and Applications”, 2021.

REFERENCES

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.
3. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

23AD1915	GAME THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- 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 41odeIIing 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 apply game theory in searching, auctioning and trading.

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 pennies - Nash equilibria -mixed strategy equilibrium - zero-sum games

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 -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 equilibria of 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon Completion of the course, the students will be able to

CO1 Define the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.

CO2 Discuss the use of Nash Equilibrium for other problems.

CO3 Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.

CO4 Identify some applications that need aspects of Bayesian Games.

CO5 Build a typical Virtual Business scenario using Game theory

TEXT BOOKS

1. Thomas Ferguson, Game Theory, World Scientific, 2018.
2. Prajit Dutta, Strategies and Games, MIT Press
3. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.
4. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.

REFERENCES

1. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008.
2. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, “Game Theory in Wireless and Communication Networks”, Cambridge University Press, 2012.
3. Y.Narahari, “Game Theory and Mechanism Design”, IISC Press, World Scientific.

23AD1916	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the MindPsychology: Place of Psychology within Cognitive Science – Science of Information Processing – Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II INFORMATION PROCESSING MODELS OF THE MIND 9

Symbols and symbol systems– Intelligent action and the physical symbol system– Syntax and the language of thought – ID3 and the physical symbol system hypothesis– The perceptron convergence rule– The backpropagation algorithm**.**

UNIT III THE ORGANIZATION OF THE MIND 9

The ACTRPM architecture– Strategies for brain mapping– Combining ERPs and singleunit recordings– Two hypotheses about visuospatial attention– Functional connectivity vs effective connectivity– Exploring mindreading - Implicit and explicit understanding of false belief– Consciousness and priming.

UNIT IV INFERENCE MODELS OF COGNITION 9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Understand the underlying theory behind cognition.

CO2: Connect to the cognition elements computationally.

CO3: Implement mathematical functions through WebPPL.

CO4: Develop applications using cognitive inference model.

CO5: Develop applications using cognitive learning model.

TEXT BOOKS

1. José Luis Bermúdez, " Cognitive Science: An Introduction to the Science of the Mind", Cambridge university press, 2020
2. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016

3. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015

REFERENCES

1. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016.

23AD1917	ROBOTIC PROCESS AUTOMATION AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYING AND MAINTAINING THE BOT 9

Case Study: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages

TOTAL: 45 PERIODS

COURSE OUTCOMES

By the end of this course, the students will be able to:

- Enunciate the key distinctions between RPA and existing automation techniquesand platforms.
- Use UiPath to design control flows and work flows for the target process
- Implement recording, web scraping and process mining by automation
- Use UIPath Studio to detect, and handle exceptions in automation processes
- Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes**.**

TEXT BOOKS

1.Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.

2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

REFERENCES

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018

3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020