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.E - COMPUTER SCIENCE AND ENGINEERING

www.panimalar.ac.in

PANIMALAR ENGINEERING COLLEGE

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

Bangalore Trunk Road, Varadharajapuram,

Poonamallee, Chennai – 600 123

Department of Computer Science and Engineering

B.E- Computer Science and Engineering

CURRICULUM AND SYLLABUS

REGULATION - 2023

(For the Students admitted during 2023-24)

B.E. COMPUTER SCIENCE AND ENGINEERING

CHOICE BASED CREDIT SYSTEM

I - VIII SEMESTERS CURRICULUM AND SYLLABI - R 2023

VISION

To create a dynamic academic environment that nurtures technologically proficient individuals with a spirit of research, innovation and effective communication while instilling strong social awareness and national responsibility, enabling them to excel in the field of Computer Engineering.

MISSION

M1: To establish a dynamic academic environment with dedicated faculty and modern resources, fostering expertise in both fundamental concepts and emerging computing domains.

M2: To equip students with industry-relevant skills, critical thinking abilities, and leadership qualities, while instilling ethical values and a sense of responsibility through knowledge dissemination and technological advancements for societal progress.

M3: To drive collaborative innovation through partnerships with academia and industry, ensuring seamless exchange of expertise, leading to intellectual property creation, product development, commercialization, and sustained research funding.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: Technical Competence and Problem-Solving: Develop a strong foundation in computer science and interdisciplinary domains to design and implement effective solutions for real-world engineering challenges.

PEO2: Career Growth and Leadership: Excel in technical and professional roles across industries, entrepreneurship, and higher education while demonstrating leadership, teamwork, and adaptability.

PEO3: Innovation, Research and Ethical Excellence: Engage in cutting-edge research, address industry needs, and develop innovative software solutions while upholding ethical responsibility and professional integrity.

PROGRAM OUTCOMES (PO)

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

PO2: Problem Analysis: Identify, formulate, review research literature and analyse 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 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: Professional Skills: To inculcate technical skills to analyze, design and implement software's related to algorithms, networking, web services, multimedia, big data analytics and recent topics of varying complexity.

PSO2: Problem-Solving Skills: To develop the capability to comprehend and solve the interdisciplinary problems through appropriate technology with the understanding of contemporary business environment.

PSO3: Successful Career and Entrepreneurship: To develop an ability to utilize the latest technology and platforms to become a triumphant professional, successful entrepreneur and an urge for pursuing higher studies.

B.E- Computer Science and Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

I - VIII SEMESTERS CURRICULUM AND SYLLABI (REGULATION 2023)

(For the Students admitted during 2023-24)

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 Courses							
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.	23MA1201	Complex Variables and Laplace Transform	BS	3/1/0	4	4	60/40
2.	23ES1201	Python Programming	ES	3/0/0	3	3	60/40
3.	23ES1103	Engineering Graphics	ES	2/0/2	4	3	60/40
Theory Cum Practical Courses							
4.	23HS1201	Communicative and Aptitude Skills	HS	2/0/2	4	3	50/50
5.	23CS1201	Web Application Development	PC	2/0/2	4	3	50/50
Laboratory Courses							
6.	23ES1211	Python Programming Laboratory	ES	0/0/4	4	2	40/60
7.	23ES1212	Technical Skill Practices I	EEC	0/0/2	2	1	40/60
Mandatory Courses							
8.	23TA1201	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HS	1/0/0	1	1	60/40
9.		Mandatory Course - I	MC	2/0/0	2	0	0/100
			TOTAL		**28**	**20**	

Semester III							
S. No	**COURSE CODE**	**COURSE TITLE**	**Category**	**L/T/P**	**Contact Hours**	**Credit**	**Ext / Int Weightage**
Theory Courses							
1.	23MA1301	Discrete Mathematics	BS	3/1/0	4	4	60/40
2.	23CS1301	Digital Principles and Computer Architecture	PC	3/0/0	3	3	60/40
3.	23CS1302	Data Structures	PC	3/0/0	3	3	60/40
4.	23CS1303	Database Management Systems	PC	3/0/0	3	3	60/40
5.	23IT1301	Object Oriented Programming	PC	3/0/0	3	3	60/40
Laboratory Courses							
6.	23CS1311	Data Structures Laboratory	PC	0/0/4	4	2	40/60
7.	23CS1312	Database Management Systems Laboratory	PC	0/0/4	4	2	40/60
8.	23IT1311	Object Oriented Programming 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.	23MA1401	Probability and Statistical Methods	BS	3/1/0	4	4	60/40
2.	23CS1401	Computer Networks	PC	3/0/0	3	3	60/40
3.	23CS1402	Computational Thinking	PC	3/0/0	3	3	60/40
4.	23IT1403	Operating Systems	PC	3/0/0	3	3	60/40
5.	23AD1405	Foundations of Data Science	PC	3/0/0	3	3	60/40
Theory Cum Practical Courses							
6.	23IT1401	Object Oriented Software Engineering	PC	2/0/2	4	3	50/50
Laboratory Courses							
7.	23CS1411	Computer Networks Laboratory	PC	0/0/4	4	2	40/60
8.	23AD1413	Foundations of 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.	23CS1501	Full Stack Development	PC	3/0/0	3	3	60/40
2.	23CS1502	Theory of Computation	PC	3/0/0	3	3	60/40
3.	23MG1501	Organizational Behaviour and Business Intelligence	MG	3/0/0	3	3	60/40
4.		Professional Elective - I	PE	3/0/0	3	3	60/40
5.		Open Elective - I	OE	3/0/0	3	3	60/40
Theory Cum Practical Courses							
6.	23CS1503	Artificial Intelligence and Machine Learning Techniques	PC	3/0/2	5	4	50/50
Laboratory Courses							
7.	23CS1511	Full Stack Development Laboratory	PC	0/0/4	4	2	40/60
8.	23CS1512	Socially Relevant Mini Project	EEC	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.	23CS1601	Mobile Application Development	PC	3/0/0	3	3	60/40
2.	23CS1602	Compiler Design	PC	3/0/0	3	3	60/40
3.	23CS1603	Cognitive Computing	PC	3/0/0	3	3	60/40
4.	23CB1402	Introduction to Innovation and Entrepreneurship	EEC	3/0/0	3	3	60/40
5.		Professional Elective - II	PE	3/0/0	3	3	60/40
Theory Cum Practical Courses							
6.	23CS1604	Internet of Things	PC	2/0/2	4	3	50/50
Laboratory Courses							
7.	23CS1611	Mobile Application Development Laboratory	PC	0/0/4	4	2	40/60
8.	23CS1612	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	0/0/4	4	2	0/100
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.	23CS1701	Cryptography and Cyber Security	PC	3/0/0	3	3	60/40
2.	23IT1701	Cloud Computing and Big Data Analytics	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
5.		Open Elective - II	OE	3/0/0	3	3	60/40
Laboratory Courses							
6.	23CS1711	Cryptography and Cyber Security Laboratory	PC	0/0/4	4	2	40/60
7.	23IT1711	Cloud Computing and Big Data Analytics Laboratory	PC	0/0/4	4	2	40/60
Employment Enhancement Courses							
8.	23CS1702	Industrial Training / Internship#	EEC	-	-	2	0/100
9.		Value Added Courses##	EEC	-	-	0	0/100
			TOTAL		**23**	**21**	

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 Courses 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 Course							
3.	23CS1811	Project Work	EEC	0/0/16	16	8	40/60
			TOTAL		**22**	**14**	

TOTAL CREDITS : 169

SUMMARY OF CREDITS

S. NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	PERCENTAGE (%)
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities and Social Sciences including Management Course (HS)	4	4			3				11	6.51
2.	Basic Science (BS)	7	4	4	4					19	11.24
3.	Engineering Sciences (ES)	9	8							17	10.06
4.	Professional Core (PC)		3	18	19	12	14	10		76	44.97
5.	Professional Elective (PE)					3	3	6	6	18	10.65
6.	Open Elective (OE)					3		3		6	3.55
7.	Employment Enhancement Courses (EEC)		1	1	1	3	6	2	8	22	13.02
8.	Mandatory Courses (MC) (Non Credit)	√	√	√						-	-
	TOTAL	20	20	23	24	24	23	21	14	169	100.00

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 offered from other Engineering Disciplines.

Registration of Professional Elective Courses from Verticals

Professional Elective Courses will be registered from Semester V onwards.

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 Elective Courses 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 one Semester and another in other semester.

HUMANITIES AND SOCIAL SCIENCE COURSES INCLUDING MANAGEMENT COURSE

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23HS1101	Communicative English and Language Skills	HS	4	2	0	2	3
2.	23TA1101	தமிழர் மரபு / Heritage of Tamils	HS	1	1	0	0	1
3.	23HS1201	Communicative and Aptitude Skills	HS	4	2	0	2	3
4.	23TA1201	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HS	2	2	0	0	1
5.	23MG1501	Organizational Behaviour and Business Intelligence	MG	3	3	0	0	3

BASIC SCIENCE COURSES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23MA1101	Matrices and Calculus	BS	4	3	1	0	4
2.	23PH1101	Engineering Physics	BS	4	2	0	2	3
3.	23MA1201	Complex Variables and Laplace Transform	BS	4	3	1	0	4
4.	23MA1301	Discrete Mathematics	BS	4	3	1	0	4
5.	23MA1401	Probability and Statistical Methods	BS	4	3	1	0	4

ENGINEERING SCIENCE COURSES

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.	23ES1201	Python Programming	ES	3	3	0	0	3
5.	23ES1103	Engineering Graphics	ES	4	2	0	2	3
6.	23ES1211	Python Programming Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE COURSES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23CS1201	Web Application Development	PC	4	2	0	2	3
2.	23CS1301	Digital Principles and Computer Architecture	PC	3	3	0	0	3
3.	23CS1302	Data Structures	PC	3	3	0	0	3
4.	23CS1303	Database Management Systems	PC	3	3	0	0	3
5.	23IT1301	Object Oriented Programming	PC	3	3	0	0	3
6.	23CS1311	Data Structures Laboratory	PC	4	0	0	4	2
7.	23CS1312	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	23IT1311	Object Oriented Programming Laboratory	PC	4	0	0	4	2
9.	23CS1401	Computer Networks	PC	3	3	0	0	3
10.	23CS1402	Computational Thinking	PC	3	3	0	0	3
11.	23IT1403	Operating Systems	PC	3	3	0	0	3
12.	23AD1405	Foundations of Data Science	PC	3	3	0	0	3
13.	23IT1401	Object Oriented Software Engineering	PC	4	2	0	2	3
14.	23CS1411	Computer Networks Laboratory	PC	4	0	0	4	2
15.	23AD1413	Foundations of Data Science Laboratory	PC	4	0	0	4	2
16.	23CS1501	Full Stack Development	PC	3	3	0	0	3
17.	23CS1502	Theory of Computation	PC	3	3	0	0	3
18.	23CS1503	Artificial Intelligence and Machine Learning Techniques	PC	5	3	0	2	4
19.	23CS1511	Full Stack Development Laboratory	PC	4	0	0	4	2
20.	23CS1601	Mobile Application Development	PC	3	3	0	0	3
21.	23CS1602	Compiler Design	PC	3	3	0	0	3
22.	23CS1603	Cognitive Computing	PC	3	3	0	0	3
23.	23CS1604	Internet of Things	PC	4	2	0	2	3
24.	23CS1611	Mobile Application Development Laboratory	PC	4	0	0	4	2
25.	23CS1701	Cryptography and Cyber Security	PC	3	3	0	0	3
26.	23IT1701	Cloud Computing and Big Data Analytics	PC	3	3	0	0	3

27.	23CS1711	Cryptography and Cyber Security Laboratory	PC	4	0	0	4	2
28.	23IT1711	Cloud Computing and Big Data Analytics Laboratory	PC	4	0	0	4	2

OPEN ELECTIVE COURSES

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.	23CY1001	Industrial Nanotechnology	OE	3	3	0	0	3
5.	23EE1003	Logic and Distributed Control Systems	OE	3	3	0	0	3
6.	23EC1011	Tele Health 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.	23CY1002	Energy Technology	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.	23EC1006	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

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23ES1212	Technical Skill Practices I	EEC	2	0	0	2	1
2.	23ES1311	Technical Skill Practices II	EEC	2	0	0	2	1
3.	23ES1411	Technical Skill Practices III	EEC	2	0	0	2	1
4.	23CB1402	Introduction to Innovation and Entrepreneurship	EEC	3	3	0	0	3
5.	23ES1511	Technical Skill Practices IV	EEC	2	0	0	2	1
6.	23CS1512	Socially Relevant Mini Project	EEC	4	0	0	4	2
7.	23ES1611	Technical Skill Practices V	EEC	2	0	0	2	1
8.	23CS1612	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	4	0	0	4	2
9.	23CS1702	Industrial Training / Internship	EEC	-	-	-	-	2
10.		Value Added Courses	EEC	-	-	-	-	0
11.	23CS1811	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 Traditional Knowledge	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

PROFESSIONAL ELECTIVES: VERTICALS

VERTICAL I	VERTICAL II	VERTICAL III	VERTICAL IV	VERTICAL V	VERTICAL VI	VERTICAL VII
Data Science	**Full Stack Development**	**Cloud Computing and Data Centre Technologies**	**Cyber Security and Data Privacy**	**Creative Media Technologies**	**Advanced Artificial Intelligence**	**Networking**
Exploratory Data Analysis **(23AD1902)**	NextGen Web Development **(23IT1901)**	Storage Technologies **(23CS1901)**	Ethical Hacking **(23IT1909)**	Video Creation and Editing **(23CS1909)**	Knowledge Engineering (**23AD1920)**	Communication Theory **(23CS1917)**
Data Visualization **(23AD1909)**	Open Source Technologies **(23IT1902)**	Cloud Tools and Techniques **(23CS1902)**	Modern Cryptography **(23IT1910)**	Digital Marketing **(23CS1910)**	Health Care Analytics **(23AD1912)**	Network Design and Programming **(23CS1918)**
Business Analytics **(23AD1918)**	App Development **(23IT1903)**	Virtualization **(23CS1903)**	Digital and Mobile Forensics **(23IT1911)**	Multimedia and Animation **(23CS1911)**	Engineering Predictive Analytics **(23AD1906)**	Network Management **(23IT1917)**
Text Analytics **(23AD1904)**	UI and UX Design **(23IT1904)**	Cloud Services Management **(23CS1904)**	Social Network Security **(23IT1912)**	Streaming Media Tools and Technologies **(23CS1912)**	Soft Computing **(23AD1903)**	Wireless Technologies **(23IT1918)**
Recommender Systems **(23AD1905)**	DevOps **(23IT1905)**	Security and Privacy in Cloud **(23CS1905)**	Cryptocurrency and Block chain Technologies **(23IT1913)**	Visual Effects **(23CS1913)**	Game Theory **(23AD1915)**	Wireless Adhoc and Sensor Networks **(23CS1919)**
Image and Video Analytics **(23AD1910)**	Software Testing and Automation **(23IT1906)**	Stream Processing **(23CS1906)**	Engineering Secure Software Systems **(23IT1914)**	3D Printing and Design **(23CS1914)**	Optimization Techniques in Machine Learning **(23AD1921)**	Protocols and Architectures for Wireless Sensor Networks **(23IT1919)**
Speech Processing and Analytics **(23AD1911)**	Web Application Security **(23IT1907)**	Site Reliability Engineering **(23CS1907)**	Cyber Physical Systems Security **(23IT1915)**	Game Development **(23CS1915)**	Robotic Process Automation and Development **(23AD1917)**	Software Defined Networks **(23IT1920)**
Computer Vision Techniques **(23AD1919)**	Project Management and Agile Technologies **(23IT1908)**	Quantum Computing **(23CS1908)**	Threat Detection and Incident Response **(23IT1916)**	Augmented Reality and Virtual Reality **(23CS1916)**	Ethics and AI **(23AD1907)**	Next Generation Networks **(23CS1920)**

PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL 1: DATA SCIENCE

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23AD1902	Exploratory Data Analysis	PE	3	3	0	0	3
2.	23AD1909	Data Visualization	PE	3	3	0	0	3
3.	23AD1918	Business Analytics	PE	3	3	0	0	3
4.	23AD1904	Text Analytics	PE	3	3	0	0	3
5.	23AD1905	Recommender Systems	PE	3	3	0	0	3
6.	23AD1910	Image and Video Analytics	PE	3	3	0	0	3
7.	23AD1911	Speech Processing and Analytics	PE	3	3	0	0	3
8.	23AD1919	Computer Vision Techniques	PE	3	3	0	0	3

VERTICAL 2: FULL STACK DEVELOPMENT

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

VERTICAL 3: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23CS1901	Storage Technologies	PE	3	3	0	0	3
2.	23CS1902	Cloud Tools and Techniques	PE	3	3	0	0	3
3.	23CS1903	Virtualization	PE	3	3	0	0	3
4.	23CS1904	Cloud Services Management	PE	3	3	0	0	3
5.	23CS1905	Security and Privacy in Cloud	PE	3	3	0	0	3
6.	23CS1906	Stream Processing	PE	3	3	0	0	3
7.	23CS1907	Site Reliability Engineering	PE	3	3	0	0	3
8.	23CS1908	Quantum Computing	PE	3	3	0	0	3

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23IT1909	Ethical Hacking	PE	3	3	0	0	3
2.	23IT1910	Modern Cryptography	PE	3	3	0	0	3
3.	23IT1911	Digital and Mobile Forensics	PE	3	3	0	0	3
4.	23IT1912	Social Network Security	PE	3	3	0	0	3
5.	23IT1913	Cryptocurrency and Block chain Technologies	PE	3	3	0	0	3
6.	23IT1914	Engineering Secure Software Systems	PE	3	3	0	0	3
7.	23IT1915	Cyber Physical Systems Security	PE	3	3	0	0	3
8.	23IT1916	Threat Detection and Incident Response	PE	3	3	0	0	3

VERTICAL 5: CREATIVE MEDIA TECHNOLOGIES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23CS1909	Video Creation and Editing	PE	3	3	0	0	3
2.	23CS1910	Digital Marketing	PE	3	3	0	0	3
3.	23CS1911	Multimedia and Animation	PE	3	3	0	0	3
4.	23CS1912	Streaming Media Tools and Technologies	PE	3	3	0	0	3
5.	23CS1913	Visual Effects	PE	3	3	0	0	3
6.	23CS1914	3D Printing and Design	PE	3	3	0	0	3
7.	23CS1915	Game Development	PE	3	3	0	0	3
8.	23CS1916	Augmented Reality and Virtual Reality	PE	3	3	0	0	3

VERTICAL 6: ADVANCED ARTIFICIAL INTELLIGENCE

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23AD1920	Knowledge Engineering	PE	3	3	0	0	3
2.	23AD1912	Health Care Analytics	PE	3	3	0	0	3
3.	23AD1906	Engineering Predictive Analytics	PE	3	3	0	0	3
4.	23AD1903	Soft Computing	PE	3	3	0	0	3
5.	23AD1915	Game Theory	PE	3	3	0	0	3
6.	23AD1921	Optimization Techniques in Machine Learning	PE	3	3	0	0	3
7.	23AD1917	Robotic Process Automation and Development	PE	3	3	0	0	3
8.	23AD1907	Ethics and AI	PE	3	3	0	0	3

VERTICAL 7: NETWORKING

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	23CS1917	Communication Theory	PE	3	3	0	0	3
2.	23CS1918	Network Design and Programming	PE	3	3	0	0	3
3.	23IT1917	Network Management	PE	3	3	0	0	3
4.	23IT1918	Wireless Technologies	PE	3	3	0	0	3
5.	23CS1919	Wireless Adhoc and Sensor Networks	PE	3	3	0	0	3
6.	23IT1919	Protocols and Architectures for Wireless Sensor Networks	PE	3	3	0	0	3
7.	23IT1920	Software Defined Networks	PE	3	3	0	0	3
8.	23CS1920	Next Generation Networks	PE	3	3	0	0	3

SEMESTER – I

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

COURSE OBJECTIVE:

- 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 techniques of integration.
- To introduce integral ideas in solving areas, volumes and other practical problems.

UNIT I MATRICES 9+3

Eigen values and Eigenvectors of a real matrix - Characteristic equation -Properties of Eigen values 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 OUTCOME(S):

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

CO1 Determine the Eigen values and Eigen vectors, diagonalization of a matrix, symmetric matrices, positive definite matrices and similar matrices.
CO2 Apply limit definition and rules of differentiation to differentiate functions.
CO3 Apply the knowledge of Maxima and Minima, Jacobian,Taylor series and apply the problems involving Science and Engineering.
CO4 Apply the knowledge of Integration by parts, Trigonometric integrals.
CO5 Apply the knowledge of Trigonometric substitutions, Integration of rational functions by partial fraction.
CO6 Apply the knowledge of Area enclosed by plane curves, Change of variables in double integrals, Triple integrals, Volume of Solids.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, NewDelhi,44thEdition,2018.
2. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 9thEdition, NewDelhi,2015.
3. Bali N., Goyal M. and Walkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvtt. Ltd.,), New Delhi, 7th Edition, 2015.

REFERENCE BOOKS:

1. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt.Ltd.Chennai, 2007.
2. Srimantha Pal and 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, John Wiley sons, 10th Edition, 2015.
5. Sivaramakrishna Dass, C. Vijayakumari, "Engineering Mathematics", Pearson
6. Education India, 4th Edition 2019.
7. Sundar Raj. M and Nagarajan. G , "Engineering Mathematics-I",3rdEdition, 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

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

- 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 accessfile-Example Program:Transaction processing using random accessfiles–Command line arguments

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

Upon successful completion of the course student 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.
- **CO6** Design applications using sequential and random access file processing.

TEXTBOOKS:

1. ReemaThareja,—ProgramminginC,OxfordUniversityPress,SecondEdition,2016
2. Kernighan,B.WandRitchie,D.M,—TheCProgramminglanguage,SecondEdition, PearsonEducation,2006

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel,— CHow to Program, Seventh edition, Pearson Publication, 2015
2. Juneja,B.Land Anita Seth,—Programming in C, CENGAGE Learning India pvt.Ltd.,2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, First Edition,Oxford UniversityPress,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 with C", McGraw-HillEducation,1996.

WEB REFERENCES:

1. https://github.com/tscheffl/ThinkC/blob/master/PDF/Think-C.pdf
2. https://freecomputerbooks.com/langCBooks.html

ONLINE COURSES/RESOURCES:

1. https://www.programiz.com/c-programming
2. https://www.tutorialspoint.com/cprogramming/index.htm
3. https://www.javatpoint.com/c-programming-language-tutorial
4. https://www.geeksforgeeks.org/c-programming-language/
5. https://en.wikibooks.org/wiki/C_Programming
6. https://www.cprogramming.com/tutorial/c-tutorial.html?inl=hp

CO – PO – PSO MAPPING

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

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

COURSE OBJECTIVE:

- 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 and C Savitha. English for Technical Communication Delhi: CUP, 2019.
2. Board of Editors. English for Engineers and Technologists Volume 1 Orient Black Swan Limited, 2020

REFERENCE BOOKS:

1. Board of Editors. Using English-A course book for Undergraduate engineers and Technologists Orient Black SwanLimited, 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,L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning ,USA:2007
4. 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/ word formation
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018 0316 21.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/2018/02/2018 031621.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 OUTCOME(S):

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**
CO2								**3**	**3**		**2**			**3**
CO3								**3**	**3**		**2**			**2**
CO4								**3**	**3**		**2**			**2**
CO5								**2**	**3**		**2**			**2**
CO6								**3**	**3**		**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 %**

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

COURSE OBJECTIVE:

- To impart knowledge in basic concepts of physics relevant to engineering applications
- 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 21ehavior- 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: homojunction and heterojunction**– 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 ofcontinuity — 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 PERIODS

LIST OF EXPERIEMENTS

1. Determination of Moment of Inertia of the disc and Rigidity Modulus of the material of 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 size determination
   (ii) Determination of Numerical Aperture and Acceptance angle of an Optical Fibre
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
8. Determine the band gap energy of a semiconductor.

PRACTICAL : 30 PERIODS
TOTAL : 60 PERIODS

TEXT BOOKS:

1. AjoyGhatak, Optics, 5th Ed., Tata McGraw Hill, 2012
2. Arthur Beiser, ShobhitMahajan and S RaiChoudhury, 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 of science and engineering http://www.springer.com/978-3- 319- 50650-0

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 Modern Physics'. 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 OUTCOME(S):

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 Have 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, nanoscience 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			2					1	2		
CO2	3	3	2			2					1	2	2	
CO3	3	3	2			2					1	2		2
CO4	3	3	1			2					1	2	2	2
CO5	3	3	1			2					1	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 %**

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

COURSE OBJECTIVE:

- 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 itsFunctional 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. 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.

REFERENCE BOOKS:

1. Del Toro, Electrical Engineering Fundamentals Pearson Education, NewDelhi, 2007
2. 2.Smarjit Ghosh,Fundamentals of Electrical and Electronics Engineering, 2nd Edition 2007
3. 3.Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things– Key applications and Protocols‖, Wiley, 2012

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:

   (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

3. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

4. Design of Half wave Rectifier & Full wave Rectifier

5. Simulation of following circuits using suitable software

   (i)Seven segment LED display

   (ii)Stepper Motor control

   (iii)Traffic Light Control

6. 2D & 3D Electrical wiring Model using suitable Software.

SOFTWARE REQUIRED: Keil/Proteus/Fusion 360

PRACTICAL: 30 PERIODS
TOTAL: 75 PERIODS

COURSE OUTCOME(S):

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 AC Machines

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		2	2	2	1	1					1	2		
CO2	3	2	2	2	1	1					1	2		
CO3	3	2	2	2	1	1					1	2		
CO4	3	2	2	2	1	1					1	2	2	
CO5	3	2	2	2	1	1					1	2	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 OBJECTIVE:

- To write, test, and debug simple C programs.
- To implement C programs with conditional and looping statement
- To develop applications in C using strings, pointers, functions.
- To implement C programs with structures and union.
- To develop applications in C using file processing
- To develop an application in real time situation

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 everycenturion 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 based on 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 asshown below <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are above theaverageheight.
8. Given a string —a$bcd./fg‖ find its reverse without changing the position of special characters. (Example input:a@gh%;j and output:j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbersusing userdefined 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 using recursion call.

13. Generate salary slip of employees using structures and pointers.
14. 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
    e) Count number of words, digits, vowels using pointers
    f) Add two matrices using Multidimensional Arrays with pointers
    g) Multiply two matrices using pointers
    h) Multiply two numbers using Function Pointers
15. Compute internal marks of students for five different subjects using structures and functions.
16. Program to demonstrate the difference between unions and structures
17. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
18. Count the number of account holders whose balance is less than the minimumbalance usingsequential access file.
19. MINI PROJECT
    Create a Railway reservation system with the following modules
    a) Booking
    b) Availability Checking
    c) Cancellation
    d) Prepare chart

TOTAL:60 PERIODS

COURSE OUTCOME(S):

Upon successful completion of the course, the students 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 structures and 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
6. https://www.tutorialspoint.com/learn_c_by_examples/simple_programs_in_c.htm

CO-PO-PSO MAPPING

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

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 - ClassicalLiterature in Tamil — Secular Nature of Sangam Literature — Distributive Justice inSangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land Bakthi Literature Azhwars and N ayanmars - Forms of minor Poetry - Development of Modernliterature 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 NATIONAL MOVEMENT AND INDIANCULTURE 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 மேலாண்மைக் கருத்துக்கள் - 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 - சிற்பக் கலை** **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் 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, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

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

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

UNIT –V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் 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 Nadu 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 – II

23MA1201	COMPLEX VARIABLES AND LAPLACE TRANSFORM	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To solve the linear differential equations with constant coefficients.
- To understand the concepts of vectors as it gives the insight into how to trace along the different types of curves.
- To understand the standard technique of a complex variable theory in particular of analytics functions and its mapping property
- Complex variable techniques have been used in a wide area of engineering
- To apply the basic ideas of Laplace Transform to solve the problems in engineering and technology

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients -Method of variation of parameters — Homogenous equation of Euler's and Legendre's type — System of simultaneous first order linear differential equations with constant coefficients.

UNIT II VECTOR CALCULUS 9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration: Green's theorem in a plane - Gauss divergence and Stokes' theorem (excluding proofs) – Simple applications involving cubes, rectangular parallelepiped, sphere and cylinder**.**

UNIT III ANALYTIC FUNCTIONS 9+3

Functions of a complex variable–Analytic functions -Cauchy-Riemann equations – Necessary and sufficient conditions–Harmonic and orthogonal properties of analytic function — Harmonic conjugate — Construction of analytic functions by Milne Thomson method– Conformal mapping: w =z+c,cz,1/z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+3

Line integrals- Cauchy's integral theorem-Cauchy's integral formula - Singularities — Residues– Cauchy's residue theorem - Taylor's and Laurent's series expansions — Application of residue theorem for evaluation of real definite integrals — Use of circular contour and semi- circular contour (excluding poles on the real axis).

UNIT V **LAPLACE TRANSFORM** **9+3**

Laplace transform: Sufficient conditions for existence — Transform of elementary functions — Basic properties–Transforms of derivatives and integrals of functions-Derivatives and integrals of transforms - Transforms of unit function, unit step function and unit impulse functions — Transforms of periodic functions– Initial and final value theorems. Inverse Laplace transforms: Convolution theorem–Solution of linear ODE of second order with constant coefficients using the techniques of Laplace transformation.

TOTAL :60 PERIODS

COURSE OUTCOME(S):

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

CO1 Apply various techniques in solving differential equations.

CO2 Identify the 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.

CO3 Understand the concepts of analytic functions, harmonic functions and conformal mapping.

CO4 Determine the types of singularities, residues and contour integration.

CO5 S olve differential equations using Laplace transform.

TEXT BOOKS:

1. Grewal B.S.,- "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition,2018.
2. B.V. Ramana, "Higher Engineering Mathematics", McGraw Hill Education, India,2018.
3. Bali N., Goyal M. and Walkins C., "Advanced Engineering Mathematics", Firewall.

REFERENCE BOOKS:

1. Kreyszig Erwin, Advanced Engineering Mathematics, John wiley and Sons,10th Edition, New Delhi.
2. Jain R.K. and Iyengar S.R.K., Advanced Engineering Mathematics, NarosaPublications, New Delhi, 3rd Edition, 2007.
3. O'Neil, P.V. Advanced Engineering Mathematics, Cengage Learning India Pvt. Ltd, New Delhi, 2007.
4. 4.Sastry, S.S, Engineering Mathematics, Vol.I & II, PHI LearnigPvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wyile, R.C. and Barrett, L.C., Advanced Engineering Mathematics, Tata McGraw Hill Education Pvt Ltd, 6thEdition, New Delhi, 2012.

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma69
2. https://onlinecourses.nptel.ac.in/noc21_ma57

CO – PO - PSO MAPPING

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

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

COURSE OBJECTIVE:

- 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 AND CONTROL 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 in loops, 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.Illustrativeprograms: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 comprehensionsTuples: 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 and minimum 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 Python Programming, Tk Widgets, Tkinter examples. Python programming with IDE. Illustrative programs: create a GUI marksheet,c alendar,file explorer using Tkinter,

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

- **CO1** Illustrate conditionals and loops for solving problems using Python programs.
- **CO2** Express proficiency in the handling of strings and functions
- **CO3** Apply Python lists, tuples, dictionaries, sets etc to Represent compound data
- **CO4** Compare and contrast reading and writing data from/to files and handle exceptions in Python programs.
- **CO5** Experiment with python packages in data analysis and design GUI
- **CO6** Build real time applications using problem solving concepts in python.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018

2. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction 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	2	2	2
CO6	2	3	3	1	2						1	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 %

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

COURSE OBJECTIVE:

- 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 0 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 is inclined 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 one of 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 OUTCOME(S):

Upon successful 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 Apply and Draw the sections and development of the surfaces of objects

CO4 Apply and Sketch the **i**sometric projections and intersection of curves of simple solids.

CO5 Analyze and Sketch 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/

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			1						2	2		
CO2	3	3			1						2	2		
CO3	3	3			1						2	2	2	
CO4	3	3			1						2	2	2	
CO5	3	3			1						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 %

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

COURSE OBJECTIVE:

- To develop linguistic and strategic competence in workplace context and to enhance language proficiency and thereby the employability of budding engineers and technologists.
- 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 and developing 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 Black Swan 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 Principles and 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.pdf
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

REFERENCE BOOKS:

1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
2. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and 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.

COURSE OUTCOME(S):

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

CO1 Recognise the need for life skills; apply them to different situations, the basic 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 communication that facilitate their ability to work collaboratively with others.

CO4 Communicate effectively & appropriately in real life situation and enhance student'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**
CO2								**3**	**3**		**2**			**3**
CO3								**2**	**3**		**2**		**2**	**3**
CO4								**2**	**3**		**2**		**3**	**3**
CO5								**2**	**3**		**2**			**3**
CO6								**3**	**1**		**3**		**3**	**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 %**

23CS1201	WEB APPLICATION DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE :

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice mark-up languages
- To introduce tools for creating interactive web pages
- To understand and practice web development using wordpress.

UNIT - I WEB ESSENTIALS 4

Clients, Servers and Communication – The Internet – Understanding the difference between internet and intranet– Basic Internet protocols – World Wide Web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers**.**

UNIT - II HTML 5.0 6

HTML5 — Tables — Lists — Image — Iframes — HTML5 control elements — Semantic elements –Drag and Drop – Canvas – SVG – Audio – Video controls.

UNIT - III CASCADING STYLE SHEETS 6

CSS3 — Inline, embedded and external style sheets — Rule cascading — Inheritance — Backgrounds — Border Images — Colors — Shadows — Text — Transformations – Transitions –Animations- Media Query.

UNIT - IV WORDPRESS FUNDAMENTALS 7

Introduction to CMS And WordPress, WordPress Installation ,WordPress Admin Creating Users, User Rights & Roles

UNIT - V WORDPRESS DEVELOPMENT 7

Creating Page and Post in Wordpress, WordPress Themes, Plugins , Menus, Widgets, SEO.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Scobey, Pawan Lingras, “Web Programming and Internet Technologies- An ECommerce Approach”, Jones & Bartlett Publishers, 2020
2. Brian Messenlehner, Jason Coleman, Building Web Apps with WordPress: 2019

REFERENCE BOOKS:

1. Andreas Maurer, HTML5 & CSS3: A Step-by-Step guide for beginners to build and design responsive and engaging websites with html5 and css3 , Kindle Edition,2020.
2. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program,Prentice Hall, 2011.
3. Gopalan N.P. and Akilandeswari J. —Web Technology, Prentice Hall of India, 2011.
4. Andreas Maurer, HTML5 & CSS3: A Step-by-Step guide for beginners to build and design responsive and engaging websites with html5 and css3 , Kindle Edition,2020.

WEB REFERENCES:

1. https://www.brainkart.com/article/Web-Essentials_10223/
2. https://developer.mozilla.org/en-US/docs/Web/HTML/Reference
3. https://developer.wordpress.org/reference

LIST OF EXPERIMENTS

1. Create a web page with the following using HTML
   a. To embed a map in a web page
   b. To fix the hot spots in that map
   c. Show all the related information when the hot spots are clicked.

2. Create a Personal blog design using HTML Multimedia elements and CSS elements - (Audio, Video, Iframe, Image, External CSS for Look and Feel)

3. Create your own Resume using HTML 5 Tags.Add Styles to your Resume using CSS 3Properties and add CSS3 Animation to your profile

4. Create a web page with the following.
   1. Cascading style sheets.
   2. Embedded style sheets.
   3. Inline style sheets. Use our college information for the web pages.

5. Create a website for a small business using Wordpress

6. Create a course website using Wordpress

7. **Mini Project** : Suggested Topics(but not limited to)
   - Survey Form
   - Quiz Game
   - Event Website

TOTAL: 30 PERIODS

COURSE OUTCOME(S):

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

CO1 Recall the concept of Internet and basic Internet Protocols

CO2 Understand the basic website design using HTML

CO3 Apply CSS to design an attractive webpage

CO4 Analyze the essential technologies for website development.

CO5 Evaluate Word press Installation and administration

CO6 Build web sites using wordpress tool

CO-PO-PSO MAPPING

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

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

COURSE OBJECTIVE:

- 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 of the 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)

1. Dice roll simulator
2. Guess the number game
3. Random password generator

TOTAL: 60 PERIODS

COURSE OUTCOME(S):

Upon 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 Develop programs using string operations.

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

CO – PO – PSO MAPPING

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

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 OBJECTIVE:

- To impart essential problem solving skills through general problem solving concepts.
- To provide basic knowledge on programming essentials using C as implementation tool.
- 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: 30 PERIODS

COURSE OUTCOME(S):

Upon successful completion of the course student will be able to**:**

CO1 Propose solutions for a given problem.

CO2 Infer the fundamental programming elements in C language and learn to apply basic 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, Pearson Publication,2016.

REFERENCES 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

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

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) – Graffition Potteries.

UNIT–II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age –Building materials and Herostones 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 and gold-Coins as source of history - Minting of Coins — Beads making-industries Stone beads
-Glass beads -Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone 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 ScientificTamil-Tamilcomputing–DigitalizationofTamilBooks– Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries –Sorkuvai Project.

TOTAL : 15 PERIODS

24TA1201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

UNIT – I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

UNIT – II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் 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 நீர்பாசனத் தொழில்நுட்பம் 3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - 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 – (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 Nadu 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

23MA1301	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

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 COMBINATORICS 9+3

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 – Graphs isomorphism – Connectivity – Euler and Hamiltonian paths.

UNIT - IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism – Normal subgroup and cosets – Lagrange 's theorem-Definitions and examples of Rings and Fields.

UNIT - V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems — Sub lattices — Direct product and homomorphism — Some special lattices — Boolean algebra.

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

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

CO1 Apply concept of Predicate Calculus in computer science like design of computing machines, artificial intelligence, and have the knowledge to test the logic of a program.

CO2 Understand the concepts of the counting principles

CO3 Analyze graph models, algorithms like Dijkstra's and properties such as connectivity to solve graph-related problems in real life problems.

CO4 Classify and apply algebraic structures such as groups, rings, and fields to evaluate and solve abstract algebra problems.

CO5 Examine the properties of lattices and Boolean algebra to simplify logical expressions and design digital systems.

TEXT BOOKS:

1. Rosen, K.H., Discrete Mathematics and its Applications, 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
3. Veerarajan. T, Discrete Mathematics: with graph theory and combinatorics, McGrawHill Education (India) Pvt. Ltd. 2007.

REFERENCE BOOKS:

1. Grimaldi, R.P. Discrete and Combinatorial Mathematics: An Applied Introduction, 4th Edition, Pearson Education Asia, Delhi,2007.
2. Lipschutz, S. and Mark Lipson., Discrete Mathematics, Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T.Discrete Mathematics with Applications, Elsevier Publications ,2006.

CO – PO – PSO MAPPING

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

23CS1301	DIGITAL PRINCIPLES AND COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To learn to design digital circuits using simplified Boolean functions
- To design Combinational Logic Circuits
- To gain knowledge on designing Sequential Logic Circuits
- To explore the basic structure and operations of a computer
- To understand Memory and Input-output Systems

UNIT- I BOOLEAN ALGEBRA AND LOGIC GATES 9

Number Systems – Arithmetic Operations – Binary Codes- Boolean Algebra and Logic Gates – Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Simplification of Boolean Functions using Karnaugh Map -- Quine McCluskey Method – Logic Gates – NAND and NOR Implementations.

UNIT- II COMBINATIONAL LOGIC CIRCUITS 9

Combinational Circuits – Analysis and Design Procedures – Binary Adder-Subtractor – Decimal Adder — Binary Multiplier — Magnitude Comparator — Decoders — Encoders — Multiplexers — Demultiplexers.

UNIT- III SEQUENTIAL LOGIC CIRCUITS 9

Sequential Circuits - Flip-Flops: RS, D, JK, and T - Shift registers-Counters.

UNIT- IV BASIC STRUCTURE OF A COMPUTER 9

Basic operational concepts, Performance, Operations, Operands of the computer hardware, Instructions representation, Decision making, Logical operations, Addressing modes.

UNIT- V MEMORY , I/O & PARALLEL PROCESSING 9

Memory Hierarchy - Cache Memory – Accessing I/O Devices – Direct Memory Access- Parallel processing challenges – Flynn's Classification – SISD, MIMD, SIMD, SPMD, and Vector Architecture.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Relate different number systems and binary codes.
CO2 Explain the basic structure of computers, operations and instructions.
CO3 Build digital circuits using simplified Boolean functions.
CO4 Design and realize simple combinational logic circuits.
CO5 Evaluate the characteristics and working of various Flip-Flops.
CO6 Compare and contrast memory hierarchies, I/O systems and Parallel processing.

TEXTBOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson Education, 2018.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.

REFERENCE BOOKS:

1. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2018.
2. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013.
3. William Stallings, Computer Organization and Architecture – Designing for Performance, Tenth Edition, Pearson Education, 2016.
4. Govindarajalu, Computer Architecture and Organization, Design Principles and Applications, Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

WEB REFERENCES:

1. https://www.javatpoint.com/digital-electronics
2. https://www.tutorialspoint.com/digital_circuits
3. https://www.tutorialspoint.com/Computer-System-Architecture
4. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

ONLINECOURSES/RESOURCES:

1. https://nptel.ac.in/courses/117105080
2. https://www.coursera.org/learn/digital-systems

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2									3		
CO2	3	2	2									3	2	
CO3	3	2	2									3	2	
CO4	3	1	1									3	2	
CO5	2	1	1									3		
CO6	2	1	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%				60 %

23CS1302	DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To learn Linear Data Structures and their applications in problem solving
- To understand Non Linear Data Structures - Trees and their applications in problem solving
- To understand Non Linear Data Structures - Graph and their implementations.
- To learn to implement Hash and Heap functions
- To understand Internal and External Sort and Searching techniques.

UNIT- I LINEAR DATA STRUCTURES – LIST, STACK AND QUEUE 9

List ADT – Singly Linked List – Doubly Linked List – Circular Linked List – Applications of List: Manipulation on Polynomial – Stack ADT – Implementation of Stack – Applications of Stack: Balancing Symbols — Conversion of Infix to Postfix Expression — Expression Evaluation – Queue ADT – Circular Queue, Double Ended Queue – Applications of Queue.

UNIT- II NON LINEAR DATA STRUCTURES – TREES 9

Trees — Terminology and Properties — Binary Trees — Expression Trees and Threaded Binary Trees – Binary Search Tree – Operations in Binary Search Tree – Tree Traversals – AVL Trees – Operations in AVL Trees.

UNIT- III NON LINEAR DATA STRUCTURES – GRAPH 9

Representation of Graph – Graph Traversal: Breadth First Search (BFS), Depth First Search (DFS) - Bi-connectivity – Euler circuits – Topological Sort – Minimum Spanning Tree : Prim's and Kruskal's Algorithm – Single Source Shortest Path: Dijkstra's Algorithm.

UNIT- IV HASHING TECHNIQUES AND HEAP 9

Hash Functions – Open Hashing – Separate Chaining, Closed Hashing – Linear Probing, Quadratic Probing, Double Hashing, Random Probing, Rehashing, Extendible Hashing. Heaps – Min/Max Heaps – Operation on Heap – Binary Heaps.

UNIT- V SORTING AND SEARCHING TECHNIQUES 9

Sorting: Quick Sort — Shell Sort — Heap Sort — Bucket Sort — Merge Sort– Radix Sort — Analysis of Sorting Algorithms – Searching: Linear Search – Binary Search – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Identify the Linear Data Structures suitable to different problem solutions.

CO2 Understand Data Structures like Stack and Queue.

CO3 Implement different types of Trees and apply them to the problem solutions

CO4 Analyze Graph structures and various operations on graphs and their applicability

CO5 Experiment with Hash tables and Heaps.

CO6 Compare the various Sorting and Searching algorithms.

TEXTBOOKS:

1. Chandan Banerjee and Atanu Das, Data Structures and Algorithms in C and Python, Universities Press,2023.
2. Reema Thareja, “Data Structures Using C", 2nd Edition, OXFORD University Press, NewDelhi, 2016.

REFERENCE BOOKS:

1. Jean-Paul Tremblay and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2nd Edition, McGraw Hill, 2013.
2. Langsam, Augenstein and Tanenbaum, “Data Structures Using C and C++”, 2nd Edition, Pearson Education, 2015.
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education 4th Edition, 2014.
4. R. Kruse, C. L. Tondo and B. Leung, “Data Structures and Program Design in C”, 2nd Edition, Pearson Education, 2006.

WEB REFERENCES:

1. https://www.programiz.com/dsa
2. https://www.w3schools.in/data-structures/tutorials/
3. https://www.javatpoint.com/data-structure-tutorial
4. https://www.geeksforgeeks.org/data-structures/
5. https://en.wikibooks.org/wiki/Data_Structures
6. https://www.simplilearn.com/tutorials/data-structure-tutorial

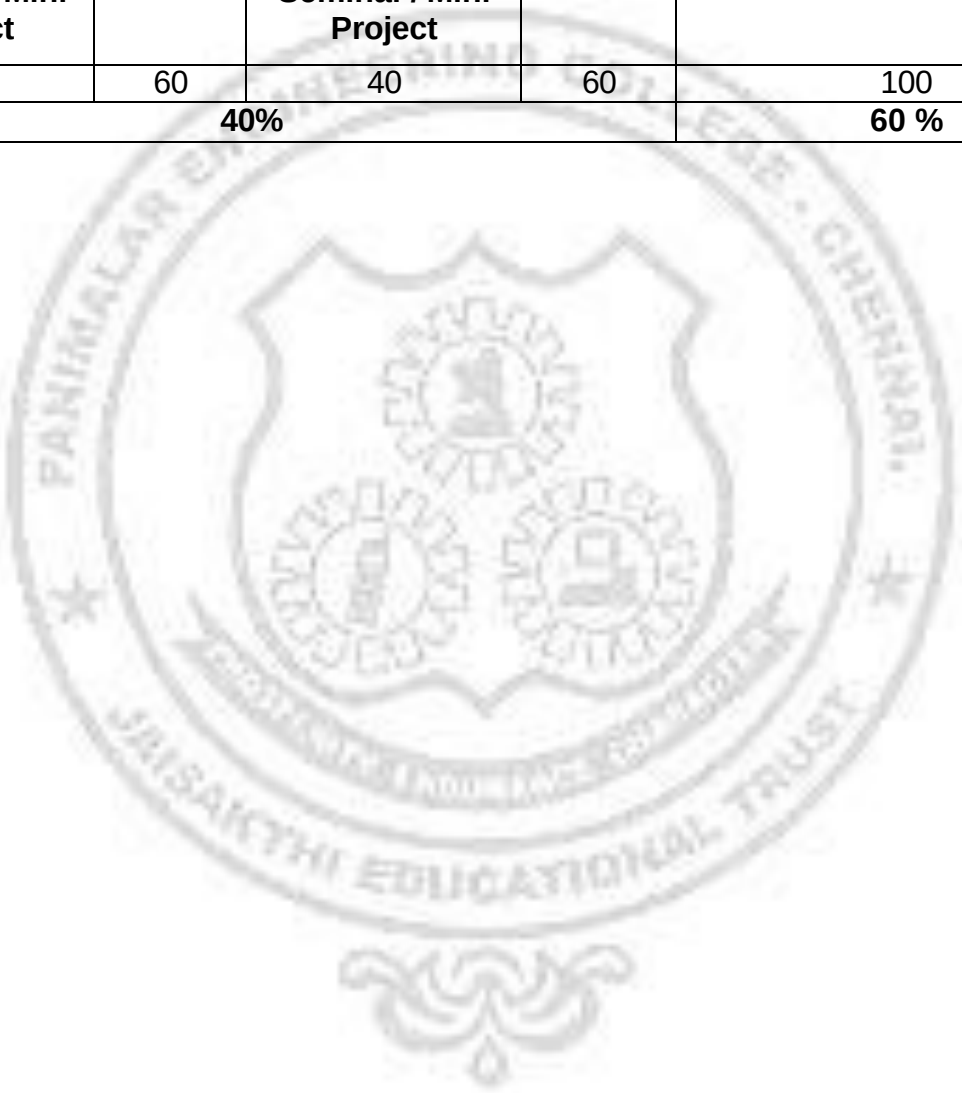
ONLINECOURSES/RESOURCES:

1. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
2. https://www.coursera.org/learn/data-structures
3. https://nptel.ac.in/courses/106102064
4. https://www.edx.org/learn/data-structures
5. https://www.udemy.com/topic/data-structures/
6. https://www.mygreatlearning.com/academy/learn-for-free/courses/data-structures-in-c

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2		1				2	3	1	1
CO2	3	3	3	3	2		1				2	3	1	1
CO3	3	3	3	3	2		1				2	3	1	1
CO4	3	3	3	3	2		1				2	3	3	2
CO5	3	3	3	3	2		1				2	3	3	2
CO6	2	2	2	2	2		1				2	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%				60 %



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

COURSE OBJECTIVE:

- To understand the role of a database management system, relational data model and successfully apply logical database design principles, including E-R diagrams.
- To learn the basic concepts and the applications of database systems.
- To learn SQL and construct queries using SQL.
- To know about Transaction processing and concurrency control.
- To understand 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, Relatio nal 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 and MongoDB: Advantages, Architecture, Data Models MongoDB Data types and CRUD Operations-Working of NoSQL Using MONGODB/CASSANDRA.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Identify and Recognize the Structure of a Database

CO2 Understand 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

TEXTBOOKS:

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.
2. Fundamentals of Database System, Ramez Elmasri and Shamkant B. Navathe, Pearson Publications, 7th Edition.
3. C. J. Date, A. Kannan and S. Swamy nathan, 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	3	2	2									3	2	2
CO2	2	1	1	1								2	1	1
CO3	2	1	1	1	1							3	2	1
CO4	2	1	1	1	1							2	2	1
CO5	2	1	1	1	1							2	1	1
CO6	2	1	1	1	2							2	1	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 %

23IT1301	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understanding Object Oriented Programming concepts and basic characteristics of Java
- Knowing the principles of packages, inheritance and interfaces
- Developing java application with threads and handling exceptions
- Understand String, I/O and Collection framework
- Learning generic programming and to build simple Graphical User Interfaces

UNIT - I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9

Object Oriented Programming - Abstraction — Objects And Classes - Encapsulation-Inheritance -Polymorphism- characteristics of Java-Java Environment- Java source File-compilation –Fundamental Programming Structures In Java –Data types-variables-operators-control flow- Defining Classes In Java — Constructors, Methods -Access Specifiers - Static Members - Arrays ,Javadoc Comments.

UNIT - II INHERITANCE, PACKAGES AND INTERFACES 9

Inheritance – Types of Inheritance-Super Keyword- Method Overrriding- Dynamic method Dispatch– Abstract classes and methods- Final classes-Object Class — Inner Class - Packages — Defining Packages — Finding Packages And CLASSPATH - Importing Packages - Interfaces — Defining an Interface, Implementing Interface and Extending Interfaces .

UNIT - III MULTITHREADING AND EXCEPTION HANDLING 9

Thread-Thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups - Exceptions - exception hierarchy - throwing and catching exceptions — built-in exceptions, creating own exceptions, Stack Trace Elements.

UNIT - IV STRING, I/O AND COLLECTION FRAMEWORK 9

Strings:String class, String Buffer Class-Input / Output Basics – Streams – Byte streams and Character streams — Reading and Writing Console — Reading and Writing Files- Collection Framework: ArrayList, Set, Map.

UNIT - V GENERIC PROGRAMMING AND EVENT DRIVEN PROGRAMMING 9

Generic Programming — Generic classes — Generic methods — Bounded Types — Restrictions and Limitations-Basics of event handling - event handlers - adapter classes - actions - mouse and key events –AWT - Introduction to Swing — layout management - Swing Components –Windows–Menus– Dialog Boxes.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Define clearly all the basic concepts of oops
CO2 Interpret simple JAVA programs by applying classes and objects
CO3 Implement the concepts of Inheritance, interfaces and packages.
CO4 Analyze real time problems with multithreading and exceptional handling concepts
CO5 Evaluate complex programs with the help of collection framework and I/O
CO6 Build applications by incorporating AWT and swing components

TEXT BOOKS:

1. Herbert Schildt, Java The complete reference, 11th Edition, McGraw Hill Education, 2019.
2. Cay S. Horstmann, Gary cornell, Core Java Volume –I Fundamentals, 11th Edition, Prentice Hall, 2018.

REFERENCE BOOKS:

1. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
2. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
3. Timothy Budd, Understanding Object-oriented programming with Java, Updated Edition, Pearson Education, 2000

WEB REFERENCES:

1. https://www.programiz.com/java-programming
2. https://www.w3schools.com/cpp/cpp_oop.asp
3. https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/
4. https://docs.oracle.com/javase/tutorial/java/concepts
5. https://www.javatpoint.com/java-oops-concepts

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs03/preview
2. https://www.udemy.com/topic/object-oriented-programming/
3. https://www.edx.org/course/object-oriented-programming
4. https://www.coursera.org/specializations/object-oriented-programming
5. https://www.coursera.org/courses?query=java

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	1	1	1	1	2	3		
CO2	3	3	3	2	3	1	1	1	1	1	2	3		
CO3	3	3	3	3	3	1	1	1	1	1	1	3	2	
CO4	3	3	3	3	3	2	1	2	1	2	1	3	3	
CO5	3	3	3	2	3	2	1	2	1	2	2	3	2	2
CO6	3	3	3	2	3	2	1	2	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 %**

23CS1311	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- To understand the basic Data Structures and their implementations.
- To gain knowledge in Linear Data Structures – Stack, Queue, Linked List.
- To explore about Non Linear Data Structures - Trees and Graphs
- To solve problems implementing appropriate data structures by understanding the strength and weakness of different Data Structures.
- To implement sorting and searching algorithms using relevant data structures

LIST OF EXPERIMENTS

1. Write a program to implement the Stack that performs the following operations
   a) Push
   b) Pop
   c) Peep
   d) Change
   e) Display
2. Write a program to Implementation the following Stack applications
   a) Balancing Parenthesis
   b) Conversion of Infix to Postfix Expression
   c) Evaluation of Postfix Expression
3. Write a program to implement the following operations on Circular Queue
   a) Insert an Element on to Circular Queue
   b) Delete an Element from Circular Queue
   c) Display the elements of Circular Queue
4. Write a program to implement the following operations on Singly Linked List
   a) Insert a node at the front of the Linked List
   b) Insert a node at the end of the Linked List
   c) Delete a First node of the Linked List
   d) Delete a node at the end of the Linked List.
5. Write a program to implement the following operations on Doubly Linked List
   a) Creation
   b) Insertion
   c) Deletion
6. Write a program to implement the following operations on Circular Linked List
   a) Creation
   b) Insertion
   c) Deletion
7. Write a program to implement the Polynomial arithmetic using Linked List.
8. Write a program for the following operations on Binary Search Tree (BST)
   a) Create a Binary Search Tree
   b) Delete an element in the Binary Search Tree
   c) Traverse the Binary Search Tree in Inorder, Preorder and Post Order
   d) Search the Binary Search Tree for a given element (KEY)
9. Write a program to perform the following operations into an AVL Tree
   a) Insert an element into an AVL tree
   b) Delete an element from an AVL tree
   c) Search for a key element in an AVL tree

10. Write a program to implement the following Graph Traversal Methods
    a) Breadth First Search
    b) Depth First Search
11. Write a program to implement Topological Sorting (Application of a Graph)
12. Write a program to implement Minimum Spanning Tree using the following algorithms
    a) Prim's Algorithm
    b) Kruskal's Algorithm
13. Write a Program to implement Single Source Shortest Path algorithm (Dijkstra's algorithm)
14. Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of M memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Write a Program that uses Hash function H: K —— > L as H(K)=K mod m (remainder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing
15. Write a program to implement Max/ Min Heap and its operations
16. Write a program that implements the following sorting
    a) Quick Sort
    b) Merge Sort
    c) Radix Sort
    d) Heap Sort
17. **MINI PROJECT (Suggested Mini Project Titles, but not limited to)**
    a) Dictionary using Binary trees
    b) Phone directory application using Doubly-linked lists
    c) Snake Game
    d) Chess Game
    e) Quiz Game
    f) Sudoku
    g) Traffic Analysis
    h) Memory Matching Game
    i) Crossword Puzzle
    j) Travel Planner (Graphs)
    k) Tic-Tac-Toe Game
    l) User Defined (Student Choice)

TOTAL:60 PERIODS

COURSE OUTCOME(S):

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

CO1 Identify the Abstract Data Type of Linked List and their applications.

CO2 Understand the concept of Linear Data Structures such as Stacks and Queues and its application.

CO3 Construct different types of Tree along with their operations and applications.

CO4 Solve problem involving Graphs and its applicability.

CO5 Evaluate the Heap & Hash Function and concepts of collision and its resolution methods.

CO6 Design efficient algorithms for Sorting and Searching.

WEB REFERENCES:

1. https://www.hackerrank.com/domains/data-structures
2. https://www.geeksforgeeks.org/data-structures/
3. https://www.codechef.com/learn/topic/data-structures-and-algorithms
4. https://www.javatpoint.com/data-structure-tutorial
5. https://www.programiz.com/dsa
6. http://www.java2s.com/example/java/data-structure/

CO – PO – PSO MAPPING

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

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 OBJECTIVE:

- 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 Command
- 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 OUTCOME(S):

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

CO1 Define the relationship between databases.
CO2 Understand various query execution such as relational constraints, joins, set operations, aggregate functions, trigger, views.
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://www.w3schools.com/sql/sql_quickref.asp
2. https://www.oracle.com/in/database/technologies/appdev/sql.html
3. https://www.tutorialspoint.com/mongodb/mongodb_database_references.htm

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		
CO2	2	1	1	1							2	3		
CO3	2	1	1	1	1						2	3	2	
CO4	2	1	1	1	1						2	3	2	
CO5	2	1	1	1	1						2	3		2
CO6	2	1	1	1	2						2	3	2	3

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

23IT1311	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- Building Software development skills using java programming for real-world applications.
- Understand and apply the concepts of classes, packages, interfaces, array list
- Understand and apply the concepts of inheritance and polymorphism
- Understand Exception handling and file processing.
- Develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1. Write a java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula.
2. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a java program that uses both recursive and non-recursive functions.
3. Write a java program for sorting a given list of names in ascending order
4. Write a program that prompts the user for an integer and then prints out all prime numbers up to that integer.
5. Write a Java program to Multiply two given matrices
6. Write a Java program that checks whether a given string is a palindrome or not.
7. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial).
8. 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.
9. 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.
10. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
11. Write a program to perform string operations using Array List. Write functions for the following
    a) Append - add at end
    b) Insert – add at particular index
    c) Search
    d) List all string starts with given letter
12. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). 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 print Area () that prints the area of the given shape.
13. Write a Java program to implement exception handling.
14. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.

15. 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.
16. Write a java program that correct implements of producer consumer program using the concept of inter thread communication
17. Write a program to implement Map.
18. Write a program to implement HashSet Class.
19. Write a java program to find the maximum value from the given type of elements using a generic function.
20. Write a java program that simulates a traffic light. The program lets the user to select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with “STOP “, “READY” or “GO” should appear above the buttons in selected color.
    Initially, it should not display any message.
21. Design a calculator using event-driven programming paradigm of Java using Scientific manipulations.
22. Develop a mini project for any application using Java concepts.

ADDITIONAL PROGRAMS

23. Design a class to represent a Student details include the Student ID, Name of the Student, Branch, year, location and college. Assign initial values using constructor. Calculate average of marks of 6 subjects and calculate attendance percentage.
24. Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism.
25. Write a program that creates three threads. First thread displays “Good Morning” every one second, the second thread displays “Hello” every two seconds and the third thread displays “Welcome” every three seconds.
26. Write a java programs to find factorial of a number. User is allowed to enter a number into the text field whose factorial is to be determined. On pressing the button the value of the text field is firstly converted into integer and then processed to find its factorial. The result will get displayed in another text field.(Hint: use swings).

TOTAL: 60 PERIODS

COURSE OUTCOME(S):

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

CO1 Understand to write basic programs in JAVA

CO2 Design simple JAVA programs by applying classes and objects

CO3 Implement the concepts of Inheritance, interfaces and packages.

CO4 Design real time problems with multithreading and exceptional handling concepts.

CO5 Evaluate complex programs with the help of collection framework and I/O

CO6 Build applications by incorporating AWT and swing components

TEXT BOOKS:

1. Herbert Schildt, Java The Complete Reference, 11th Edition, McGraw Hill Education, 2011.

REFERENCE BOOKS:

1. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
2. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
3. Timothy Budd, Understanding Object-oriented programming with Java, Updated Edition, Pearson Education, 2000

WEB REFERENCES:

1. https://www.programiz.com/java-programming
2. https://www.w3schools.com/cpp/cpp_oop.asp
3. https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/
4. https://docs.oracle.com/javase/tutorial/java/concepts
5. https://www.javatpoint.com/java- oops-concepts

CO – PO – PSO MAPPING

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

- 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. Stack ADT
5. Problems on Postfix and Infix expressions
6. Binary Tree Traversal
7. Binary Search Tree
8. B-Tree
9. Binary Heaps
10. Linear search algorithm and 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 OUTCOME(S):

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

CO1 Implement arrays and abstract data types for list.
CO2 Solve real world problems using appropriate linear data structures.

CO3 Apply appropriate tree data structures in problem solving.
CO4 Implement various searching and sorting algorithms.
CO5 Implement appropriate Graph representations and solve real-world applications.
CO6 Apply various hashing operations.

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,2023.
3. Dr.HarshBhasin,"DataStructureswithPython",BPBPublications,Delhi, 2023.
4. John Canning, AlanBroder, RobertLafore,``Data Structures & Algorithms in Python", Addison-Wesley Professional, 2022.
5. Y Daniel Liang,"Introduction To Python Programming And Data Structures",Global Edition 3rd Edition,Pearson Publications, 2022.

REFERENCE BOOKS:

1. Dr.Basant Agarwal,"Hands-On Data Structures and Algorithms with Python",3rdEdition, Packt Publishing, 2022.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2016.
3. Michael H.Gold wasser, Michael T. Goodrich,and Roberto Tamassia," Data Structures and Algorithms in Python",Wiley Publications ,2013.

ONLINE COURSES/RESOURCES:
1. https://www.codechef.com/practice.
2. https://www.javatpoint.com/data-structure-tutorial.
3. https://www.simplilearn.com/tutorials/python-tutorial/data-structures.
4. 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	2	2	3			1	1		2	3		
CO2	3	3	3	2	3			1	1		2	3	2	
CO3	3	3	3	3	3			1	1		2	3	2	
CO4	3	3	3	3	3			1	1	2	2	3	3	2
CO5	3	3	3	3	3			1	1	2	2	3	3	
CO6	3	3	3	3	3			1	1	2	2	3	2	

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

SEMESTER – IV

23MA1401	PROBABILITY AND STATISTICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important role in the field of agriculture.
- To introduce the basic concepts of solving algebraic and transcendental equations.

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 and linear regression– Central limit theorem for Independent Identically Distributed random variable(without proof).

UNIT III TESTING OF HYPOTHESIS 9+3

Statistical hypothesis - Large sample test based on Normal distribution for Proportion , single mean and difference of two means - Student'sttest for single mean and difference of two means, F test for Variance. Chi-square tests for independence of attributes and goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 9+3

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

UNIT V NUMERICAL SOLUTION OF EQUATIONS 9+3

Solution of algebraic and transcendental equations - Fixed point theorem (without proof)- Newton Raphson method - Solution of linear system of equations - Gauss elimination method - Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel.

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

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

CO1 Understand the basic concepts of one dimensional random variables and apply in engineering applications.

CO2 Apply standard distributions to solve real world problems.

CO3 Understand the basic concepts of two dimensional random variables and apply in engineering applications.

CO4 Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO5 Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO6 Understand the basic concepts and techniques of solving algebraic and

transcendental equations.

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers,10thEdition, New Delhi, 2015

REFERENCE BOOKS:

1. Veerarajan T, “Probability, Statistics and Random Processes with Queueing Theory”, McGraw Hill, 1st Edition, 2018.
2. Kandasamy, P., Thilagavathy ,K.,and Gunavathy,S., ‘Numerical Methods’, Chand and Co.,2007
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 8th Edition, 2014.
4. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
5. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum‘s Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

CO – PO – PSO MAPPING

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

23CS1401	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand protocol layering and physical level communication
- To be familiar with data link layer and media access control layer functions.
- To learn the various routing protocols used in network layer
- To understand the functions and protocols of the Transport layer.
- To realize the application Layer protocols and attacks.

UNIT- I INTRODUCTION AND PHYSICAL LAYER 9

Networks — Network Types — Protocol Layering — TCP/IP Protocol suite — OSI Model
— Physical Layer: Performance — Guided transmission media, Wireless transmission — Switching.

UNIT- II DATA-LINK LAYER & MEDIA ACCESS 9

Introduction — Link-Layer Addressing — Data-Link Layer Protocols — HDLC — PPP — Media Access Control — Wired LANs: Ethernet — Wireless LANs: IEEE 802.11, The Link- Layer Protocol for Cable Internet Access, Switched Local Area Networks.

UNIT- III NETWORK LAYER 9

Introduction — Network Layer Protocols: IPV4, ICMP, IPV6 — Unicast Routing Algorithms— Multicasting Basics , Routing for mobile hosts.

UNIT- IV TRANSPORT LAYER 9

Introduction — Transport Layer Protocols — User Datagram Protocol — Transmission Control Protocol —Multiprotocol Label Switching (MPLS).

UNIT- V APPLICATION LAYER 9

WWW and HTTP — FTP — Email –Telnet –SSH — DNS — Application layer attacks.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Define the basic layers and its functions in computer networks.
CO2 Understand the basics of how data flows from one node to another.
CO3 Apply routing algorithms to the network.
CO4 Analyze the difference between the TCP and UDP protocols
CO5 Evaluate the performance of a network.
CO6 Compare the principles of the different application layer protocols.

TEXTBOOKS

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2017(Reprint)
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.

REFERENCE BOOKS

1. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
2. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

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1. https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
2. http://www.cs.ccsu.edu/~stan/classes/CS490/Slides/Networks4-Ch4-4.pdf.
3. http://ecourses.vtu.ac.in/nptel/courses/Webcourse-contents/IIT-MADRAS/ComputerNetworks/pdf

CO – PO – PSO MAPPING

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

23CS1402	COMPUTATIONAL THINKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To learn to effectively use computers and technology to analyze and solve problems.
- To understand Brute force, divide and conquer, greedy algorithm design techniques
- To learn about Dynamic Programming and iterative improvement algorithm design techniques
- To understand Backtracking and Branch and Bound design technique.
- To impart knowledge on NP Classes, Approximation algorithms.

UNIT- I COMPUTATIONAL THINKING AND ALGORITHMS 9

Fundamentals of Computing — Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language-creating oral algorithms for everyday tasks - Asymptotic Notations and its properties -Best case, Worst case and average case analysis-Mathematical analysis for Recursive and Non-recursive algorithms.

UNIT- II ALGORITHM DESIGN TECHNIQUES - I 9

Brute Force : String Matching, Selection sort, **Exhaustive Search** - Travelling Salesman Problem - Knapsack Problem - Assignment problem, **Divide and Conquer Methodology** - Binary Search - Merge sort - Quick sort- Strassen‘s Matrix Multiplication, **Greedy Technique**: Container loading problem — Minimum spanning tree: Prim‘s algorithm and Kruskal‘s Algorithm-Huffman Trees.

UNIT- III ALGORITHM DESIGN TECHNIQUES - II 9

Dynamic programming: - Principle of optimality - Computing a Binomial Coefficient — Floyd‘s algorithm - Multi stage graph - Optimal Binary Search Trees - Knapsack Problem**, Iterative Improvement :** The Maximum-Flow Problem : Ford-Fulkerson algorithm - Stable Marriage algorithm.

UNIT- IV BACKTRACKING AND BRANCH AND BOUND ALGORITHMS 9

Backtracking - n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem - Graph Coloring Problem, **Branch and Bound**: Assignment problem - Knapsack Problem - Travelling Salesman Problem.

UNIT- V P,NP-CLASSES AND APPROXIMATION ALGORITHM 9

Tractable and intractable problems : P, NP NP- Complete and NP Hard Problems, **Approximation Algorithms for NP-Hard Problems:** Travelling Salesman problem - Knapsack problem.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Define problems in a way that allows computers to effectively address and solve them.

CO2 Classify algorithmic design approaches like divide and conquer, greedy techniques to effectively solve problems.

CO3 Apply algorithmic design methodologies such as dynamic programming, Iterative Improvement for problem-solving.

CO4 Categorize the state space search method as a strategy for solving problems.

CO5 Determine an approximation algorithm to solve problems.

CO6 Construct the classes P, NP,NP-Hard, NP Complete.

TEXTBOOKS:

1. S.Sridhar, Design and Analysis of Algorithms, Second Edition, Oxford Edition, 2023.
2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2018.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, 4th Edition, Prentice Hall of India,2022.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman,Data Structures and Algorithms, Reprint Edition, Pearson Education.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Computer Algorithms/C++ Orient Blackswan, 2nd Edition, 2019.
2. Harsh Bhasin, Algorithms Design and Analysis, Oxford university press, 2015.

CO – PO – PSO MAPPING

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

23IT1403	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understand the basic concepts and functions of operating systems.
- Understand concepts of Processes and analyze Scheduling algorithms
- Understand the concept of Deadlocks.
- Analyze various memory management schemes.
- Understand I/O management and File Systems.
- Familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT - I OPERATING SYSTEM OVERVIEW 9

Computer System Overview- Instruction Execution, Interrupts, Multiprocessor and Multicore Organization. Operating system overview - objectives and functions, Evolution of Operating System - Operating System Structures — Operating- system Services - System Calls - System Services - Operating system Structure — Building and Booting Operating system - Processes — Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication.

UNIT - II PROCESS MANAGEMENT 9

CPU Scheduling — Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Process Synchronization – The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock

UNIT - III STORAGE 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 - IV FILE SYSTEMS 9

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

UNIT - V MODERN OPERATING SYSTEMS 9

Linux System — Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS – iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System

TOTAL : 45 PERIODS

COURSE OUTCOME(S)

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

CO1 Understand the basics of Operating System.

CO2 Articulate the concepts of Process, Process scheduling, Process Synchronization, Deadlock.

CO3 Analyze the various memory management schemes.

CO4 Examine various File systems.

CO5 Describe Linux OS.
CO6 Elaborate Mobile OS like Android and iOS.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts,10th Edition, John Wiley and Sons Inc., 2018.
2. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition by Pearson,2017.

REFERENCE BOOKS:

1. Ramaz Elmasri,A. GilCarrick, David Levine,Operating Systems–A Spiral Approach, Tata McGraw HillEdition, 2010.
2. AchyutS. Godbole, AtulKahate, Operating System, McGraw Hill Education,Third Edition, 2017.PearsonEducation,2016.
3. GaryNutt, Operating Systems,Third Edition,PearsonEducation,2004.
4. Harvey M.Deitel, Paul JDeital, Davis RChoffnes, Operating System,Third Edition, Pearson Education,2004.
5. Daniel P Bovet and Marco Cesati, Understanding the Linux kernelll,3rdedition, O'Reilly,2005

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/106108101
2. https://www.coursera.org/learn/codio-intro-to-operating-systems-2-memory-management?specialization=codio-introduction-operating-systems.

CO – PO – PSO MAPPING

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

23AD1405	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To acquire skills in data preparatory and preprocessing steps.
- To understand the mathematical skills in statistics.
- To learn the tools and packages in Python for data science.
- To gain knowledge to understand classification and Regression Model.
- 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 I 9

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability — range — variance — standard deviation — degrees of freedom — inter quartile range.

UNIT- III DESCRIBING DATA II 9

Normal distributions — z scores — normal curve problems — finding proportions — finding 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 — multiple regression equations — regression toward the mean.

UNIT- IV 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 —— combining datasets — aggregation and grouping.

UNIT- V PYTHON FOR DATA VISUALIZATION 9

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings and density – three dimensional plotting – geographic data —— graph plotting using Plotly.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Demonstrate the skills of data inspecting and cleansing.
CO2 Determine the relationship between data dependencies using statistics.
CO3 Construct data using primary tools for data science in Python.
CO4 Represent the useful information using mathematical skills.
CO5 Apply the knowledge for data describing the Data.
CO6 Implement real time application using visualization tools.

TEXTBOOKS:

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 VanderPlas, Python Data Science Handbook, O'Reilly, 2016.

REFERENCE BOOKS:

1. Allen B. Downey, Think Stats: Exploratory Data Analysis in Python, Green Tea Press, 2014.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/data-science-fundamentals
2. https://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch

ONLINE COURSES/ RESOURCES:

1. https://www.coursera.org/learn/foundations-of-data-science
2. https://nptel.ac.in/courses/106106179

CO – PO – PSO MAPPING

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

23IT1401	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Identify and create the key activities in managing a software project and recognize different process model.
- Analyze the requirements for project development, design exploration, and mid-sized project estimation.
- Understand the fundamentals of object modelling.
- Design and differentiate Unified Process from other approaches using UML diagrams.
- Articulate the students to learn different design patterns in Object Oriented solutions for Real- real-world problems.
- Create and implement models of object-oriented software systems with testing and maintenance.

UNIT- I INTRODUCTION TO SOFTWARE ENGINEERING AND SOFTWARE REQUIREMENTS 6

Introduction - Definition-Characteristics of Software Engineers ,Systems Developer, Application Developer -Program and Software Product -SDLC-Process Models: Waterfall Model, RAD Model, Spiral Model, V-mode, lncremental Model, Agile Model, Iterative Model, Big-Bang Model, Prototype Model-Unified Process -Project Management- Tools- Gantt Chart-PERT Chart.

UNIT- II ANALYSIS OF SOFTWARE REQUIREMENTS AND ESTIMATION 6

Software Requirements: Functional and Non-Functional requirements- FURPS - Software Requirement Specification(SRS)- Characteristics for SRS- IEEE Standard Requirements Documents -Requirements Analysis- Data Flow Diagrams(DFD)-Estimation of Software Project- The COCOMO Model-Risk Management - Reliability Models- Jelinski and Moranda Model.**Case study: SRS for Credit card processing system.**

UNIT- III OBJECT ORIENTED SYSTEM ANALYSIS AND UML MODELING 6

An Engineering Perspective- Object Orientation Analysis(OOA)- Design(OOD)- Requirements Elicitation -Unified Modeling Language(UML)- Structure diagrams: Class diagrams - Component diagrams -Package diagram- Behavior diagrams: Activity diagram-Use Case diagram -State Chart diagram - Interaction diagrams: Sequence diagram-Collaboration diagram- Timing diagrams- When to use diagram- Analysis Object Model(Domain Model).**Case study: UML for Credit card processing system**

UNIT- IV OBJECT ORIENTED DESIGN PATTERNS 6

Design Principles - Designing objects with responsibilities- GRASP: -Creator - Information expert - Low Coupling -High Cohesion-Indirection -Polymorphism- Protected Variations- Pure Fabrication-Applying GOF design pattern- Design Patterns in Smalltalk MVC-Creational Design Patterns - Structural Design Patterns-Behavioral Design Patterns.

UNIT- V IMPLEMENTATION, TESTING AND MAINTENANCE 6

Mapping Design (Models) to Code – Testing : STLC-Type of Software Testing-Develop Test Cases and Test Plans- Usability – Deployment – Configuration Management - Software Quality - ISO 9000 Certification - SEICMM - PCMM -Six Sigma – Maintenance - Recent Trends in Object-oriented Software Development.

TOTAL: 30 PERIODS

COURSE OUTCOME(S):

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

CO1 Identify and select a suitable Process Model for the given problem and have a thorough understanding of various Software Life Cycle models.

CO2 Analyze the requirements of the given software project and produce requirement specifications.

CO3 Apply the knowledge of object-oriented modeling concepts and design methods with a clear emphasis on Unified Modelling Language for a moderately realistic object-oriented system.

CO4 Apply various software architectures, including frameworks and design patterns, when developing software projects.

CO5 Evaluate the software project using various Testing techniques.

CO6 Recognize the deployment strategy and Configuration Management strategies of the software project.

TEXTBOOKS:

1. Roger S. Pressman, Software Engineering: A Practitioner‘s Approach , McGraw Hill International Edition, Eighth Edition, 2019
2. Carol Britton and Jill Doake, A Student Guide to Object-Oriented Development.
3. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education,2008.

REFERENCE BOOKS:

1. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young Ph.D., Jim Conallen, Kelli A. Houston: Object-Oriented Analysis and Design with Applications,Addison-Wesley Professional, 2021.
2. Brahma Dathan,Object Oriented Analysis And Design,2nd Edn,Blackswan Private Limited.2021.

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1. https://www.simplilearn.com/tutorials/software-development-resources/software-engineering-materials
2. https://courses.cs.washington.edu/courses/cse403/01au/lectures
3. https://www.uml-diagrams.org/uml-object-oriented-concepts.html
4. https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_tutorial.pdf
5. https://kvrsoftwares.blogspot.com/2019/04/ooad-3-1-r16-ph.html

ONLINECOURSES/RESOURCES:

1. https://www.coursera.org/courses?query=software%20engineering
2. https://www.udemy.com/courses/development/software-engineering/
3. https://www.udemy.com/course/djeyamala-ooad-uml/
4. https://onlinecourses.nptel.ac.in/noc22_cs99/preview

LIST OF EXPERIMENTS **30 PERIODS**

Prepare the following documents for each experiment and develop the software using software engineering methodology.

1. Problem Analysis and Project Planning -Thorough study of the problem –Identify Project scope, Objectives and Infrastructure.
2. Software Requirement Analysis - Describe the individual Phases/modules of the project and Identify deliverables, Software requirements Specification SRS.
3. Data Modeling - Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams, State Transition Diagram, Component and deployment diagrams.
4. Software Development and Debugging – Implement the design by coding.
5. Software Testing - Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.

List of Projects:

1. Credit card processing
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Passport automation system.
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management System
14. Library Management System
15. Student Information System

SOFTWARE REQUIRED:

1. Argo UML
2. Java-Net beans
3. Oracle-Database

REFERENCE BOOKS:

1. Gerardus Blokdyk (Ebook) -" UML A Complete Guide ", Publisher, Emereo Publishing, 2020 Edition
2. Sparx Systems - User Guide Series :"Unified Modeling Language(UML)"- Enterprise Architect,2022 .

WEB REFERENCES:

1. https://creately.com/blog/diagrams/uml-diagram-types-examples/
2. https://venngage.com/blog/uml-diagram-examples/
3. https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-class-
4. diagram-tutorial/
5. https://sparxsystems.com/resources/user-guides/16.0/model-domains/uml-models.pdf

CO – PO – PSO MAPPING

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

23CS1411	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- To understand and apply a range of network commands to configure, troubleshoot, and manage network devices effectively.
- To explore various flow control algorithms used in networking protocols
- To gain practical skills in programming with TCP and UDP sockets
- To learn to utilize network simulation tools to model and analyze network behavior,
- To apply routing protocols within network simulation tools to design, configure, and evaluate network

LIST OF EXPERIMENTS

1. a) Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute.
   b) Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a code for implementing Stop and Wait Flow Control Technique.
3. Write a code for implementing Sliding Window Flow Control Technique.
4. Write a code for simulating ARP / RARP protocols.
5. Write a code for simulating of error correction code (like CRC).
6. Write a code using TCP sockets for implementing Echo client and Echo server.
7. Write a code using TCP sockets for implementing Chat Client and Chat Server
8. Write a code using TCP sockets for implementing File Transfer between client and server.
9. Write a HTTP web client program to download a web page using TCP sockets.
10. Simulation of DNS using UDP sockets.
11. Study of Network simulator (NS).
12. Simulation of Congestion Control Algorithms using NS.
13. Simulation of Distance Vector Routing algorithm.
14. Simulation of Link State Routing algorithm.
15. Performance evaluation of Routing protocols using Simulation tool.

TOTAL:60 PERIODS

SOFTWARE REQUIRED : C / PYTHON / JAVA

COURSE OUTCOME(S):

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

CO1 Implement various protocols using TCP and UDP.
CO2 Compare the performance of different transport layer protocols.
CO3 Use simulation tools to analyze the performance of various network protocols..
CO4 Analyze the routing algorithms.
CO5 Develop the algorithms for flow control and congestion control
CO6 Implement error correction codes.

WEB REFERENCES:

1. https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
2. https://www.coursera.org/learn/illinois-tech-computer-networking
3. https://onlinecourses.nptel.ac.in/noc22_cs19/preview

CO – PO – PSO MAPPING

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

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

23AD1413	FOUNDATIONS OF DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- Understanding the python libraries for data science.
- Understanding the basic Statistical and Probability measures for data science.
- Learning descriptive analytics on the benchmark data sets.
- Applying correlation and regression analytics on standard data sets.
- Presenting and interpreting data using visualization packages in Python.

LIST OF EXPERIMENTS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Create an empty and a full NumPy array.
3. Program to remove rows in Numpy array that contains non-numeric Values.
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
    a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
    b. Bivariate analysis: Linear and logistic regression modeling
    c. Multiple Regression analysis
    d. Also compare the results of the above analysis for the two data sets
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. Program to find the variance and standard deviation of set of elements.
9. Write a Python program to draw line charts of the financial data of Alphabet Inc. between October 3, 2016 to October 7, 2016.
10. Program to plot a Correlation and scatter plots.
11. Program for Linear Regression and Logistic Regression.
12. Apply and explore various plotting functions on UCI data sets.
    a. Normal curves
    b. Density and contour plots
    c. Correlation and scatter plots
    d. Histograms
    e. Three dimensional plotting
13. Perform Mini Project on Fake News Detection.
14. Build an application to detect colors in the given picture using Basic Data Science.

TOTAL:60 PERIODS

COURSE OUTCOME(S):

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

CO1 Make use of the python libraries for data science

CO2 Execute the basic Statistical and Probability measures for data science.

CO3 Perform descriptive analysis on the benchmark data sets.

CO4 Implement correlation and regression analysis on standard data sets

CO5 Present and interpret data using visualization packages in Python

CO6 Implement data Science concept to develop small application.

REFERENCES:

1. Jake Vander Plas, “Python Data Science Handbook”, O’Reilly, 2016.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
3. Data Science From Scratch: First Principles with Python, Second Edition by Joel Grus, 2019

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	3		
CO2	3	2	2		1				1	3	2	3	2	
CO3	3	2	1		1				1	1	1	3	2	
CO4	2	3	1						3	2	3	3	2	
CO5	1	2	3		1				1	3	1	3		2
CO6	2	2	2		1				2	2	2	3	2	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 OBJECTIVE:

- To understanding Java Fundamentals.
- To develop proficiency in flow control statements and Understand the usage of arrays and var-arg types
- To exploring Object-Oriented Programming Concepts through Java Programming
- To develop programs on Exception handling through Java Programming
- To 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: 30PERIODS

COURSE OUTCOME(S):

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

CO1 Understand the fundamental programming elements of Java and learn to apply basic control structures in Java.

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

TEXTBOOKS:

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.

REFERENCES 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

CO – PO – PSO MAPPING

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

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

SEMESTER – V

23CS1501	FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To grasp the fundamentals of JavaScript and the significance of the MERN stack.
- To comprehend the role of React in building front-end components.
- To explore the design challenges in developing backend components using Node.js and Express
- To gain insight into the advanced features of full stack development.
- To recognize the importance of using MongoDB as a database system

UNIT- I **OPEN SOURCE JAVASCRIPT AND BASICS OF MERN** **9**

JavaScript Fundamentals - Objects - Generators, advanced iteration - Modules - DOM tree - Node properties - browser events - Event delegation - UI Events -Forms, controls - Document and resource loading - Mutation observer - Event loop: micro tasks and macro tasks - MERN Components - React - Node.js - Express - MongoDB - Need for MERN - Server-Less Hello World - Server Setup - nvm - Node.js — npm.

UNIT- II **REACT** **9**

React Introduction - React ES6 - React Render HTML - React JSX - Components -React Classes - Composing Components - Passing Data - Dynamic Composition - React state - setting State - Async State Initialization - Event Handling Communicating from Child to Parent - Stateless Components - Designing components- React Forms - React CSS - React SaaS.

UNIT- III **NODE.JS AND EXPRESS** **9**

Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js Event Emitter - Frameworks for Node.js - Express.js Web App - Serving static Resource - Node.js Data Access - Express REST APIs - REST - Resource Based - HTTP Methods as Actions - JSON- Express - Routing - Handler Function - Middleware - The List API - Automatic Server Restart - Testing - The Create API - Using the List API - Using the Create API- Error Handling - Template Engine.

UNIT- IV **ADVANCED FEATURES AND MONGO DB** **9**

Modularization and Web pack - Routing with React Router - Forms - More Filters in the List API - UI Components - Update API - Delete API - React-Bootstrap - Bootstrap Installation - Navigation - Table and Panel - Forms - Alerts - Modals -Server Rendering - Basic Server Rendering - Handling State — Mongo DB Aggregate - Replication - Sharding - Creating backup — Deployment - Pagination - Higher Order Components - Search Bar - Google Sign In - Session Handling.

UNIT- V **CASE STUDY** **9**

Developing a Blogging Platform - Building a Social Media Platform Using React, Real-Time Chat Application, Real-Time Collaborative Document Editing Application.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1	Outline the Web Applications using Java stack technologies Software Development.
CO2	Understand Enterprise Applications using Java stack technologies.
CO3	Present Front end development using React.
CO4	Illustrate the Back end development Node.js and Express
CO5	Experiment fully working applications that can be used on cross-platforms.
CO6	Create a flexible, scalable, and high-performance database solutions using Mongo DB.

TEXTBOOKS :

1. Vasan Subramanian ,Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, A Press Publisher, 2019.

REFERENCE BOOKS :

1. Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott ,Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, FullStack publishing,2019.
2. TomaszDyl, Kamil Przeorski , Maciej Czarnecki ,Mastering Full Stack React Web Development Paperback , 2017.

WEB REFERENCES :

1. https://www.geeksforgeeks.org/courses/full-stack-node.
2. https://www.simplilearn.com/full-stack-developer-course-mern-certification-training.
3. https://www.scaler.com/courses/full-stack-developer/.

ONLINECOURSES/RESOURCES :

1. https://www.udemy.com/course/ultimate-web/.
2. https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer.

CO – PO MAPPING

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

23CS1502	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To know about the Chomsky hierarchy for organizing languages.
- To introduce concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships.
- To design grammars and recognizers for different formal languages.
- To understand undecidability and decide on languages that is undecidable.

UNIT- I FINITE AUTOMATA 9

Introduction to Formal Proof — Additional Forms of Proof — Inductive Proofs - Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-Deterministic Finite Automata (NFA) – Finite Automata with Epsilon Transitions – NFA to DFA conversion – Epsilon NFA to DFA conversion - Applications and Limitation of FA.

UNIT- II REGULAR EXPRESSION AND REGULAR LANGUAGES 9

Definition - Operators of Regular Expression - Algebraic Laws for Regular Expressions– Equivalence of FA and Regular Expressions — Minimization of Finite Automata - Pumping Lemma for Regular Languages - Closure Properties of Regular Languages / Sets.

UNIT- III CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA 9

Context-Free Grammar (CFG) — Derivation Trees — Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Language of a Pushdown Automata — Equivalence of Pushdown Automata and CFG — Pumping Lemma for CFL –Closure Properties of CFL- Deterministic Pushdown Automata.

UNIT- IV PROPERTIES OF CONTEXT-FREE LANGUAGES 9

Simplification of Context-free Grammar – Chomsky Normal Form – Greibach Normal Form - TURING MACHINES (TM) - Formal Definition and Behaviour - Languages of a TM - Turing Machine as a Computing Device and Language Acceptor — Techniques for TM .

UNIT- V UNDECIDABILITY 9

Recursive and Recursively Enumerable Languages - Halting Problem - Introduction to Undecidability and Reducibility - Undecidable Problems about TMs — Post Correspondence Problem (PCP) - Modified PCP.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1	Construct finite automata, regular expression for any pattern.
CO2	Write context free grammar for any construct.
CO3	Build pushdown automata to recognise a context free language
CO4	Design Turing machines for any language.
CO5	Propose computation solutions using Turing Machine.
CO6	Derive whether a problem is decidable or not.

TEXTBOOKS :

1. John E. Hopcroft ,Rajeev Motwani, Jeffery D. Ullman, Introduction to Automata Theory, Languages and Computations, Third Edition, Pearson Education ,2009.
2. Kamala Krithivasan and R. Rama, Introduction to Formal Languages, Automata Theory and Computation, Pearson Education, Delhi, 2009.

REFERENCE BOOKS :

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the theory of Computation, Second Edition, Prentice-Hall of India Pvt. Ltd, 2003.
2. J. Martin, Introduction to Languages and the Theory of Computation, Third Edition, Tata Mc Graw Hill, New Delhi, 2003.
3. Micheal Sipser, —Introduction of the Theory and Computation‖, Thomson Learning, 1997.

WEB REFERENCES :

1. https://onlinecourses.nptel.ac.in/noc21_cs83/preview
2. https:// automation simulator.com/

ONLINECOURSES/RESOURCES :

1. http://www.youtube.com/watch?v=eqCkkC9A0Q4
2. http://www.udemy.com/course/theory-of-computation-toc/

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		2	3	2	
CO2	2	2	2	3	3			2			2	3	2	
CO3	3	3	3	3	3	2		2	2		2	3	2	
CO4	3	3	3	3	3	2		2	2		2	3	2	
CO5	3	3	3	3	3	2		2	2		2	3	3	
CO6	3	3	3	3	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 %

23MG1501	ORGANIZATIONAL BEHAVIOUR AND BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To introduce the fundamentals of human behavior in organizational settings.
- To enable students to apply data-driven techniques for managerial and business decision-making.
- To integrate behavioral insights with business intelligence tools for improved decision support.
- To provide hands-on exposure to BI platforms and dashboards for solving organizational problems.

UNIT- I INDIVIDUAL BEHAVIOUR and BUSINESS INTELLIGENCE OVERVIEW 9

Organizational Behaviour: Meaning – Importance – Contributing Disciplines - Personality: Types – Factors influencing personality - Perception: Factors – Interpersonal perception – Attitude formation – Measurement - Introduction to Business Intelligence: Definition – Need – BI vs Data Analytics – BI Architecture - Role of BI in understanding employee behavior.

UNIT- II GROUP BEHAVIOUR & COLLABORATION ANALYTICS 9

Group Dynamics – Informal Groups – Norms – Team Building – Interpersonal Relations - Leadership: Theories – Styles – Influence and Power - Organizational Communication – Process – Barriers – Effective Strategies - BI in Collaboration Platforms (MS Teams, Slack): Team productivity analysis – Sentiment Tracking.

UNIT- III ORGANIZATIONAL CULTURE, ETHICS & BI FOR HR DECISIONS 9

Organizational Culture: Types – Impact on Behavior and Performance - Organizational Politics – Conflict Management – Negotiation Techniques - Ethical Decision Making in Organizations - BI Applications: Attrition Prediction, Employee Satisfaction Dashboards, Ethical Risk Analytics - HR Analytics-Predictive Modelling.

UNIT- IV BUSINESS INTELLIGENCE TOOLS & DATA MODELS 9

Data Warehousing: ETL Concepts – OLAP – Data Modeling – Introduction to BI Tools: Power BI / Tableau / Google Data Studio - Data Visualization Best Practices – Designing Behavioral Dashboards - Key Metrics in HR/OB Context: KPIs, Performance Metrics, Behavioral Trends.

UNIT- V BI IMPLEMENTATION, CASE STUDIES & PRACTICAL APPLICATIONS 9

Building Real-Time BI Dashboards for Organizational Use Cases - BI Project Lifecycle – Success Factors – Ethical Considerations - Case Studies : Retail Industry BI , Healthcare BI , Finance Industry BI etc. - Mini Project: Building a BI Dashboard to Analyze Team/Org Performance.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Understand individual and group behavior in organizational contexts.

CO2 Apply organizational theories to improve workplace dynamics.

CO3 Utilize business intelligence tools to analyze organizational behavior.

CO4 Design interactive BI dashboards using real-world behavioral data.

CO5 Analyze ethical dilemmas and apply decision-making frameworks.

CO6 Implement BI-based strategies for organizational decision-making.

TEXTBOOKS :

1. Stephen P.Robbins, Timothy A.Judge, Neharika Vohra, Organizational Behavior, Pearson Education, 18th edition, 2018.
2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", 2nd Edition, Morgan Kaufmann, 2013.

REFERENCE BOOKS :

1. Fred Luthans, Organisational Behavior, McGraw Hill, 12th Edition, 2013.
2. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence and Analytics", Pearson Education, 2014.
3. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, 2017.
4. Wayne W. Eckerson, "Performance Dashboards: Measuring, Monitoring, and Managing Your Business", Wiley, 2010.
5. McShane, Mary Von Glinow, "Organizational Behavior", 8th Edition, Tata McGraw Hill, 2017.

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		3	
CO2				1	2	3	2	3	3	2	2		3	
CO3	1	2		1	3	3	3	2	2	2	2	2	3	2
CO4	1		2	1	3	3	3	3	2	2	2	3	2	3
CO5		2		1	3	3	3	3	2	2	2		3	
CO6	1		2	1	3	3	3	3	3	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 %

23CS1503	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVE :

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To know about the various applications of AI.
- To understand the need for machine learning and various algorithms in machine learning.

UNIT- I INTRODUCTION 9

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems- Search Strategies- Uninformed – Informed-BFS-Greedy best first search-A* search .

UNIT- II PROBLEM SOLVING METHODS 9

Problem solving Methods – Heuristics - Iterative Deepening A*- RBFS – Memory Bounded A* – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing –Min Max- Optimal Decisions in Games – Alpha Beta Pruning – Stochastic Games.

UNIT- III KNOWLEDGE REPRESENTATION AND AI APPLICATIONS 9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering- AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition-Robot.

UNIT - IV MACHINE LEARNING AND SUPERVISED LEARNING ALGORITHMS 9

Introduction to Machine Learning (ML) - Essential concepts of ML — Learning a Class from Examples- Linear, Non-Linear-Multi-class and Multi-label classification, Decision Trees- ID3- -Regression - Linear Regression- Multiple Linear Regression- Logistic Regression- Bayesian Classifier.

UNIT- V UNSUPERVISED LEARNING AND NEURAL NETWORKS 9

Introduction to clustering, clustering algorithms - Self-Organizing Map - Expectation Maximization - Gaussian Mixture Models – Principal Component Analysis (PCA) – Basic Neural Networks: Concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

TOTAL : 45 PERIODS

LIST OF EXERCISES 30 PERIODS

ARTIFICIAL INTELLIGENCE

1. Write a program to implement simple Facts and Queries.
2. Write a program to solve Monkey Banana Problem.
3. Implementation of A* Algorithm
4. Implementation of hill climbing algorithm.
5. Write a program to DFS and BFS.

MACHINE LEARNING

Note:The programs can be implemented in either JAVA or Python
Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students

1. Create a Linear Regression Model in Python using a randomly created data set.
2. 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.
3. 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.
4. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and Comment on the quality of clustering.
5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.
6. Write a program to implement Feed forward network Tensor flow/keras Environment.

TOTAL : 75 PERIODS

COURSE OUTCOME(S):

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

CO1	Define the concepts of Artificial Intelligence and different types of intelligent agents and their architecture
CO2	Explain state space search problem .
CO3	Apply informed and uninformed searching algorithms and different heuristics
CO4	Illustrate the concept of knowledge representation
CO5	Investigate supervised and unsupervised learning algorithms.
CO6	Formulate Machine learning algorithms for real world problems.

TEXTBOOKS :

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall,Fourth Edition, 2020
2. Tom M. Mitchell, Machine Learning, Indian Edition, McGraw-Hill, 2017.

REFERENCE BOOKS :

1. Munesh Chandra Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing, 2019.

2. Vinod Chandra S.S, Anand Hareendran S, Artificial Intelligence and Machine Learning, PHI Learning, 2014.
3. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
4. Charu C. Aggarwal, Data Classification Algorithms and Applications, CRC Press,2014.
5. Stephen Marsland, Machine Learning – An Algorithmic Perspective, 2nd Edition,CRC Press, 2015

WEB REFERENCES :

1. https://www.geeksforgeeks.org/self-organising-maps-kohonen-maps/
2. https://www.geeksforgeeks.org/unsupervised-neural-network-models/

CO – PO – PSO MAPPING

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

23CS1511	FULL STACK DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	4

COURSE OBJECTIVE :

- To learn the browser-based JavaScript features in a web based environment.
- To understand and develop front end UI development using React JS.
- To design back end development using Node.js and Express.
- To be familiar with Mongo DB technologies and data management with web application.
- To get an insight about the advanced features such as Routers, Bootstrap

LIST OF EXPERIMENTS

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

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

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

CO1 Illustrate and deploy the client side of the web application.

CO2 Summarize the browser-based JavaScript features in a web based environment

CO3 Execute the server side applications using NodeJS.

CO4 Examine the use of Express framework in web development.

CO5 Experiment a full stack single page application using React, Node JS, and a Database and deploy using containers.

CO6 Design an architect database systems in both NoSQL and SQL environments

TEXTBOOKS :

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.

REFERENCE BOOKS :

1. Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott ,Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, FullStack publishing.2019..
2. TomaszDyl , Kamil Przeorski , Maciej Czarnecki ,Mastering Full Stack React Web Development Paperback,2017

WEB REFERENCES :

1. https://www.geeksforgeeks.org/courses/full-stack-node.
2. https://www.simplilearn.com/full-stack-developer-course-mern-certification-training.
3. https://www.scaler.com/courses/full-stack-developer/.

ONLINE COURSES / RESOURCES:

1. https://www.udemy.com/course/ultimate-web/.
2. https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer.

CO – PO – PSO MAPPING

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

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

LIST OF EXPERIMENTS

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 OUTCOME(S):

Upon successful completion of the course, the 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
CO6	Apply various input, output and error handling functions in python.

TEXTBOOKS :

1. Reema Thareja, ``Problem Solving and Programming with Python'', 2nd edition, OXFORD University Press, New Delhi, 2019
2. Bill Lubanovic, —Introducing Python-Modern Computing in Simple Packagell, 2 nd edition, O'REILLY, 2019

REFERENCE BOOKS :

1. Steven F. Lott, —Modern Python Cookbook, 2nd Edition, O'REILLY, 2020.
2. Ryan Marvin, Mark Ng'ang'a, Amos Omondi, —Python Fundamentals, Packt Publishing., 2018.

WEB REFERENCES:

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

CO – PO – PSO MAPPING

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

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

SEMESTER – VI

23CS1601	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile applications.
- To understand the design issues in the development of mobile applications.
- To understand the development procedure for mobile applications.
- To develop mobile applications using various tools and platforms.

UNIT- I INTRODUCTION TO ANDROID OS 9

Android: An Open Platform for Mobile Development- Introducing the Open Handset Alliance- Introducing the Development Framework- Developing for Android- Developing for Mobile and Embedded Devices- Android Development Tools- Introducing the Application Manifest File -The Android Application Lifecycle

UNIT- II BUILDING USER INTERFACE AND INTENT CREATIONS 9

Fundamental Android UI Design- Android User Interface Fundamentals- Introducing Layouts- The Android Widget Toolbox- Introducing Intents- Creating Intent Filters and Broadcast Receivers- Using Internet Services-Connecting to Google App Engine.
Tools: Use of Flutter Tool

UNIT- III DATABASES AND CONTENT PROVIDERS 9

Introduction on SQLite- Working with SQLite Databases- Creating Content Providers- Native Android Content Providers- Introducing Services -Using Background Threads- Using Alarms- Creating and Using Menus and Action Bar Action Items.
Tools: Use of Flutter Tool

UNIT- IV LOCATION-BASED SERVICES AND WIRELESS SERVICES 9

Using Location-Based Services-Using the Emulator with Location-Based Services- Selecting a Location Provider- Finding Your Current Location- Using Bluetooth- Managing Network and Internet Connectivity- Managing Wi-Fi

UNIT- V TELEPHONY AND SMS , PUBLISHING APPLICATIONS 9

Using Telephony - Introducing SMS and MMS - Distributing Applications-Introducing the Google Play - Getting Started with Google Play-Publishing Applications.
Flutter for the Web: Create a New Project with Web Support

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1	Understand and Installation of android SDK and Install Flutter in Android Studio.
CO2	Apply the working knowledge of User Interface & Intent.
CO3	Build and Design Mobile Application that manages Database operations.
CO4	Experiment working knowledge on building location based services and wireless environments.
CO5	Construct Flutter application using database.
CO6	Deploy the Android Applications.

TEXTBOOKS :

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2013.

REFERENCE BOOKS :

1. RetoMeier, “Professional Android 4 Application Development”, Wiley, First Edition, 2012.
2. ZigurdMednieks, LairdDornin, G. Blake Mike, Masumi Nakamura, “Programming Android”, O’Reilly, 2ndEdition, 2012.
3. Alasdair Allan, “iPhone Programming”, O’Reilly, First Edition, 2010.

WEB REFERENCES :

1. https://developer.android.com/modern-android-development
2. https://checks.google.com/app-compliance/
3. https://flutter.dev/learn
4. https://www.androidauthority.com/android-studio-tutorial-beginners-637572/
5. https://www.digitaltrends.com/mobile/guide-to-ios/

ONLINECOURSES/RESOURCES :

1. https://www.udemy.com/course/ionic-2-the-practical-guide-to-building-ios-android-apps/?couponCode=LEADERSALE24A
2. https://www.udemy.com/course/master-android-7-nougat-java-app-development-step-by-step/?couponCode=LEADERSALE24A
3. https://www.coursera.org/learn/introduction-to-android-mobile-application-development
4. https://www.coursera.org/learn/intro-to-mobile-development

CO – PO – PSO MAPPING

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

23CS1602	COMPILER DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement front-end of the compiler.
- To learn to implement code generator.

UNIT- I INTRODUCTION TO COMPILERS & LEXICAL ANALYSIS 8

Introduction- Translators- Compilation and Interpretation- Language processors -The Phases of Compiler — Lexical Analysis — Role of Lexical Analyzer — Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata– Minimizing DFA - Language for Specifying Lexical Analyzers – Lex tool

UNIT- II SYNTAX ANALYSIS 11

Role of Parser — Grammars — Context-free grammars — Writing a grammar Top Down Parsing - General Strategies - Recursive Descent Parser Predictive Parser-LL(1) - Parser-Shift Reduce Parser-LR Parser- LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC tool - Design of a syntax Analyzer for a Sample Language

UNIT- III SYNTAX DIRECTED TRANSLATION & INTERMEDIATE CODE GENERATION 9

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type Checker-Equivalence of Type Expressions-Type Conversions. Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Back patching

UNIT- IV RUN-TIME ENVIRONMENT AND CODE GENERATION 9

Runtime Environments — Source language issues — Storage organization — Storage Allocation Strategies: Static, Stack and Heap allocation - Parameter Passing-Symbol Tables -Dynamic Storage Allocation - Issues in the Design of a code generator — Basic Blocks and Flow graphs - Design of a simple Code Generator - Optimal Code Generation for Expressions

UNIT- V CODE OPTIMIZATION 8

Principal Sources of Optimization — Peep-hole optimization - DAG- Optimization of Basic Blocks - Global Data Flow Analysis - Efficient Data Flow Algorithm . Recent trends in Compiler Design

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1	Understand the techniques in different phases of a compiler.
CO2	Design a lexical analyser for a sample language and learn to use the LEX tool.
CO3	Apply different parsing algorithms to develop a parser and learn to use YACC tool.
CO4	Understand semantics rules (SDT), intermediate code generation and run-time environment.
CO5	Implement code generation.
CO6	Apply the various optimization techniques.

TEXTBOOKS :

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education Limited, 2014.

REFERENCE BOOKS :

1. Des Watson,”A Practical Approach to Compiler Construction”- 2017.
2. Allen I. Holub, “Compiler Design in C”, Prentice-Hall Software Series, 2014.
3. Randy Allen, Ken Kennedy, and Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
4. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
5. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, Publishers Elsevier Science, 2004.
6. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

WEB REFERENCES :

1. https://www.geeksforgeeks.org/introduction-of-compiler-design/
2. https://www.javatpoint.com/compiler-tutorial
3. https://www.tutorialspoint.com/compiler_design/index.html

ONLINECOURSES/RESOURCES :

1. https://onlinecourses.nptel.ac.in/noc23_cs57/preview
2. https://www.udemy.com/topic/compiler-design/

CO – PO – PSO MAPPING

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

23CS1603	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To develop algorithms that use AI and machine learning along with human interaction and feedback
- To know about the business applications of Cognitive Computing
- To build cognitive applications, as well as explore how knowledge-based artificial intelligence
- To understand how Cognitive computing supports human reasoning by evaluating data in context
- To Learn Natural Language processing role in cognitive computing
- To get into all applications of Cognitive Computing

UNIT- I INTRODUCTION 9

Cognitive Computing, Cognitive Psychology, The Architecture of the Mind, The Nature of Cognitive Psychology, Cognitive architecture, Cognitive processes, The Cognitive Modeling Paradigms, Declarative / Logic based Computational cognitive modeling, connectionist models –Bayesian models. Introduction to Knowledge-Based AI – Human Cognition on AI — Cognitive Architectures.

UNIT- II FUZZY AND DECISION SUPPORT SYSTEMS 9

Intelligent Decision making, Fuzzy Cognitive Maps, learning algorithms: Nonlinear Hebbian Learning, Data driven NHL, Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps.

UNIT- III MACHINE LEARNING AND BIG DATA 9

Machine learning Techniques for cognitive decision making, Hypothesis Generation and Scoring Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.

UNIT- IV NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS 9

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.

UNIT- V **CASE STUDIES** **9**

Cognitive Systems in health care, Cognitive Assistant for visually impaired — AI for cancer detection, Predictive Analytics, Text Analytics, Image Analytics, Speech Analytics — IBM Watson.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Choose distinct methods from conventional computing ways by comprehending the fundamentals of cognitive computing and its variations.

CO2 Understand the evolution of Watson services from the original Deep QA architecture.

CO3 Apply AI architectures to real world cognitive problems.

CO4 Analyze Natural language processor role in Cognitive computing.

CO5 Compare various case studies related to cognitive Computing.

CO6 Develop cognitive computing related applications, like Chabot.

TEXTBOOKS :

1. Hurwitz, Kaufman, and Bowles, “Cognitive Computing and Big Data Analytics”, Wiley, Indianapolis,2015.

REFERENCE BOOKS :

1. Jerome R. Busemeyer, Peter D. Bruza, “Quantum Models of Cognition and Decision”, Cambridge University Press,2012.
2. Emmanuel M. Pothos, Andy J. Wills, “Formal Approaches in Categorization”, Cambridge University Press,2011
3. Nils J. Nilsson, “The Quest for Artificial Intelligence”, Cambridge University Press,2010
4. Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, “Cognitive Science: An Introduction”, MITPress.

WEB REFERENCES :

1. https://www.theknowledgeacademy.com/in/courses/artificial-intelligence-and-machine-learning/cognitive-computing-training/

ONLINECOURSES/RESOURCES :

1. https://www.shiksha.com/online-courses/cognitive-computing-certification

CO – PO – PSO MAPPING

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

CO4		**3**	**3**	**1**	**3**	**2**	**3**	**1**	**1**	**3**	**2**	**2**	**2**	**1**
CO5	**2**	**2**	**3**	**1**	**3**	**2**	**3**	**1**	**2**	**2**	**1**	**1**	**3**	**3**
CO6	**2**	**2**	**3**	**1**	**3**	**2**	**3**	**1**	**2**	**2**	**1**	**1**	**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 %**

23CB1402	INTRODUCTION TO INNOVATION AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- Learn to be familiar with creative and innovative thinking styles.
- Learn to investigate, understand and internalize the process of founding a start-up.
- Learn to protect the innovations and intangible assets from exploitation.
- Learn to manage various types of IPR to protect competitive advantage.

UNIT- I INTRODUCTION TO INNOVATION 9

Innovation: What and Why?, Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.

Discussion Topic - Is innovation manageable or just a random gambling activity?.

UNIT- II INNOVATIVE ORGANIZATION BUILDING 9

Building an Innovative Organization : Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture

Discussion Topic - Innovation: Co-operating across networks vs. 'go-it-alone' approach.

UNIT- III ENTREPRENEURSHIP AND FINANCIAL PLANNING 9

Entrepreneurship: Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management, Maintaining Competitive Advantage- Use of IPR to protect Innovation.

Financial Planning - Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing.

UNIT- IV INTELLECTUAL PROPERTY RIGHTS (IPR) 9

Intellectual Property Rights (IPR): Introduction and the economics behind development of IPR: Business Perspective, IPR in India — Genesis and Development, International Context.

UNIT- V INTELLECTUAL PROPERTY TYPES 9

Types of Intellectual Property : Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name , Geographical Indications- What is GI, Why protect them?, Copyright- What is copyright, Industrial Designs- What is design? How to protect?

Discussion Topic - Major Court battles regarding violation of patents between corporate companies.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1	Create a learning system to enhance the innovation.
CO2	Develop Creative thinking skills.
CO3	Acquaint themselves with the special challenges of starting new ventures.
CO4	Use IPR as an effective tool to protect their innovations and intangible assets from exploitation.
CO5	Identify criteria's to fit one's own intellectual work in particular form of IPRs.
CO6	Apply statutory provisions to protect particular form of IPRs.

TEXTBOOKS :

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change, 7th Edition, 2020

REFERENCE BOOKS :

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Derek Bosworth and Elizabeth Webster,The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
3. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
4. EDII "Faulty and External Experts — A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.
5. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
6. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005.

CO – PO – PSO MAPPING

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

23CS1604	INTERNET OF THINGS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE :

- To study the fundamentals about IoT
- To study about IoT and M2M
- To study the design methodology and utilizing Python for various stages of development
- To provide students with practical knowledge and skills for working with IoT devices
- To study the basics of IoT Data Analytics with various IoT case studies

UNIT- I INTRODUCTION AND CONCEPTS **6**

Introduction - Physical design of IoT, Logical Design of IoT, IoT Enabling technologies, IoT Levels and Deployment Templates, Domain Specific IoT - Introduction, Home automation, Cities, Environment, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

UNIT- II IoT AND M2M **6**

IoT and M2M Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, IoT System Management with NETCONFIG-YANG.

UNIT- III DEVELOPING INTERNET OF THINGS **6**

IoT Platform Design Methodology, Introduction, IoT Design Methodology, Case Study on IoT system for Weather Monitoring, Motivation using Python, IoT System logical design using Python - Introduction, Python Data Types, Control Flow, Functions, Modules, Packages, File Handling, Data/Time Operations, Classes, Python packages of interest for IoT.

UNIT- IV IOT PHYSICAL DEVICES AND ENDPOINTS **6**

Introduction to IoT Device, Linux on Raspberry PI, Raspberry PI Interfaces, Programming Raspberry with Python - Controlling LED, Interfacing LED, Interfacing a Light Sensor with Raspberry PI.Case Studies - Home Automation - Smart Lighting, Home Intrusion Detection.

UNIT- V DATA ANALYTICS FOR IOT&CASE STUDIES **6**

Data Analytics for IoT - Introduction, HadoopMap reduce, Apache Hadoop, Hadoop YARN, Apache Oozie, Case Studies - Weather Monitoring System, Weather Monitoring Bot, Agriculture - Smart Irrigation System.

TOTAL:30 PERIODS

LIST OF EXERCISES (30 PERIODS)

1. Weather Monitoring System
2. Controlling LED
3. Interfacing a Light Sensor
4. Gas Detection System
5. Home Automation
6. Smart Lighting
7. Home Intrusion Detection System
8. Bot creation
9. Smart Irrigation
10. Traffic Light Simulator

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

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

CO1	Gain Knowledge about the fundamentals of IoT.
CO2	Differentiate between IoT and M2M.
CO3	Understand design and knowledge on utilizing Python in various stages of IoT.
CO4	Gain practical knowledge and skills for working with IoT devices.
CO5	Analyze and Interpret data collected from IoT devices effectively.
CO6	Compare IOT Applications in Industrial and real world.

TEXTBOOKS :

1. Arshdeep Bahga , Vijay Madisetti ,Internet of Things:A Hands-On Approach, 2014.

REFERENCE BOOKS :

1. Andrew Minteer, Analytics for the Internet of Things (IoT: Intelligent analytics for your intelligent devices,Packt Publishing Ltd, 2017
2. Cuno Pfister, Getting Started with the Internet of Things: connecting Sensors and Microcontrollers to the Cloud,O'Reilly,2011
3. MaciejKranz, Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry, Wiley,2016
4. Anand Tomboli,"Build Your Own IoT Platform,Develop a Fully Flexible and Scalable Internet of Things Platform in 24 Hours, Apress, 2019.

ONLINECOURSES/RESOURCES :

1. https://onlinecourses.nptel.ac.in/noc24_cs35/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs34/preview
3. https://onlinecourses.swayam2.ac.in/ntr24_ed01/preview

CO – PO – PSO MAPPING

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

23CS1611	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE :

- To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles
- To understand how to work with various mobile application development frameworks
- To learn the basic and important design concepts and issues of development of mobile applications
- To understand the capabilities and limitations of mobile devices
- To use Mobile Application Development Tools

LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager.
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed.
11. Develop a mobile application to send an email.

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

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

CO1 Develop mobile applications using GUI and Layouts.

CO2 Develop mobile applications using Event Listener.

CO3 Develop mobile applications using Databases.

CO4 Analyze and discover your own mobile app for simple needs.

CO5 Develop GPS location Information and SMS services.

CO6 Publish Android applications

WEB REFERENCES :

1. https://developer.android.com/modern-android-development
2. https://checks.google.com/app-compliance/

3. https://flutter.dev/learn
4. https://www.androidauthority.com/android-studio-tutorial-beginners-637572/
5. https://www.digitaltrends.com/mobile/guide-to-ios/

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		2
CO2	3	2	2		2						2	3		2
CO3	3	3	3	2	2						2	3	2	2
CO4	3	3	3	3	2						2	3	3	3
CO5	2	3	3	3	3						2	3	2	3
CO6	3	2	3		3	3					2	3		3

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

23CS1612	PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE :

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Innovation, Entrepreneurship and Employability skills of the students.

This course is an immersive program to keep up with the industry demand and to have critical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration and with mentoring.

Highlights of the course:

- Students undergo training on emerging technologies
- Students develop solutions for real-world use cases
- Students work with mentors to learn and use industry best practices
- Students access and use Self-Learning courses on various technologies, approaches and methodologies.
- Collaborate in teams with other students working on the same topic.

COURSE OUTCOME(S):

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

CO1	Up skill in emerging technologies and apply to real industry-level use cases
CO2	Understand agile development process
CO3	Develop career readiness competencies, Team Skills / Leadership qualities
CO4	Develop Time management, Project management skills and Communication Skills
CO5	Use Critical Thinking for Innovative Problem Solving
CO6	Develop entrepreneurship skills to independently work on products.

Table 1 : Activities

Activity Name	Activity Description
Choosing a Project	Selecting a project from the list of use cases.
Team Formation	Students shall form a team of 3 or 4 members before enrolling to a project. Team members shall distribute the project activities among themselves.
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.
Project Development	Project shall be developed in agile mode. The status of the project shall be updated through reviews.
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.
Evaluation and Scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics.

TOTAL : 60 PERIODS

COURSE EVALUATION SCHEME

The course carries 100% and shall be evaluated through continuous assessment. The individual weightage are as follows:

Table 2: Evaluation Scheme

S.No	Evaluation Criteria	Weightage
1	Industry Certification (NASSCOM/NPTEL)	40 %
2	Project Development and Evaluation	60 %
TOTAL WEIGHTAGE		**100**

PASSING CRITERIA

The passing requirement for the course is 50% of the continuous assessment marks only.

Table 3: Detailed Evaluation Scheme

	Skills		Weightage
I	**Technical Skills**		
	1	Industry Certification	40%
	2	Project Planning	5%
	3	Requirements Analysis	5%
	4	Project Design	5%
	5	Innovation	5%
	6	Technology Stack (Utilization of various APIs, tools, techniques)	5%
	7	Coding	15%
	8	Acceptance Testing	5%
	9	Project Demonstration	5%
II	**Soft Skills**		
	1	Team Work	5%
	2	Project Documentation	5%
Total Weightage			**100%**

CO – PO - PSO MAPPING

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

Internal Assessment		End Semester Examination
Evaluation of Project	Industry Certification	Practical
60	40	--
100 %		--

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

COURSE OBJECTIVE :

- Develop the logical design of the database using data modelling 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 OUTCOME(S):

Upon successful completion of the course, the 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

TEXTBOOKS :

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, Addison Wesley, 7thEdition, 2016

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. James R.Groff, Paul N.Weinberg, AndrewJ. Oppel,The Complete Reference,3rd edition by Dr.P.S.Deshpande ,SQL & PL/SQL for Oracle10g

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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

CO-PO-PSO MAPPING

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

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

SEMESTER - VII

		L	T	P	C
`23CS1701	CRYPTOGRAPHY AND CYBER SECURITY	3	0	0	3

COURSE OBJECTIVE :

- Learn to analyze the security of in-built cryptosystems.
- Know the fundamental mathematical concepts related to security.
- Develop cryptographic algorithms for information security.
- Comprehend the various types of data integrity and Authentication schemes.
- Understand cyber-crimes and cyber security.

UNIT- I INTRODUCTION 9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security — Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography-Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT- II SYMMETRIC KEY CRYPTOGRAPHY 9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid"s algorithm- Congruence and matrices –Groups- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard-Triple DES-Blow Fish-RC4 –RC5 Algorithm– Key distribution.

UNIT- III PUBLIC KEY CRYPTOGRAPHY 9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem - Chinese Remainder-Theorem–Exponentiation and logarithm-SYMMETRIC KEY CIPHERS: RSA Cryptosystem- Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT- IV MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA-- HMAC – CMAC–Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509.

UNIT- V CYBER CRIMES AND CYBER SECURITY 9

Cyber Crime and Information Security – Classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, Electronic Mail security – PGP, S/MIME – IP security – Web Security- SET - OWASP- XSS-SQL Injection-SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1	Understand the fundamentals of network security, security architecture.
CO2	Analyze various threats and vulnerabilities in systems.
CO3	Apply the different cryptographic operations of symmetric cryptographic algorithms.
CO4	Apply the different cryptographic operations of public key cryptography.
CO5	Apply the various Authentication schemes to simulate different applications.
CO6	Understand various cyber-crimes and cyber security Concepts.

TEXTBOOKS :

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2020.
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

REFERENCE BOOKS :

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	2			1			1	3		
CO2	3	3	3	3	3			2			2	3	3	
CO3	3	3	3	3	3			3			1	3	2	
CO4	3	3	3	3	3			3			1	3	2	
CO5	3	2	3	2	3			2			2	3	2	2
CO6	3	2	3	3	2			1			2	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%				**60 %**

23IT1701	CLOUD COMPUTING AND BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- Understand the basic concepts and characteristics of cloud computing.
- Analyze the enabling technologies behind cloud computing like virtualization and web services.
- Apply cloud management, storage solutions, and security measures in cloud environments.
- Learn the fundamentals of data science and big data technologies.
- Analyze the challenges in big data and data analytics tools.

UNIT- I INTRODUCTION TO CLOUD COMPUTING 9

Introduction to Cloud Computing – Evolution of Cloud Computing – Cloud Characteristics –Elasticity in Cloud — On-demand Provisioning — NIST Cloud Computing Reference Architecture– Architectural Design Challenges – Deployment Models: Public, Private and Hybrid Clouds – Service Models: IaaS – PaaS – SaaS – Benefits of Cloud Computing.

UNIT- II CLOUD ENABLING TECHNOLOGIES 9

Introduction to Web Service and Service Oriented Architecture – SOAP – REST – Basics of Virtualization – Full and Para Virtualization– Implementation Levels of Virtualization – Tools and Mechanisms — Virtualization of CPU — Memory — I/O Devices — Desktop Virtualization – Server Virtualization.

UNIT- III CLOUD MANAGEMENT, STORAGE AND SECURITY 10

Resource Provisioning and Methods – Cloud Management Products – Cloud Storage – Provisioning Cloud Storage – Managed and Unmanaged Cloud Storage – Cloud Security Overview — Cloud Security Challenges –Security Architecture design — Virtual MachineSecurity – Application Security –Data Security.*Case study: Amazon S3 storage.

UNIT- IV INTRODUCTION TO DATA SCIENCE AND BIG DATA 8

Data Science – Fundamentals and Components – Data Scientist – Terminologies Used in Big Data Environments – Types of Digital Data – Introduction to Big Data – Characteristics of Data — Evolution of Big Data — Big Data Analytics –Classification of Analytics — Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools.

UNIT- V DATA ANALYTICAL FRAMEWORKS 9

Introducing Hadoop –Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Processing Data with Hadoop–Introduction to MapReduce – Features of MapReduce – Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL)- IBM SPSS predictive analytics tool.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Recall and explain cloud computing concepts and service models.

CO2 Describe and compare cloud enabling technologies and virtualization techniques.

CO3 Analyze and implement cloud storage and security mechanisms.

CO4 Evaluate data science methods and big data challenges in practical applications.

CO5 Apply Hadoop, MapReduce, and NoSQL databases for data analytics in cloud environments.

CO6 Design and use big data frameworks and tools for data analysis tasks.

TEXTBOOKS :

1. Rajkumar Buyya, James Broberg, and Andrzej Goscinski, "Cloud Computing: Principles and Paradigms",2nd Edition ,Wiley,2023.
2. Dan C. Marinescu, "Cloud Computing: Theory and Practice", Morgan Kaufmann publihser, 3rd Edition 2023.
3. Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi,"Big Data: Principles and Paradigms",Morgan Kaufmann Publisher, 2022.

REFERENCE BOOKS :

1. Gerardus Blokdyk ,"Cloud Computing A Complete Guide" 5STARCooks publisher, edition 2021.
2. Douglas Comer,"The Cloud Computing Book: The Future of Computing Explained", First Edition, CRC Press, 2021.
3. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph",Elsevier,2022.
4. "Kim H. Pries, Robert D. Fulton, Big Data Analytics: A Practical Guide for Managers", CRC Press ,2022.

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1. https://www.javatpoint.com/cloud-computing-tutorial
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3. https://www.tutorialpoints.com/cloud-computing
4. https://www.ibm.com/in-en/analytics/big-data-analytics
5. https://www.teradata.com/Trends/Data-Management/Data-Analytics-Framework

ONLINE COURSES /RESOURCES :

1. https://www.udemy.com/topic/cloud-computing/free/
2. https://intellipaat.com/academy/course-cat/cloud-computing-courses/
3. https://www.makeuseof.com/free-cloud-computing-courses/
4. https://www.boardinfinity.com/micro-learning/big-data-with-certification

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**		
CO2	**3**	**3**	**2**	**2**	**2**					**2**	**1**	**3**		
CO3	**3**	**3**	**3**	**2**	**2**	**2**			**2**	**3**		**3**	**2**	
CO4	**2**	**2**	**3**	**3**	**3**				**2**	**2**		**3**	**2**	**2**
CO5	**2**	**3**	**3**	**3**	**3**	**2**			**2**	**2**	**3**	**3**	**3**	**2**
CO6	**3**	**3**	**3**	**3**	**3**	**3**			**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 %**

23CS1711	CRYPTOGRAPHY AND CYBER SECURITY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE :

- To learn different cipher techniques
- To implement the algorithms DES, RSA,SHA-1
- To understand the usage of security tools and vulnerability assessment tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
   a. Ceaser cipher
   b. Playfair cipher
   c. Hill cipher
   d. Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   i. Rail Fence
   ii. Row & Column Transformation
3. Implementation DES algorithm
4. Implementation AES algorithm.
5. Implement RSA Algorithm using HTML and JavaScript.
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - DSA.
9. Demonstrate intrusion detection system (IDS) using any tool eg. Snort .
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
11. Implementation of XSS and SQL injection.
12. **MINI PROJECTS: (Suggested Mini Project Titles, but not limited to)**
    i. Keylogger projects.
    ii. Antivirus.
    iii. Analysis and Assessment of different Cyber-Attacks
    iv. Network Monitoring and Anomalies Discovery.
    v. Bug Bounties.

COURSE OUTCOME(S):

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

CO1	Develop code for classical Encryption Techniques to solve the problems.
CO2	Build cryptosystems by applying symmetric and public key encryption algorithms
CO3	Construct code for authentication algorithms.
CO4	Develop a signature scheme using Digital signature standard.
CO5	Demonstrate the cyber security system using open source tools.
CO6	Demonstrate the system security using open-source tools.

TEXTBOOKS :

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 8th Edition, 2020. BehrouzA. Ferouzan, Cryptography & Network Security,Tata McGraw Hill,2nd edition 2015.
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

REFERENCE BOOKS :

1. BehrouzA. Ferouzan, Cryptography & Network Security,Tata McGraw Hill,2nd edition 2015.
2. Charles Pfleeger, Security in Computing, 5th Edition, Prentice Hall of India, 2015

WEB REFERENCES :

1. https://b-ok.asia/book/1000937/c170e3
2. https://people.scs.carleton.ca/~paulv/toolsjewels.html

ONLINECOURSES/RESOURCES :

1. https://nptel.ac.in/courses/106/105/106105162/
2. https://nptel.ac.in/courses/106/103/106103015/
3. https://nptel.ac.in/courses/106/107/106107155/

CO – PO – PSO MAPPING

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

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

23IT1711	CLOUD COMPUTING AND BIG DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE :

- Understand and install various analytical tools and configure distributed file systems.
- Develop skills in executing analytical procedures using distributed frameworks and databases.
- Implement and deploy applications to handle large datasets.
- Learn data modeling techniques in NoSQL databases.
- Familiarize with deploying simple applications in OpenStack cloud environments.
- Apply suitable analytical frameworks and tools for real-world applications.

LIST OF EXPERIMENTS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
   (i) Reading data from text file, Excel and the web.
   (ii) Exploring various commands for doing descriptive analytics on Iris data set.
2. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   (i) Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   (ii) Bivariate analysis: Linear and logistic regression modeling
   (iii) Multiple Regression analysis Also compare the results of the above analysis for the two data sets.
3. Apply Bayesian and SVM techniques on Iris and Diabetes data set.
4. Apply and explore various plotting functions on UCI data sets.
5. Mini Project: Disease Prediction
6. Installation of OpenStack.
7. Creation of VMs and installing applications and executing simple programs in OpenStack.
8. Install Hadoop single node cluster
9. Develop a MapReduce program to calculate the frequency of a given word in a given file (wordcount).
10. Install Google App Engine. Create hello world app and other simple web applications using python/java. Use GAE launcher to launch the web applications.
11. Create Bucket in Amazon S3.
12. Create a retail data base with the following tables: Product, Customer, Manufacturer, Shipping and Time using MongoDB and perform data replication using sharding techniques.
13. Install HIVE and implement the above retail schema definition and perform CRUD operations.
14. Mini Project: Chatbot

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Recall and list analytical tools and distributed file system configurations.

CO2 Execute analytical procedures using Python packages and distributed frameworks.

CO3 Analyze and deploy applications on large datasets using MapReduce.

CO4 Design and implement data models in NoSQL databases like MongoDB.

CO5 Develop and deploy applications in OpenStack cloud environments.

CO6 Apply analytical frameworks and tools to develop real-world applications.

WEB REFERENCES

1. https://careerfoundry.com/en/blog/data-analytics/data-analytics-tools/
2. https://cloud.google.com/

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			3		
CO2	3	3	3	2	2				2	2		3	2	2
CO3	3	3	3	3	3	2			2	3		3	3	2
CO4	2	3	2	3	3	3			3	3		3	2	2
CO5	3	3	3	3	3	3	2		3	3	3	3	2	3
CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3

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

VERTICAL I - DATA SCIENCE

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

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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

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.

REFERENCE BOOKS:

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,GeorgesGrinstein,Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

23AD1909	DATA VISUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the fundamental concepts related to visualization data
- 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 OUTCOME(S):

Upon completion of the course, 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 concept of AI.

CO4 Design and process the data for Visualization.

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. “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.

REFERENCE BOOKS:

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 Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

23AD1918	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

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

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- Optimizing Inventory Management.

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 - Enhancing Decision-Making with Business Intelligence.

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- Demand Forecasting for Retail Chain

UNIT - IV HR & SUPPLY CHAIN ANALYTICS 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 MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales - Enhancing Marketing and Sales Effectiveness.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Define key concepts of Business Analytics and its life cycle.
CO2 Explain the role of Business Intelligence in decision-making.
CO3 Apply predictive analytics for demand forecasting.
CO4 Analyze supply chain and HR analytics models.
CO5 Evaluate marketing and sales analytics strategies.
CO6 Develop a complete business analytics solution.

TEXT BOOKS:

1. R. Evans James, Business Analytics, 2017.
2. R N Prasad , Seema Acharya , Fundamentals of Business Analytics.
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016.
4. Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition, Pearson Education, 2018.

23AD1904	TEXT ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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

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 Cheng Xiang Zhai, eds., “Mining text data”, Springer Science & Business Media, 2012.

REFERENCE BOOKS:

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 OBJECTIVE:

- 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 OUTCOME(S):

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

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

TEXT BOOKS:

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,1st ed.,2011.
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.

23AD1910	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

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

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

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)

REFERENCE BOOKS:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited,2011
2. 2.Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012
3. 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 OBJECTIVE:

- 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 OUTCOME(S):

Upon completion of the course, 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

TEXT BOOKS:

1. 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.

REFERENCE BOOKS:

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.

23AD1919	COMPUTER VISION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To understand the fundamental concepts related to Image formation and processing
To learn feature detection, matching and detection
To become familiar with feature based alignment and motion estimation.
To develop skills on 3D reconstruction.
To understand image based rendering and recognition.

UNIT - I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

Computer Vision - 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.

UNIT - II FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT - III FEATURE-BASED ALIGNMENT & 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.

UNIT - IV 3D RECONSTRUCTION 9

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT - V MARKETING & SALES ANALYTICS 9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Understand basic knowledge, theories and methods in image processing and computer vision.
CO2 Implement basic image processing techniques in OpenCV.
CO3 Implement some advanced image processing techniques in OpenCV.
CO4 Apply 2D feature-based image alignment, segmentation and motion estimations
CO5 Apply 3D image reconstruction techniques.
CO6 Design and develop innovative image processing and computer vision applications.

TEXT BOOKS:

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

VERTICAL II: FULL STACK DEVELOPMENT

23IT1901	NEXTGEN WEB DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 WEB BASICS AND 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 FRONTEND ESSENTIALS 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 BACKEND 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 FULLSTACK INTEGRATION 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 AND 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 OUTCOME(S):

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 Web Assembly, Packt Publishing, 2022.
5. Ben Lesh, RxJS in Action, Manning Publications, 2021.

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:

Upon 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 OBJECTIVE:

- 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 OUTCOME(S):

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 OBJECTIVE:

- 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 UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT - III 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 OUTCOME(S):

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 OBJECTIVE:

- 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 OUTCOME(S):

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 OBJECTIVE:

- 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 OUTCOME(S):

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:

Upon 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 OBJECTIVE:

- 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 OUTCOME(S):

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 CENTRE TECHNOLOGIES

23CS1901	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE : To impart Knowledge on the following topics

- 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 OUTCOME(S):

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 OBJECTIVE :

- 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, Cloud Formation, 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 OUTCOME(S):

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 OBJECTIVE :

- 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 OUTCOME(S):

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 OBJECTIVE :

- 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 OUTCOME(S):

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 OBJECTIVE :

- 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 OUTCOME(S):

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 OBJECTIVE :

- 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 OUTCOME(S):

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 by Tyler 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: 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 OBJECTIVE :

- 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 OUTCOME(S):

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/TrainingSiteReliability 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 OBJECTIVE :

- 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 OUTCOME(S):

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 OBJECTIVE:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods
- To understand hacking options available in Web and wireless applications
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

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 OUTCOME(S):

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 OBJECTIVE:

- 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 OUTCOME(S):

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 OBJECTIVE:

- 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 OUTCOME(S):

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 OBJECTIVE:

- Understand the evolution, structure, and analysis methods of social networks.
- Identify key privacy and security issues emerging in social network environments.
- Explore techniques for extracting and mining data from social networks.
- Predict human behavior and address privacy concerns in online social platforms.
- Apply methods for access control, authentication, and authorization in social networking platforms.

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 OUTCOME(S):

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

CO1 Identify the key components and security concepts in social networking platforms.

CO2 Explain privacy concerns, user behavior, and anonymity in online social

networks.

CO3 Apply data mining and community detection techniques to analyze social networks.

CO4 Analyze human behavior patterns and contextual information for trust and privacy evaluation.

CO5 Evaluate access control methods and their impact on privacy and data protection.

CO6 Design a secure identity and access management solution using single sign-on and identity federation.

TEXT BOOKS:

1. M. A. Russell and M. Klassen, Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More, 3rd ed. Sebastopol, CA: O'Reilly Media, 2019.
2. J. Golbeck, Analyzing the Social Web, 2nd ed. Cambridge, MA: Morgan Kaufmann (Elsevier), 2020.
3. R. Zafarani, M. A. Abbasi, and H. Liu, Social Media Mining: An Introduction, 2nd ed. Cambridge: Cambridge University Press, 2022.
4. N. Ziv, Trust and Privacy in Social Media, 1st ed. Hershey, PA: IGI Global, 2021.
5. B. Schneier, Data and Goliath: The Hidden Battles to Collect Your Data and Control Your World, Updated ed. New York: W. W. Norton & Company, 2021

REFERENCE BOOKS:

1. Kaufman, Charlie, Radia Perlman, and Mike Speciner. Network Security: Private Communication in a Public World. Updated ed., Pearson Modern Reprints, 2021.
2. Ohm, Paul. The Information Privacy Law Reader. 2nd ed., Foundation Press, 2020.
3. Floridi, Luciano, editor. The Ethics of Artificial Intelligence and Robotics. Oxford University Press, 2023.
4. Sundar, S. Shyam, editor. The Handbook of the Psychology of Communication Technology. Wiley-Blackwell, 2022.
5. Hennion, Antoine. Privacy in Social Media: Tools and Algorithms for Privacy-Preserving Data Publishing. Springer, 2021.

23IT1913	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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 OBJECTIVE:

- 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 OUTCOME(S):
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 OUTCOME(S):

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 OBJECTIVE:

- 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 OUTCOME(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 TECHNOLOGIES

23CS1909	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- 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: 45 PERIODS

COURSE OUTCOME(S):

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 OBJECTIVE :

- 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: 45 PERIODS

COURSE OUTCOME(S):

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 OBJECTIVE :

- 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 OUTCOME(S):

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, 2 ½ 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.
2. Rick parent, Computer Animation: Algorithms and Techniques, Morgan Kauffman, 3rd Edition, 2012.

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. 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 OBJECTIVE :

- 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 OUTCOME(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 OBJECTIVE :

- 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 OUTCOME(S):

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.

23CS1914	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- 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 OUTCOME(S):

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

23CS1915	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- 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 OUTCOME(S):

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.

23CS1916	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE :

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT- I INTRODUCTION 9

Introduction to Virtual Reality and Augmented Reality — Definition — Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality — Virtual Reality Vs 3D Computer Graphics — Benefits of Virtual Reality — Components of VR System — Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers — Navigation and Manipulation Interfaces — Gesture Interfaces — Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays — Large Volume Displays — Sound Displays — Human Auditory System.

UNIT- II VR 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 – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT- III VR PROGRAMMING 9

VR Programming — Toolkits and Scene Graphs — World Tool Kit — Java 3D — Comparison of World Tool Kit and Java 3D.

UNIT- IV APPLICATIONS 9

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR — Education, Arts and Entertainment — Military VR Applications — Emerging Applications of VR — VR Applications in Manufacturing — Applications of VR in Robotics — Information Visualization — VR in Business – VR in Entertainment – VR in Education.

UNIT- V AUGMENTED REALITY **9**

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modeling and Annotation- Navigation-Wearable devices.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Understand the basic concepts of AR and VR

CO2 Understand the tools and technologies related to AR/VR

CO3 Understand the graphical processing units and their architectures.

CO4 Know the working principle of AR/VR related Sensor devices

CO5 Design of various models using modeling techniques

CO6 Develop AR/VR applications in different domains

TEXTBOOKS :

1. Charles Palmer, John Williamson, ―Virtual Reality Blueprints: Create compelling VR experiences for mobile, Packt Publisher, 2018

2. Dieter Schmalstieg, Tobias Hollerer, ―Augmented Reality: Principles & Practice Addison Wesley, 2016

REFERENCE BOOKS :

1. John Vince, ―Introduction to Virtual Reality, Springer-Verlag, 2004.

2. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design‖, Morgan Kaufmann, 2003.

VERTICAL VI - ADVANCED ARTIFICIAL INTELLIGENCE

23AD1920	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT - I **REASONING UNDER UNCERTAINTY** **9**

Introduction – Propositional Logic - Predicate logic - Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT - II **METHODOLOGY AND MODELING** **9**

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT - III **ONTOLOGIES – DESIGN AND DEVELOPMENT** **9**

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT - IV **REASONIING WITH ONTOLOGIES AND RULES** **9**

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT - V **LEARNING AND RULE LEARNING** **9**

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 To understand the basics of Knowledge Engineering.

CO2 To discuss methodologies and modeling for Agent Design and Development.

CO3 To design and develop ontologies.

CO4 To apply reasoning with ontologies and rules.

CO5 To understand learning and rule learning.

TEXT BOOKS:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016

23AD1912	HEALTH CARE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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

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.

REFERENCE BOOKS:

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

23AD1906	ENGINEERING PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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

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 visualizayion 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

REFERENCE BOOKS:

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

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

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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

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, 2015.
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020

REFERENCE BOOKS:

1. Roj Kaushik and Sunita Tiwari, Soft Applications, 1st Edition, McGraw Hill, 2018.
2. Computing-Fundamentals Techniques and 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.

23AD1915	GAME THOERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate,including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of gametheory, and to provide insights into using game theory in modelIing 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-non- cooperative 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 two- player, 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 OUTCOME(S):

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

CO1 Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.

CO2 Formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications.

CO3 Discuss the use of Nash Equilibrium for other problems.

CO4 Identify key strategic aspects and be able to connect them to appropriate theoretic concepts given a real world situation.

CO5 Identify some applications that need aspects of Bayesian Games.

CO6 Implement a typical Virtual Business scenario using Game theory.

TEXT BOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.
2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.
3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory. Cambridge University Press, 2007.
4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.
5. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic,and Logical Foundations, Cambridge University Press 2008.

REFERENCE BOOKS:

1. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, ―Game Theory in Wireless and Communication Networks‖, Cambridge University Press, 2012.
2. Y.Narahari, ―Game Theory and Mechanism Design‖, IISC Press, World Scientific.
3. William Spaniel, ―Game Theory 101: The Complete Textbook‖, CreateSpace Independent Publishing, 2011.

23AD1921	OPTIMIZATION TECHNIQUES IN MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To formulate and solve linear programming problems
- To understand and analyze how to deal with changing data.
- To identify and interpret potential unintended effects in the project.
- To understand and define procedures to operationalize the machine learning model
- To maintain the applied machine learning model.

UNIT - I INTRODUCTION 9

Optimization, Formulation of LPP, Solution of LPP: Simplex method,Basic Calculus for optimization: Limits and multivariate functions,Derivatives and linear approximations: Single variate functions and multivariate functions.

UNIT - II MACHINE LEARNING STRATEGY 9

ML readiness, Risk mitigation, Experimental mindset, Build/buy/partner, setting up a team, Understanding and communicating change.

UNIT - III RESPONSIBLE MACHINE LEARNING 9

AI for good and all, Positive feedback loops and negative feedback loops, Metric design andobserving behaviours, Secondary effects of optimization, Regulatory concerns.

UNIT - IV MACHINE LEARNING IN PRODUCTION AND PLANNING 9

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT - V CARE AND FEEDING OF MACHINE LEARNING MODEL 9

MLPL Recap, Post deployment challenges, QUAM monitoring and logging, QUAM Testing, QUAM maintenance, QUAM updating, Separating Data stack from Production, Dashboard Essentials and Metrics monitoring.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Formulate and solve linear programming problems.

CO2 Understand and analyze how to deal with changing data.

CO3 Understand and interpret potential unintended effects in their project.

CO4 Understand and define procedures to Operationalize the applied machine learning model.

CO5 Understand and define procedures to maintain the applied machine learning model.

CO6 Understand how to optimize the use of Machine Learning in real-life problems.

TEXT BOOKS:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.
2. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing, 2020.
3. Optimization in Machine Learning and Applications, Suresh Chandra Satapathy, Anand J.Kulkarni, Springer, 2019.

REFERENCE BOOKS:

1. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill,2017.
2. Optimization for Machine Learning, Suvrit Sra, Sebastian Nowozin andStephen J. Wright, MITPress, 2011.
3. Algorithms for Optimization by Mykel J. Kochenderfer and Tim A. Wheeler,MIT Press, 2019.
4. Accelerated Optimization for Machine Learning: First-Order Algorithmsby Cong Fang, Huan Li,and Zhouchen Lin, Springer, 2020.

23AD1917	ROBOTIC PROCESS AUTOMATION AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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

CO1 Enunciate the key distinctions between RPA and existing automation techniques and platforms.

CO2 Use UiPath to design control flows and work flows for the target process

CO3 Implement recording, web scraping and process mining by automation

CO4 Use UIPath Studio to detect, and handle exceptions in automation processes

CO5 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.

REFERENCE BOOKS:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, 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

23AD1907	ETHICS AND AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the need for ensuring ethics in AI
- To understand ethical issues with the development of AI agents
- To apply the ethical considerations in different AI applications
- To evaluate the relation of ethics with nature
- To overcome the risk for Human rights and other fundamental values
- 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

COURSE OUTCOME(S):

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

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

REFERENCE BOOKS:

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
3. K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.
4. Wallach, W., & Allen, C, “Moral machines: ceaching robots right from wrong”, Oxford University Press, 2008.

VERTICAL VII – NETWORKING

23CS1917	COMMUNICATION THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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- DSBSC, 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.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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 OBJECTIVE :

- 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 NETWORKING PRINCIPLES 9

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Collision detection and collision avoidance, Hidden and Exposed Terminals – Switched networks – Datagrams, Virtual circuits, Cell switching and Label switching – Wireless Networks – Infrastructure based, ad hoc and hybrid – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios –Applications, Quality of Service – End to end level and network level solutions.

UNIT- II PHYSICAL NETWORK DESIGN 9

LAN cabling topologies – Ethernet Switches – High speed and Gigabit and 10 Gbps – Building cabling topologies and Campus cabling topologies – Routers, Firewalls and L3 switches –Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks

UNIT- III LOGICAL DESIGN AND MANAGEMENT 9

IPv4 and IPv6 Dynamic Addressing –Hierarchical routing – VLSMand CIDR – Transition from IPv4 to IPv6 – NAT and DHCP – Static and Dynamic routes – RIP, OSPF and BGP – VPN – RMON and SNMP

UNIT- IV INNOVATIVE NETWORKS 9

Software Defined Networks – Evolution of switches and control planes – Centralized and distributed data and control planes – Open Flow and SDN Controllers – Network Function Virtualization – Needs of the Data Centers – SDN solutions for data centers - Delay Tolerant Networks – Overlay architecture – Bundle Protocol – Opportunistic routing and Epidemic routing

UNIT- V NETWORK PROGRAMMING IN UNIX C 9

Socket address structures – Byte ordering and byte manipulation functions – Elementary TCP sockets - socket, connect, bind, listen, accept and close functions – TCP client and server – Elementary UDP sockets –recvfrom and send to functions , connect function with UDP – Raw sockets – Client-server design alternatives – Iterative and Concurrent servers.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

CO1 Apply the networking principles to design a network

CO2 Explore various networking devices

CO3 Explore protocols required for network design and management

CO4 Apply SDN in computing paradigms like Cloud Computing and Internet of Things

CO5 Configure the networking devices and protocols

CO6 Develop network applications in various platforms

TEXTBOOKS :

1. Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach, 5th edition, Morgan Kauffman, 2011.
2. W.Richard Stevens, Bill Fenner and Andrew M Rudoff, Unix Network Programming: The Sockets Networking API: Volume 1, 3rd Edition, Addison Wesley, 2003.
3. Paul Goransson, Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kauffman, 2014.

REFERENCE BOOKS :

1. ParitoshPuri, M.P.Singh,A survey paper on routing in delay tolerant networks, International Conference on Information and Computer Networks (ISCON), 2013, DOI:10.1109/ICISCON 2013.6524206.
2. Ying Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill, 2011.

23IT1917	NETWORK MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 OUTCOME(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 OBJECTIVE:

- 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 OUTCOME(S):

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 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 protocols

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 OUTCOME(S):

Upon completion of the course, 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.

TEXT BOOKS:

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, ―Ad Hoc Mobile Wireless Networks‖,Auerbach 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.

23IT1919	PROTOCOLS AND ARCHITECTURES FOR WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- 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 OUTCOME(S):

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 OBJECTIVE:

- 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 INTRODUCTION TO SDN 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 OUTCOME(S):

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 OBJECTIVE :

- 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 OUTCOME(S):

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.

TEXT BOOKS :

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 Management,Wiley & IEEE Press Publications, 2010.

REFERENCE BOOKS :

1. Madhusanga Liyanage, Andrei Gurtov, Mika Ylianttila, "Software Defined Mobile Networks beyond LTE Network Architecture", Wiley, June 2015.
2. Savo G Glisic," Advanced Wireless Networks- Technology and Business models", Wiley, 3rd edition- 2016.