

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 2024-25

B.TECH - INFORMATION TECHNOLOGY

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 INFORMATION TECHNOLOGY B.TECH- INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABUS

REGULATION – 2023
(For the Students admitted during 2024 – 2025)

Vision

To impart fundamental knowledge and practical expertise in Information Technology to students, instilling ethical principles to achieve excellence in academics and corporate, to emerge as distinguished graduates.

Mission

- **M1:** To establish a strong foundation in technology through innovation and research.
- **M2:** To create a tech-driven learning environment that promotes academic success.
- **M3:** To develop skilled graduates in IT, research and entrepreneurship with global competence.
- **M4:** To collaborate with industry and government affairs to gain exposure while maintaining standards and promoting ethics, diversity and social impact.

Programme Educational Objectives (PEO)

- **PEO1: Technical Competence and Problem-Solving:** To provide graduates with a robust foundation in engineering and mathematics, enabling them to design and enhance cutting-edge technology systems.
- **PEO2: Technological Expertise:** To collaborate with industry and government affairs to gain exposure while maintaining standards and promoting ethics, diversity, and social impact.
- **PEO3: Industry and Research Collaboration:** To encourage collaboration with industries, universities, and research centers to drive innovation and create impactful solutions.

Programme Outcomes (PO)

- **PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- **PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- **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. (WK5)
- **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.(WK8).
- **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. (WK2 and WK6)
- **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. (WK1, WK5 and WK7).
- **PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).

- **PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- **PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
- **PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- **PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Programme Specific Outcomes (PSO)

- **PSO1: Software Development**
To design and develop robust, internet-enabled software systems addressing real-world business and societal needs through computational thinking.
- **PSO2: System Architecture and Engineering**
To design and model complex computing systems using engineering tools, domain knowledge, and IT infrastructure for efficient and scalable solutions.
- **PSO3: Innovation Exploration**
To implement contemporary technologies to plan, design, and execute innovative projects developing intelligent systems for emerging IT challenges.

B.Tech. – Information Technology
CHOICE BASED CREDIT SYSTEM (CBCS)
I - VIII CURRICULUM AND SYLLABI (REGULATION 2023)

(For the Students admitted during 2024 - 25)

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.	23ES1106	Programming in C	ES	3/0/0	3	3	60/40
Theory Cum Practical Courses							
3.	23HS1103	Communicative English and Language Skills I	HS	2/0/2	4	3	50/50
4.	23PH1103	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.	23ES1113	Programming in C Laboratory	ES	0/0/4	4	2	40/60
7.	23ES1114	Innovative Thinking and Prototype Development Laboratory	ES	0/0/4	4	2	40/60
Mandatory Course							
8.	23TA1101	தமிழர் மரபு / Heritage of Tamils	HS	1/0/0	1	1	60/40
9.	23HS1104	Interpersonal Communication skills I	EEC	0/0/2	1	0	0/100
10.	23HS1105	Quantitative Aptitude Practices I	EEC	0/0/1	1	0	0/100
TOTAL					31	22	

Semester II							
S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit	Ext / Int Weightage
Theory Courses							
1.	23MA1206	Complex Variables and Transforms	BS	3/1/0	4	4	60/40
2.	23ES1206	Programming in Python	ES	3/0/0	3	3	60/40
Theory Cum Practical Courses							
3.	23HS1203	Communicative English and Language Skills II	HS	2/0/2	4	3	50/50
4.	23IT1201	Digital Logic and Computer Organization	PC	3/0/2	5	4	50/50
Laboratory Courses							
5.	23ES1215	Programming in Python Laboratory	ES	0/0/4	4	2	40/60
6.	23ES1212	Technical Skill Practices I	EEC	0/0/2	2	0	0/100
Mandatory Course							
7.	23TA1201	தமிழரும் தொழில் நுட்பமும் /Tamils and Technology	HS	1/0/0	1	1	60/40
8.		Mandatory Course I	MC	2/0/0	2	0	0/100
9.	23HS1204	Interpersonal Communication skills II	EEC	0/0/2	1	0	0/100
10.	23HS1205	Quantitative Aptitude Practices II	EEC	0/0/1	1	0	0/100
TOTAL					27	17	

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.	23CS1302	Data Structures	PC	3/0/0	3	3	60/40
3.	23CS1303	Database Management Systems	PC	3/0/0	3	3	60/40
4.	23IT1302	Microprocessor and Microcontroller Design	PC	3/0/0	3	3	60/40
5.	23IT1303	Object Oriented Design and Programming	PC	3/0/0	3	3	60/40
Laboratory Courses							
6.	23IT1312	Object Oriented Design and Programming Laboratory	PC	0/0/4	4	2	40/60
7.	23CS1311	Data Structures Laboratory	PC	0/0/4	4	2	40/60
8.	23CS1312	Database Management Systems Laboratory	PC	0/0/4	4	2	40/60
9.	23ES1311	Technical Skill Practices II	EEC	0/0/2	2	0	0/100
Mandatory Course							
9.		Mandatory Course - II	MC	2/0/0	2	0	0/100
11.	23HS1301	Skills for Career Building and Development I	EEC	0/0/2	2	0	0/100
12.	23HS1302	Quantitative Aptitude Practices III	EEC	0/0/1	1	0	0/100
TOTAL					35	22	

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.	23IT1402	Design and Analysis of Algorithms	PC	3/0/0	3	3	60/40
4.	23IT1404	Operating Systems With Linux Administration	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.	23IT1411	Operating Systems and Linux Administration Practical 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	0	0/100
Mandatory Course							
10.	23HS1401	Skills for Career Building and Development II	EEC	0/0/2	2	0	0/100
11.	23HS1402	Quantitative Aptitude Practices IV	EEC	0/0/1	1	0	0/100
TOTAL					33	23	

Semester V							
S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit	Ext / Int Weightage
Theory Courses							
1.	23IT1501	Automata Theory and Compiler Engineering	PC	3/0/0	3	3	60/40
2.	23CS1501	Full Stack Development	PC	3/0/0	3	3	60/40
3.	23IT1503	Embedded Systems and Internet of Things	PC	3/0/0	3	3	60/40
4.	23IT1504	Artificial Intelligence	PC	3/0/0	3	3	60/40
5.		Professional Elective I	PE	3/0/0	3	3	60/40
6.		Open Elective I	OE	3/0/0	3	3	60/40
Laboratory Courses							
7.	23CS1511	Full Stack Development Laboratory	PC	0/0/4	4	2	40/60
8.	23IT1512	Embedded Systems and Internet of Things Laboratory	PC	0/0/4	4	2	40/60
9.	23IT1513	Design Thinking and Socially Relevant Project Development	EEC	0/0/2	2	1	40/60
10.	23ES1511	Technical Skill Practices IV	EEC	0/0/2	2	0	0/100
TOTAL					30	23	

Semester VI							
S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit	Ext / Int Weightage
Theory Courses							
1.	23IT1601	Pattern Recognition and Machine Learning	PC	3/0/0	3	3	60/40
2.	23IT1604	Modern DevOps and Practices	PC	3/0/0	3	3	60/40
3.		Professional Elective – II	PE	3/0/0	3	3	60/40
Theory Cum Practical Courses							
4.	23IT1602	Mobile and Pervasive Computing	PC	2/0/2	4	3	50/50
5.	23IT1603	Deep Learning and Natural Language Processing	PC	2/0/2	4	3	50/50
Laboratory Courses							
6.	23IT1611	Pattern Recognition and Neural Networks Laboratory	PC	0/0/4	4	2	40/60
7.	23CS1612	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	0/0/4	4	2	40/60
8.	23ES1611	Technical Skill Practices V	EEC	0/0/2	2	0	0/100
TOTAL					27	19	

Semester VII							
S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit	Ext / Int Weightage
Theory Courses							
1.	23IT1701	Cloud Computing and Big Data Analytics	PC	3/0/0	3	3	60/40
2.	23CS1701	Cryptography and Cyber Security	PC	3/0/0	3	3	60/40
3.	23IT1703	Software Testing and Quality Assurance	PC	3/0/0	3	3	60/40
4.		Professional Elective - III	PE	3/0/0	3	3	60/40
5.		Professional Elective - IV	PE	3/0/0	3	3	60/40
6.		Open Elective – II	OE	3/0/0	3	3	60/40
Laboratory Courses							
7.	23CS1711	Cryptography and Cyber Security Laboratory	PC	0/0/4	4	2	40/60
8.	23IT1711	Cloud Computing and Big Data Analytics Laboratory	PC	0/0/4	4	2	40/60
9.	23IT1712	Software Testing and Quality Assurance Laboratory	PC	0/0/4	4	2	40/60
Employment Enhancement Courses							
10.	23IT1702	Industrial training / Internship*	EEC	-	-	2	0/100
11.		Value added Courses**	EEC	-	-	0	0/100
TOTAL					30	26	

* 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 03 to 07 semesters

Semester VIII							
S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit	Ext / Int Weightage
Theory Courses							
1.		Professional Elective V	PE	3/0/0	3	3	60/40
2.		Professional Elective VI	PE	3/0/0	3	3	60/40
Laboratory Courses							
3.	23IT1811	Project Work	EEC	0/0/16	16	8	40/60
TOTAL					22	14	

TOTAL CREDITS: 166

SUMMARY OF CREDITS

Sl. No.	Subject Area	Credits Per Semester								Credits Total	Percentage %
	Semester	I	II	III	IV	V	VI	VII	VIII		
1.	Humanities and Social Studies including Management course (HS)	4	4							8	4.8
2.	Basic Sciences (BS)	7	4	4	4					19	11.4
3.	Engineering Sciences (ES)	11	5							16	9.6
4.	Professional Core (PC)		4	18	19	16	14	15		86	51.8
5.	Professional Electives (PE)					3	3	6	6	18	10.8
6.	Open Electives (OE)					3		3		6	3.6
7.	Project Work / Employability Enhancement Courses (PR/EEC)					1	2	2	8	13	7.8
8.	Non-Credit/(Mandatory)									0	0
	Total	22	17	22	23	23	19	26	14	166	100

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.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also.

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

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

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

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

R2023 (admitted during 2024 - 25) - PROFESSIONAL ELECTIVES: VERTICALS - IT

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
23AD1902 - Exploratory Data Analysis	23IT1901 - NextGen Web Development	23CS1901 - Storage Technologies	23IT1909 - Ethical Hacking	23CS1909 - Video Creation and Editing	23AD1920 - Knowledge Engineering	23CS1917- Communication Theory
23AD1909 - Data Visualization	23IT1902 - Open Source Technologies	23CS1902 - Cloud Tools and Techniques	23IT1910 - Modern Cryptography	23CS1910 - Digital Marketing	23AD1912 - Health Care Analytics	23CS1918 - Network Design and Programming
23AD1918 - Business Analytics	23IT1903 - App Development	23CS1903 - Virtualization	23IT1911 - Digital and Mobile Forensics	23CS1911 - Multimedia and Animation	23AD1906 - Engineering Predictive Analytics	23IT1917 - Network Management
23AD1904 – Text Analytics	23IT1904 - UI and UX Design	23CS1904 - Cloud Services Management	23IT1912 - Social Network Security	23CS1912 - Streaming Media Tools and Technologies	23AD1903 - Soft Computing	23IT1918 - Wireless Technologies
23AD1905 - Recommender Systems	23IT1921 – Cloud Native Development	23CS1905 - Security and Privacy in Cloud	23IT1913 - Cryptocurrency and Blockchain Technologies	23CS1913 – Visual Effects	23AD1915 – Game Theory	23CS1919 - Wireless Adhoc and Sensor Networks
23AD1910 - Image and Video Analytics	23IT1922 - Microservices Architecture	23CS1906 - Stream Processing	23IT1914 - Engineering Secure Software Systems	23CS1914 - 3D Printing and Design	23AD1921 - Optimization Techniques in Machine Learning	23IT1919 - Protocols and Architectures For Wireless Sensor Networks
23AD1911 - Speech Processing and Analytics	23IT1907 - Web Application Security	23CS1907 - Site Reliability Engineering	23IT1915 - Cyber Physical Systems Security	23CS1915 - Game Development	23AD1917 - Robotic Process Automation and Development	23IT1920 - Software Defined Networks
23AD1919 - Computer Vision Techniques	23IT1908 - Project Management and Agile Technologies	23CS1908 - Quantum Computing	23IT1916 - Threat Detection and Incident Response	23CS1916 - Augmented Reality and Virtual Reality	23AD1907 – Ethics and AI	23CS1920 - Next Generation Networks

PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL I : DATA SCIENCE**

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

VERTICAL II : FULL STACK DEVELOPMENT

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	L/T/P	CONTACT HOURS	CREDIT
1.	23IT1901	NextGen Web Development	PE	3/0/0	3	3
2.	23IT1902	Open Source Technologies	PE	3/0/0	3	3
3.	23IT1903	App Development	PE	3/0/0	3	3
4.	23IT1904	UI and UX Design	PE	3/0/0	3	3
5.	23IT1921	Cloud Native Development	PE	3/0/0	3	3
6.	23IT1922	Microservices Architecture	PE	3/0/0	3	3
7.	23IT1907	Web Application Security	PE	3/0/0	3	3
8.	23IT1908	Project Management and Agile Technologies	PE	3/0/0	3	3

VERTICAL III: CLOUD COMPUTING AND DATA CENTRE TECHNOLOGIES

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

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

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

VERTICAL V: CREATIVE MEDIA TECHNOLOGIES

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

VERTICAL VI: ADVANCED ARTIFICIAL INTELLIGENCE

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

VERTICAL VII: NETWORKING

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

HUMANITIES AND SOCIAL SCIENCES (HS)

S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit
1.	23HS1103	Communicative English and Language Skills I	HS	2/0/2	4	3
2.	23TA1101	தமிழர் மரபு / Heritage of Tamils	HS	1/0/0	1	1
3.	23HS1203	Communicative English and Language Skills II	HS	2/0/2	4	3
4.	23TA1201	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HS	1/0/0	1	1

BASIC SCIENCES (BS)

S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit
1.	23MA1101	Matrices and Calculus	BS	3/1/0	4	4
2.	23PH1101	Engineering Physics	BS	2/0/2	4	3
3.	23MA1206	Complex Variables and Transforms	BS	3/1/0	4	4
4.	23MA1301	Discrete Mathematics	BS	3/1/0	4	4
5.	23MA1401	Probability and Statistical Methods	BS	3/1/0	4	4

ENGINEERING SCIENCES (ES)

S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit
1.	23ES1106	Programming in C	ES	3/0/0	3	3
2.	23ES1103	Engineering Graphics	ES	2/0/2	4	3
3.	23ES1113	Programming in C Laboratory	ES	0/0/4	4	2
4.	23ES1114	Innovative Thinking and Prototype Development Laboratory	ES	0/0/4	4	2
5.	23ES1206	Programming in Python	ES	3/0/0	3	3
5.	23ES1102	Basic Electrical and Electronics Engineering	ES	3/0/2	5	4
6.	23ES1215	Programming in Python Laboratory	ES	0/0/4	4	2

PROFESSIONAL CORE (PC)

S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit
1.	23IT1201	Digital Logic and Computer Organization	PC	3/0/2	5	4
2.	23IT1303	Object Oriented Design and Programming	PC	3/0/0	3	3
3.	23CS1302	Data Structures	PC	3/0/0	3	3
4.	23CS1303	Database Management Systems	PC	3/0/0	3	3
5.	23IT1302	Microprocessor and Microcontroller Design	PC	3/0/0	3	3
6.	23IT1312	Object Oriented Design and Programming Laboratory	PC	0/0/4	4	2
7.	23CS1311	Data Structures Laboratory	PC	0/0/4	4	2
8.	23CS1312	Database Management Systems Laboratory	PC	0/0/4	4	2
9.	23CS1401	Computer Networks	PC	3/0/0	3	3
10.	23IT1402	Design and Analysis of Algorithms	PC	3/0/0	3	3
11.	23IT1404	Operating Systems With Linux Administration	PC	3/0/0	3	3
12.	23AD1405	Foundations of Data Science	PC	3/0/0	3	3
13.	23IT1401	Object Oriented Software Engineering	PC	2/0/2	4	3
14.	23IT1411	Operating Systems and Linux Administration Practical Laboratory	PC	0/0/4	4	2
15.	23AD1413	Foundations of Data Science Laboratory	PC	0/0/4	4	2
16.	23IT1501	Automata Theory and Compiler Engineering	PC	3/0/0	3	3
17.	23CS1501	Full Stack Development	PC	3/0/0	3	3
18.	23IT1503	Embedded Systems and Internet of Things	PC	3/0/0	3	3
19.	23IT1504	Artificial Intelligence	PC	3/0/0	3	3
20.	23CS1511	Full Stack Development Laboratory	PC	0/0/4	4	2

21.	23IT1512	Embedded Systems and Internet of Things Laboratory	PC	0/0/4	4	2
22.	23IT1601	Pattern Recognition and Machine Learning	PC	3/0/0	3	3
23.	23IT1602	Mobile and Pervasive Computing	PC	2/0/2	4	3
24.	23IT1603	Deep Learning and Natural Language Processing	PC	2/0/2	4	3
25.	23IT1604	Modern DevOps and Practices	PC	3/0/0	3	3
26.	23IT1611	Pattern Recognition and Neural Networks Laboratory	PC	0/0/4	4	2
27.	23IT1701	Cloud Computing and Big Data Analytics	PC	3/0/0	3	3
28.	23CS1701	Cryptography and Cyber Security	PC	3/0/0	3	3
29.	23IT1703	Software Testing and Quality Assurance	PC	3/0/0	3	3
30.	23CS1711	Cryptography and Cyber Security Laboratory	PC	0/0/4	4	2
31.	23IT1711	Cloud Computing and Big Data Analytics Laboratory	PC	0/0/4	4	2
32.	23IT1712	Software Testing and Quality Assurance Laboratory	PC	0/0/4	4	2

OPEN ELECTIVES (OE)

OPEN ELECTIVE – I

S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit
1.	23CE1010	Air Pollution and Control Engineering	OE	3/0/0	3	3
2.	23ME1008	Energy Conservation and Management	OE	3/0/0	3	3
3.	23GE1004	Hospital Waste Management	OE	3/0/0	3	3
4.	23ME1009	Industrial Nanotechnology	OE	3/0/0	3	3
5.	23EE1003	Logic and Distributed Control Systems	OE	3/0/0	3	3
6.	23EC1011	Telehealth Technology	OE	3/0/0	3	3

OPEN ELECTIVE II

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

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit
	23HS1104	Interpersonal Communication skills I	EEC	0/0/2	1	0
	23HS1105	Quantitative Aptitude Practices I	EEC	0/0/1	1	0
1.	23ES1212	Technical Skill Practices I	EEC	0/0/2	2	0
2.	23HS1204	Interpersonal Communication skills II	EEC	0/0/2	1	0
3.	23HS1205	Quantitative Aptitude Practices II	EEC	0/0/1	1	0
4.	23ES1311	Technical Skill Practices II	EEC	0/0/2	2	0
5.	23HS1301	Skills for Career Building and Development I	EEC	0/0/2	2	0
6.	23HS1302	Quantitative Aptitude Practices III	EEC	0/0/1	1	0
7.	23ES1411	Technical Skill Practices III	EEC	0/0/2	2	0
8.	23HS1401	Skills for Career Building and Development II	EEC	0/0/2	2	0

9.	23HS1402	Quantitative Aptitude Practices IV	EEC	0/0/1	1	0
10.	23IT1513	Design Thinking and Socially Relevant Project Development	EEC	0/0/2	2	1
11.	23ES1511	Technical Skill Practices IV	EEC	0/0/2	2	0
12.	23CS1612	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	0/0/4	4	2
13.	23ES1611	Technical Skill Practices V	EEC	0/0/2	2	0
14.	23IT1811	Project Work	EEC	0/0/16	16	8

MANDATORY COURSES (MC)

SI. 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.	23MC1005	Essence of Indian Knowledge Tradition	MC	2	2	0	0	0
5.	23MC1006	Soft Skills and Personality Development	MC	2	2	0	0	0
6.	23MC1007	Value Education, Human Rights & Legislature Procedure	MC	2	2	0	0	0

SEMESTER - I

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

COURSE OBJECTIVE:

- Matrix transforms are very useful within the world of computer graphics. A matrix algebra can be readily applied to the structural properties of graphs from an algebraic point of view.
- The aim of this course to get depth knowledge about calculus.
- Familiarize the functions of two variables and finding its extreme points.
- To make the students understand various techniques of integration.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

UNIT I MATRICES 9+3

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

UNIT II DIFFERENTIAL CALCULUS 9+3

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

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

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

UNIT IV INTEGRAL CALCULUS 9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts - Bernoulli's formula - Integration of rational functions by partial fraction - Improper integrals.

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 completion of the course, students will be able to:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Anton H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2019.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd. Chennai, 2007.
4. Srimantha Paland Bhunia, S.C., "Engineering Mathematics" Oxford University Press, 2015.
5. Weir M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.
6. B.V. Ramana "Higher Engineering Mathematics", McGraw Hill Education, India.
7. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley sons, 10th Edition, 2015.
8. Sivaramakrishna Dass, C. Vijayakumari, "Engineering Mathematics", Pearson Education India, 4th Edition 2019.
9. Sundar Raj. M and Nagarajan. G, "Engineering Mathematics-I", 3rd Edition, Sree Kamalamani Publications, Chennai, 2020.

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma60/preview
2. https://onlinecourses.nptel.ac.in/noc21_ma58/preview

CO-PO-PSO MAPPING

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

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

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

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Learn the syntax for C programming
- CO2** Develop simple applications in C using basic constructs
- CO3** Design and implement applications using arrays and strings
- CO4** Develop and implement applications in C using functions and pointers.
- CO5** Develop applications in C using structures and union.
- CO6** Design applications using sequential and random access file processing

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, C How to Program, Seventh edition, Pearson Publication, 2015
2. Juneja, B. L and Anita Seth, Programming in C, CENGAGE Learning India pvt. Ltd.,2011
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009
4. Anita Goel and Ajay Mittal, Computer Fundamentals and Programming in C, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011
5. Byron S. Gottfried, "Schism's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 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	3	2	1									3	2	
CO2	3	3	2	1								3	2	
CO3	3	3	3	2	1							3	3	2
CO4	3	3	3	3	2							3	3	3
CO5	3	3	3	3	3	1				1	1	3	3	3
CO6	3	3	3	3	3	2				2	2	3	3	3

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

23HS1103	COMMUNICATIVE ENGLISH AND LANGUAGE SKILLS I	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

UNIT I	INFORMAL COMMUNICATION	6
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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.

ACTIVITY: Listening to self -introduction before the interview committee after listening modules.

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.

ACTIVITY: Listening to conversation and performing role play and Writing dialogues on various work context.

UNIT III	OFFICIAL COMMUNICATIONS	6
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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.

ACTIVITY: Preparing Permission letters and short talks and presentation on various topics related to professions.

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.

ACTIVITY: Listening to Group Discussion and sharing recommendation.

UNIT V**DEFINITIONS AND PRODUCT DESCRIPTION****6**

Listening: Listening to a Product Description (labeling 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.

ACTIVITY: Reading about the modern gadgets and describing them.

TOTAL :30 PERIODS**COURSE OUTCOME**

Upon 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** Recognize the use of grammar in speech and writing.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Board of Editors. Using English-A course book for Undergraduate engineers and Technologists Orient Black Swan Limited, 2017
2. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
3. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011 3. Means, 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/wordformation>
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20180316_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/2018/02/2018031621.pdf>
4. <https://www.ego4u.com/en/cram-up/grammar/prepositions>

LANGUAGE SKILLS LAB

30 Hours

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.
Reading and Comprehending the passages in the competitive exams like GATE, TOEFL, GRE, IELTS, and other exams conducted by Central and state governments.

REFERENCES:

1. Suresh Kumar.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

CO-PO-PSO MAPPING

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

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

23PH1103	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 girders

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

UNIT – II **SEMICONDUCTING AND MAGNETIC MATERIALS** **6**

Semiconducting Materials: Density of Energy State - Intrinsic Semiconductors – energy band diagram – carrier concentration in intrinsic semiconductors – extrinsic semiconductors (theory) – application – Hall effect

Magnetic Materials: Origin of magnetism – Basic definitions – Classifications of Magnetic Materials- Ferromagnetic Domain theory – M versus H Behaviour- Hard and Soft Magnetic materials – applications

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– industrial applications

Fiber Optics: components and principle of fiber optics – numerical aperture and acceptance angle derivation – types (material, refractive index, and mode) – losses associated with optical fiber – applications - 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 time independent and time dependent wave equations

Nanoscience: Introduction – Classification of nanomaterials (0D, 1D, 2D and 3D) – preparation (bottom up and top down approaches) - carbon nanotubes: types - mechanical, optical and electrical properties – applications.

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

TOTAL : 30 PERIODS

COURSE OUTCOME(S):

Upon successful completion of the course, the 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.

TEXT BOOKS:

1. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012
2. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014
3. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017
4. Karl.F.Reck, Basics of laser physics: for students of science and engineering, Second edition, Springer Publications.

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

LIST OF EXPERIEMENTS

30 HOURS

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 energy band gap of a semiconductor.

CO-PO-PSO MAPPING

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

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

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 wiring - tools and components, different types of wiring, safety measures at home and industry. **Case Study** - staircase Wiring and ceiling fan Wiring.

UNIT II ELECTRICAL MACHINES 9

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

UNIT III SEMICONDUCTOR DEVICES AND CIRCUITS 9

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

UNIT IV SENSORS AND ACTUATORS 9

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

UNIT V EMERGING TECHNOLOGIES 9

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

TOTAL :45 PERIODS

COURSE OUTCOME

Upon completion of the course, students 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

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, New Delhi, 2007
2. Smarjit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition 2007
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

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

30 Hours

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

CO-PO-PSO MAPPING

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

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

23ES1113	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- Recognize and remember to Write, test, and debug simple C programs
- Implement C programs with conditional and looping statement
- Develop applications in C using strings, pointers, functions
- Implement C programs with structures and union
- Develop applications in C using file processing
- 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 every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number
5. Check whether a given number is Armstrong number or not.
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights 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 as shown below <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height.
8. Given a string —a\$bcd./fgll 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 numbers using 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. Search an element from an unsorted array using linear search Search an element in an array using Binary search recursion call
13. Generate salary slip of employees using structures and pointers
14. Programs using Pointers
 - a. Pointer demonstration the use of & and *

- b. Access Elements of an Array Using Pointer
 - c. Perform the string operations like Length of the String ,
 - d. 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 minimum balance using sequential 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, 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	2	2		2					2		3	2	
CO2	3	3	3	2	2					2		3	2	1
CO3	3	3	3	2	3					2	2	3	3	2
CO4	3	3	3	3	3	2				2	2	3	3	3
CO5	3	3	3	3	3	3				2	2	3	3	3
CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3

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

23ES1114	INNOVATIVE THINKING AND PROTOTYPE DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

To impart Knowledge on the following topics:

- To demonstrate the essence of agile development methods and create a GitHub repository.
- To acquire practical knowledge for Designing using Adobe Photoshop, COREL Draw.
- To Gain Knowledge, in CANVA Tools.
- Apply the basic knowledge of design thinking in project work.
- Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects.

LIST OF EXPERIMENTS

1. Introduction to GIT Setting a GIT repository. Create a repository in a GitHub for a team.
2. Design your college Logo using COREL Draw tools.
3. Design a visiting card using COREL Draw tools.
4. Adobe Photo Shop Tools – Magnetic Lasso Tool –image, Patch Tool –Smudge Tool, Blur-Filter Tool.
 - a. Make Selections with the Magnetic Lasso Tool
 - b. Replace unwanted content with the patch tool and Apply filter to it
 - c. Work with the smudge tool to smooth and blend colors.
 - d. Blur areas in an image with Blur tool.
5. Timeline & Trimming adding, arranging, and trimming video clips, images, and audio tracks. Using CANVA Tools.
6. Learn basic CHAT GPT tools and perform Provide the text to ChatGPT and tell it what you're looking for/what you want it to find.
7. Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of England?"
8. Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas.

Ex: Prompt: "In a world where gravity suddenly stopped working, people started

floating upwards. Write a story about how society adapted to this new reality."

9. Design of 3D printing using Fusion 360 and product development.
10. Write CNC programming for CNC Lathe and Milling.
11. Create design for CNC router for ART cam software.
12. Create a PCB design for product Development
13. Develop The Mini Project Using Idea Lab.

TOTAL:60 PERIODS

COURSE OUTCOME(S):

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

- CO 1** Define agile development methods in software development practices
- CO 2** Identify the various tools used to Edit Videos using CANVA tools.
- CO 3** Apply the Knowledge for Designing using Photo Shop ,COREL draw
- CO 4** Implement the usage of ChatGPT and its tools.
- CO 5** Design thinking using 3D Printer
- CO 6** Develop a simple PCB boards using etching and milling Process

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International Edition, Ninth Edition, 2020.
2. Ulrich and Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
3. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018.
4. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan, Weldon Owen; 2017

WEB REFERENCES:

1. <https://www.raypcb.com/video-electronics-pcb>
2. <https://www.coursera.org/courses?query=3d%20printing>
3. <https://www.coursera.org/courses?query=photoshop>

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

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

UNIT – I LANGUAGE AND LITERATURE 3

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

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

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

UNIT – III FOLK AND MARTIAL ARTS 3

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

UNIT –IV THINAI CONCEPT OF TAMILS 3

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

UNIT –V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

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

Total : 15 PERIODS

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: International Institute 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 Civilization 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) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and 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	
40%				60 %

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, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

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

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கப்பியம் 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.

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்ச 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. பொருளை - 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: International Institute 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 Civilization 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) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and 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 %

23HS1104	INTERPERSONAL COMMUNICATION SKILLS I	L	T	P	C
		0	0	2	0

COURSE OBJECTIVES

- To understand and control emotions, promoting personal growth, self-confidence, and a positive mind-set.
- To strengthen skills in navigating relationships, staying motivated, adapting to new situations, and communicating effectively.
- To teach methods for organizing tasks, meeting deadlines, and resolving disputes to improve productivity and relationships.
- To develop abilities in creative problem-solving and thoughtful decision-making using structured techniques for innovative solutions.
- To collaborate effectively, lead with confidence, and inspire others in group and professional settings

Unit I

Self-Analysis - Growth Mind-set- Empathy for Self

Unit II

Attitude Reengineering- Motivation- Interpersonal Skills

Unit III

Time Management (Deadlines management, Prioritisation)- Conflict Resolution - Change Management

Unit IV

Decision Making - Creative Thinking Skills - Six Thinking Hats Technique -

Unit V

Leadership- Collaborative Skills- Teamwork- Presentation Skills

TOTAL : 30 PERIODS

TEXT BOOKS

1. Covey, Stephen R. The 7 Habits of Highly Effective People: 30th Anniversary Edition. Simon & Schuster, 2020.
2. Goleman, Daniel. Emotional Intelligence: Why It Can Matter More Than IQ. 10th anniversary ed., Bantam Books, 2005.

REFERENCE BOOKS

1. Dweck, C. S. (2006). Mindset: The New Psychology of Success. Random House.
2. De Bono, E. (2017). Six Thinking Hats (Revised Edition). Penguin Books.

WEB REFERENCES

1. <https://casel.org/what-is-the-casel-framework/>
2. <https://ggie.berkeley.edu/sel-for-students-self-awareness-and-self-management/>

ONLINE COURSES / RESOURCES

1. <https://www.coursera.org/learn/emotional-intelligence-leadership>
2. <https://www.coursera.org/learn/critical-thinking-skills>

COURSE OUTCOME

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

- CO1** Manage emotions effectively, embrace a growth-oriented mind-set, and build stronger selfconfidence.
- CO2** Demonstrate strong interpersonal skills, motivation, and adaptability, fostering effective communication across diverse settings.
- CO3** Prioritize tasks and handle conflicts constructively, enhancing their productivity and interpersonal interactions.
- CO4** Make informed decisions and address challenges creatively using structured problem-solving approaches.
- CO5** Excel in teamwork, exhibit leadership, and positively influence others in group and community initiatives.

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	2	2	
CO3								2	3		2	3	3	2
CO4								2	3		2	2	2	
CO5								2	3		2	3	3	

23HS1105	QUANTITATIVE APTITUDE PRACTICES I	L	T	P	C
		0	0	1	0

COURSE OBJECTIVE:

- To strengthen students understanding of number systems, algebra and assist them in developing their problem-solving skills.
- To get the abilities needed to address challenges with quantitative aptitude.

Module 1 Number system 3

Numbers - HCF and LCM- simplification - square root - cube root.

Module 2 Algebra 3

Algebra - decimal fraction - arithmetic progression - geometric progression.

Module 3 Blood relations 3

Blood relations - pattern sequence - alphabet test question – clocks - calendars.

Module 4 Data Interpretation 3

Table chart- pie chart - bar chart - line charts

TOTAL : 12 PERIODS

COURSE OUTCOME(S):

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

- CO1** Demonstrate solid understanding to address number system and algebraic problems.
- CO2** Handle problems with the blood relations and data interpretation.

TEXT BOOKS:

1. Aggarwal R.S.(2017).Quantitative Aptitude for Competitive Examinations 3rd edition NewDelhi: S.Chand Publishing.
2. Abhijit guha(2016). Quantitative Aptitude for All Competitive Examinations, 6th edition. Noida : McGraw Hill Education Pvt. Ltd.
3. FACE.(2016).Aptipedia Aptitude Encyclopedia1(Ed.).New Delhi: Wiley Publications.

REFERENCE BOOKS:

1. Sharma arun.(2016).Quantitative aptitude,7th(Ed.).Noida : McGraw Hill Education Pvt. Ltd.
2. Praveen. R.V 3rd edition, Quantitative aptitude and reasoning, PHI learning publication.

WEB REFERENCES:

1. [https:// www.indiabix.com](https://www.indiabix.com)

MODE OF EVALUATION: Online Test

SEMESTER – II

23MA1206	COMPLEX VARIABLES AND TRANSFORMS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- 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 make the student appreciate the purpose of using fourier transforms to create a new domain in which it is easier to handle the problem that is being investigated.
- To solve the problems in electronic circuits.

UNIT - I 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 theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes, rectangular parallelopiped, sphere and cylinder.

UNIT - II 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 - III COMPLEX INTEGRATIONS 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 - IV FOURIER TRANSFORM 9+3

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT - V LAPLACE TRANSFORM 9+3

Laplace transform – Sufficient condition 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 – Transform of periodic functions– Initial and final value theorems. Inverse Laplace transform -Convolution theorem–Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

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

- CO1** Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- CO2** Understanding analytic functions, harmonic functions, conformal mapping.
- CO3** Determine the types of singularities, residues, contour integration.
- CO4** Determine the Fourier transforms for a function and evaluates special integrals.
- CO5** Solve differential equations using laplace transforms.

TEXT BOOKS:

1. Grewel. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.
2. B.V. Ramana, " Higher Engineering Mathematics", McGraw Hill Education, India.
3. 3. Bali N., Goyal M. and Walkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.), New Delhi, 7th Edition, 2009.

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", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt. Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol.I& II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wyle, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt Ltd, 6th Edition, 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	2	2								3	2	
CO2	3	3	2	3								3	2	
CO3	3	3	3	3								3	3	2
CO4	3	3	2	3								3	3	
CO5	3	3	3	3								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	
40%				60 %

23ES1206	PROGRAMMING IN PYTHON	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 9

AND

CONTROL STRUCTURES

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. Illustrative programs: power of a number, sorting, Fibonacci series using lambda.

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

UNIT - III COLLECTIONS 9

List: Create, Access, Slicing, Negative Indices, List Methods, and comprehensions
Tuples: Create, Indexing and Slicing, Operations on tuples. Dictionary: Create, add, and replace values, operations on dictionaries. Sets: Create and operations on set.

Illustrative programs: Interchange first and last element in a list, maximum 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 Value Error exception if the input is not a valid integer, open a file and handles a File Not Found Error exception if the file does not exist, prompt the user to input two numbers and raises a Type Error exception if the inputs are not numerical, executes an operation on a list and handles an Index Error 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 data frame 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, calendar, 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. ReemaThareja,"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 MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3								3
CO2	3	3	3	3								3
CO3	3	3	3	3	2							3
CO4	3	3	3	3	2							3
CO5	3	3	3	3	3							3
CO6	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	
40%				60 %

23HS1203	COMMUNICATIVE ENGLISH AND LANGUAGE SKILLS II	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 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:** Punctuation, Numerical Expressions and Sentence pattern. **Vocabulary Development:** Idioms and Phrases
ACTIVITY: Writing and speaking about achievements of eminent personalities

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.
ACTIVITY: Reading transcripts of TED Talks and presenting them

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, Order of Adjectives, Impersonal Passive Voice and Phrasal verbs **Vocabulary Development:** Misspelt words. Homophones and Homonyms.
ACTIVITY: Reading Newspaper articles and presenting them.

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

ACTIVITY: Presentation on Technical and non-technical topics of interests with reference to IELTS

UNIT V **INTERVIEW SKILLS** **9**

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, Verbal Analogy. **Vocabulary Development:**

Technical Vocabulary, Purpose Statement

ACTIVITY: Preparing an effective Resume' and participating in Mock interview.

TOTAL :30 PERIODS

COURSE OUTCOME(S):

Upon 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.

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.
5. Cengage Learning, USA: 2007.

WEB REFERENCES:

1. <https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabularyexams/wordformation>
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/>

ONLINE COURSES / RESOURCES:

1. <https://basicenglishspeaking.com/wh-questions/>
2. <https://agendaweb.org/verbs/modals-exercises.html>

LANGUAGE SKILLS LAB

30 Hours

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.

REFERENCES:

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.

CO-PO-PSO MAPPING

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

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

23IT1201	DIGITAL LOGIC AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	2	4

COURSE OBJECTIVE:

- To design digital circuits using simplified Boolean functions
- To analyze and design Combinational and Sequential Circuits
- To understand the functional units in a digital computer system
- To trace the execution sequence of an instruction through the processor
- To understand the memory hierarchies, cache memories and parallel processing

UNIT I Number Systems, Codes and Boolean Algebra 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 and Sequential Circuits 9

Combinational Circuits – Analysis and Design Procedures – Binary Adder - Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – Demultiplexers – Sequential circuits: Flip-Flops: RS, D, JK, and T shift registers – Counters.

UNIT III Fundamentals of Computer Systems 9

Functional Units of a Digital Computer – Operation and Operands of Computer Hardware – Software Interface – Translation from a High Level Language to Machine Language – Instruction Set Architecture – RISC and CISC Architectures – Addressing Modes – Addition and Subtraction – Fast Adders – Multiplication: Booths Algorithm, Bit Pair Recoding – Division: Restoring and Non-Restoring – Floating Point Numbers: Single and Double Precision – Arithmetic Operations – ALU Design.

UNIT IV Processor Basics 9

Design Convention of a Processor – Building a MIPS Datapath and designing a Control Unit –Execution of a Complete Instruction – Pipelining - Hardwired and Micro programmed Control – Introduction to Multicore – Graphics Processing Units- Case study: NVIDIA GPU

UNIT V Memory, I/O and Parallel Processing 9

Types of Memories – Need for a hierarchical memory system –Cache memories– Memory Mapping – Improving Cache Performance – Virtual Memory – Memory Management Techniques – Accessing I/O devices – Programmed Input/output – Interrupts – Direct Memory Access. Parallel processing challenges – Flynn's classification – SISD, MIMD, SIMD, SPMD, and Vector Architecture.

TOTAL :45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Simplify complex Boolean functions
- CO2** Design digital circuits with combinational and sequential components
- CO3** Understand the characteristics of various Flip-Flops
- CO4** Understand the basic structure of computers, operations and instructions
- CO5** Implement a control unit as per the functional specification
- CO6** Understand the memory hierarchies, cache memories and parallel processing

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2013
2. 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
3. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014

REFERENCE BOOKS:

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2018
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013
4. Donald D. Givone, Digital Principles and Design, Tata Mc Graw Hill, 2003
5. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016
6. John L. Hennessey, David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fourth Edition, 2007
7. Douglas E. Comer, "Essentials of Computer Architecture", Sixth Edition, Pearson Education, 2012
8. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014

LIST OF EXPERIMENTS

30 Hours

1. Verification of Boolean Theorems using basic gates
2. Implement the combinational circuits using basic gates for arbitrary functions, code converters
3. Design and Implement Half/Full Adder and Subtractor
4. Design and Implement combinational circuits using MSI devices:
 - 4 – bit binary adder / Subtractor
 - Parity generator / checker
 - Magnitude Comparator
 - Application using multiplexers
5. Simulate the shift-registers.
6. Design and Implement synchronous counters.
7. Simulate the asynchronous counters.

CO-PO-PSO MAPPING

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

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

23ES1215	PROGRAMMING IN PYTHON 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** Develop functions to decompose a Python program.
- CO4** Compare various string operations in Python.
- CO5** Experiment with 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	3	3	2	2					2		3	2	2
CO2	3	3	3	2	2					2		3	2	2
CO3	3	3	3	3	3					3		3	3	2
CO4	3	3	3	3	3					3		3	3	3
CO5	3	3	3	3	3	2				3		3	3	3
CO6	3	3	3	3	3	3	3	2	2	3	2	3	3	3

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	0

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:

ReemaThareja, ``Programming in C''', 2nd edition, OXFORD University Press, New Delhi, 2019.

Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication,2016.

REFERENCES BOOKS:

Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education, 2014.

Herbert Schildt, "C: The Complete Reference", Fourth Edition, McGraw Hill, 2000.

ONLINE COURSES / RESOURCES:

<https://www.javatpoint.com/c-programming-language-tutorial>

<https://www.tutorialspoint.com/cprogramming/>

<https://nptel.ac.in/Courses/>

CO-PO-PSO MAPPING

[illegible]

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

UNIT – I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT – II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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

UNIT – III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper 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 Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total : 15 PERIODS

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. பொருதை - 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:
International Institute 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 Civilization 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 Book and 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	
40%				60 %

23TA1201	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.

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.

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: International Institute 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 Civilization 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	
40%				60 %

23HS1204	INTERPERSONAL COMMUNICATION SKILLS II	L	T	P	C
		0	0	2	0

COURSE OBJECTIVES

- To enhance their vocabulary through understanding synonyms, antonyms, and word formation techniques.
- To identify and correct grammatical errors and use precise word choices in sentences.
- To apply grammar rules, including subject-verb agreement, pronouns, tenses, and sentence structure.
- To effectively rearrange sentences and solve para jumbles to improve coherence and logical flow in writing.
- To foster reading comprehension and creative storytelling abilities through structured activities and practice.

Unit I

Introduction to Verbal-Word Building- Synonyms & Antonyms

Unit II

Common Confusables- One word Substitution- Sentence Completion

Unit III

Error Spotting- Sentence Correction

Unit IV

Sentence Rearrangement- Para jumbles

Unit V

Reading Comprehension- Story Building Activity

TOTAL : 30 PERIODS

COURSE OUTCOME:

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

- CO1** Demonstrate an expanded vocabulary and accurately use synonyms, antonyms, and wordbuilding techniques in communication.
- CO2** Identify and correct common grammatical errors and apply one-word substitutions and sentence completion strategies effectively.
- CO3** Construct grammatically correct sentences, ensuring proper use of subject-verb agreement, pronouns, tenses, and modifiers.
- CO4** Rearrange sentences and para jumbles to create coherent and logically structured texts.
- CO5** Excel in reading comprehension and create engaging stories, showcasing improved analytical and creative writing skills.

TEXT BOOKS:

1. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Learners of English. 5th ed., Cambridge University Press, 2019.
2. Wren, P. C., and H. Martin. High School English Grammar and Composition. Revised ed., S. Chand Publishing, 2017.

REFERENCE BOOKS:

1. Leech, G., & Svartvik, J. (2013). A Communicative Grammar of English (3rd ed.). Routledge.
2. Azar, B. S., & Hagen, S. A. (2016). Understanding and Using English Grammar (5th ed.). Pearson Education.

WEB REFERENCES:

1. <https://learnenglish.britishcouncil.org/grammar>
2. https://owl.purdue.edu/owl/general_writing/grammar/index.html

ONLINE COURSES / RESOURCES:

1. <https://www.edx.org/course/english-grammar-and-style>
2. <https://www.coursera.org/learn/careerdevelopment>

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	2	2	
CO3								2	3		2	3	3	2
CO4								2	3		2	2	2	
CO5								2	3		2	3	3	

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 : 45 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** Understand the application of various types of graphs in real life problem.
- CO4** Identify isomorphism and analyze structure between graphs
- CO5** Apply the concepts and properties of algebraic structures.
- CO6** Determining Boolean functions and simplify expression using its properties.

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	2	3								3		
CO2	3	3	3	2								3		
CO3	3	2	3	2								3	2	
CO4	3	3	3	3								3	2	
CO5	3	3	3	3								3	2	
CO6	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	
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, New Delhi, 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.
5. R. Kruse, C. L. Tondo and B. Leung, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2006.

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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	2	3								3		
CO2	3	3	3	2								3		
CO3	3	2	3	3								3	2	
CO4	3	3	3	3								3	2	
CO5	3	3	3	3								3	2	
CO6	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	
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, Relational algebra operators, SQL - Introduction, Data Definition in SQL, Table, Key and Foreign key definitions, Update behaviours. Querying in SQL, Notion of aggregation, Aggregation functions Group by and Having clauses, Embedded SQL, Query Processing.

UNIT- III DATABASE DESIGN 9

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

UNIT- IV TRANSACTION MANAGEMENT 9

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

UNIT- V IMPLEMENTATION TECHNIQUES AND NON-RELATIONAL MODEL 9

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

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

On 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 Hill India 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	1			1		2		2	1	3	2	1
CO2		3	2	1	2	2		1			3	2		
CO3			3	2	2	3	1	2	2	1	2	3	2	
CO4	2	2	3	3	1	1	1	2	3	3	3	2	1	
CO5	3	3	3		2	2		1		2	3	2	3	2
CO6	2				2	1	1	2	1	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	
40%				60 %

23IT1302	MICROPROCESSOR AND MICROCONTROLLER DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understanding of 8086 Microprocessor architecture and its components
- Develop proficiency in programming 8086 microprocessors to control and interact with various system peripherals
- Understand the signals, configurations, timing, and design considerations of the 8086 microprocessor
- Expertise in I/O Interfacing with 8086 Microprocessor.
- Understanding of Microcontroller Architecture
- Designing and implementing microcontroller-based systems for various applications

UNIT - I 8086 Microprocessor 9

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

UNIT - II 8086 System Bus Structure 9

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

UNIT - III I/O Interfacing 9

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

UNIT - IV Microcontroller 9

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

UNIT - V Applications and Design of Microcontroller Based Systems 9

Memory Interfacing, 7-Segment LED Display, LCD and Keyboard Interfacing, ADC, DAC interfacing, relay, Stepper Motor Interfacing, DC motor control, different Sensors and relevant application programs. RISC Microcontrollers, introduction to AVR series microcontrollers. Introduction to ARM7 microcontroller (LPC2148).

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Recognize and recall the fundamental principles of microprocessor and microcontroller architecture.
- CO2** Implement basic assembly language programs for microprocessors and microcontroller design memory interfacing circuits.
- CO3** Design and implement interfacing of peripheral with microprocessor and microcontroller.
- CO4** Analyse, comprehend, design and simulate microcontroller based systems used for control and monitoring.
- CO5** Assess the reliability and robustness of microcontroller-based systems under different environmental conditions.
- CO6** Understand and appreciate advanced architecture evolving microprocessor field.

TEXTBOOKS:

1. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2011.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.

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1. Douglas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012
2. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals "3rd edition, Tata McGrawHill, 2012
3. Kenneth J. Ayala, "The 8051 Microcontroller: Architecture Programming & Applications", Penram International Publishing, Second Edition, 1996

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1. <https://www.tutorialspoint.com/microprocessor-and-microcontroller>
2. <https://www.javatpoint.com/microprocessor-and-microcontroller>

ONLINECOURSES/RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee12/preview
2. <https://www.udemy.com/course/microprocessors-and-microcontrollers/>

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

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

23IT1303	OBJECT ORIENTED DESIGN AND PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understand the basics of Object-Oriented Programming (OOP) and Java fundamentals.
- Use OOP concepts like classes, objects, inheritance, and polymorphism to write Java programs.
- Learn how to organize code using inheritance, interfaces, and packages in Java.
- Work with threads and exceptions to make Java programs more efficient and reliable.
- Handle strings, files, and data with Java's built-in libraries and Collection Framework.
- Build flexible programs using Java's generics and event-driven programming techniques.

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 Overriding- 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

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Understand basic Java programming concepts like classes, objects, and methods.
- CO2** Apply inheritance, interfaces, and packages to create organized Java programs.
- CO3** Work with threads and handle exceptions to manage errors and improve performance.
- CO4** Use Java's String class, I/O functions, and Collection Framework to manage data.
- CO5** Create reusable code with generics to handle different data types safely.
- CO6** Develop interactive applications using Java's event handling system

TEXT BOOKS:

1. E. Balagurusamy, Programming with Java, McGraw Hill, 7th Edition, 2024.
2. Aamer Khan, Java Programming Language | Learn Java from Basic to Advance 2022, Code Academy, 2022.
3. Mahesh Gurunani, Java Programming (22412), Nirali Prakashan, 2020.
4. Ravi Majithia, Advance Java Programming, Shree Hari Publications, 2021.
5. Surbhi Kakar, A Textbook of Java Programming, Dreamtech Press, 2019.

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1. John MacCormick, Functional Programming and Streams, 2023.
2. Sachin Malhotra, Programming in Java, Oxford University Press, Revised 2nd Edition, 2018.
3. Patrick Niemeyer and Daniel Leuck, Learning Java, O'Reilly Media, 5th Edition, 2020.
4. Herbert Schildt, Java: The Complete Reference, McGraw Hill, 11th Edition, 2018.
5. Kathy Sierra and Bert Bates, Head First Java, O'Reilly Media, 2nd Edition, 2005.

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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			3				2		2	3		
CO2	3	3	3		3				2	2		3	3	3
CO3	3	3	3	3	3	2			2		3	3		3
CO4	3		2		3	2					2	3	3	
CO5	3		3		3						3	3		3
CO6	3	3	3	3	3	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	
40%				60 %

23IT1312	OBJECT ORIENTED DESIGN AND PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- Remember the basic principles of Object-Oriented Programming (OOP) and Java programming concepts.
- Understand how to implement core Java constructs like classes, objects, and inheritance.
- Apply advanced Java concepts such as exception handling and multithreading to solve problems.
- Analyze the use of data structures and algorithms in Java to optimize solution performance.
- Create Java applications with user interfaces, using event handling and GUI programming.

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. Develop a mini project for any application using Java concepts.

ADDITIONAL PROGRAMS

21. 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.
22. Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism
23. 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.

TOTAL: 60 PERIODS

COURSE OUTCOME(S):

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

- CO1** Recall Java programming basics like data types and control structures.
- CO2** Explain Java OOP concepts like inheritance and polymorphism.
- CO3** Use Java to solve problems like quadratic equations and prime number checks.
- CO4** Break down problems and design Java solutions using classes and methods.
- CO5** Test and improve Java code for performance and reliability.
- CO6** Build Java applications using advanced concepts like multi-threading and file handling

TEXT BOOKS:

1. E. Balagurusamy, Programming with Java, McGraw Hill, 7th Edition, 2024.
2. Aamer Khan, Java Programming Language | Learn Java from Basic to Advance 2022, Code Academy, 2022.
3. Mahesh Gurunani, Java Programming (22412), Nirali Prakashan, 2020.
4. Ravi Majithia, Advance Java Programming, Shree Hari Publications, 2021.
5. Surbhi Kakar, A Textbook of Java Programming, Dreamtech Press, 2019.

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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

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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>
<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			3				2		2	3		
CO2	3	3	3		3				2	2		3	3	3
CO3	3	3	3	3	3	2			2		3	3		3
CO4	3		2		3	2					2	3	3	
CO5	3		3		3						3	3		3
CO6	3	3	3	3	3	3		2	3		3	3	3	3

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

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 $H: K \rightarrow L$ as $H(K)=K \bmod m$ (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.

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

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

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

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

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

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

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. List ADT
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 & Binary search algorithm
11. Sorting algorithms
 - a) Bubble Sort
 - b) Selection Sort
 - c) Insertion Sort
 - d) Merge Sort
 - e) Quick sort
 - f) Radix Sort
 - g) Bucket Sort
 - h) Heap Sort
 - i) Shell Sort
12. Graph Traversal algorithms
 - a) BFS
 - b) DFS
 - c) Topological Sorting
13. Shortest Path algorithm
 - a) Dijkstra Algorithm
 - b) Bellman-Ford Algorithm
14. Minimum Spanning tree
 - a) Kruskal Algorithm
 - b) 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, 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,February2023.
3. Dr.Harsh Bhasin,"Data Structures with Python", BPB Publications,Delhi,March2023.
4. John Canning ,Alan Broder,Robert Lafore,``Data Structures & Algorithms in Python", Addison-Wesley Professional, October 2022.
5. Y Daniel Liang, "Introduction To Python Programming And Data Structures", Global Edition 3rd Edition ,Pearson Publications ,November 2022.

REFERENCE BOOKS:

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

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

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

23HS1301	SKILLS FOR CAREER BUILDING AND DEVELOPMENT I	L	T	P	C
		0	0	2	0

COURSE OBJECTIVE

- To improve language accuracy through error spotting, sentence correction, and text completion.
- To build critical thinking by analysing arguments and organizing ideas.
- To create a strong personal brand and effective self-introduction using social media.
- To develop persuasion, negotiation, and business planning skills.
- To enhance teamwork, empathy, and feedback skills for better interpersonal relations.

Unit I

Error Spotting- Sentence Correction- Subject Verb Agreement- Pronouns- Tense- Comparisons – Modifiers- Parallelism

Unit II

Sentence Equivalence and Text completion: Grammar- Single, Double and Triple blanks

Unit III

Para jumble – Para Completion.

Unit IV

Critical Reasoning – Facts – Inference – Judgement – Strengthening and Weakening an Argument

Unit V

Reading Comprehension

TOTAL : 30 PERIODS

COURSE OUTCOME(S):

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

- CO1** Proficiently spot and correct advanced errors, complete texts, and achieve sentence equivalence with accuracy
- CO2** Demonstrate strong critical reasoning by analysing arguments, making judgments, and organizing coherent paragraphs.
- CO3** Create impactful self-introductions and personal brands, leveraging social media for effective profiling.
- CO4** Apply persuasion and negotiation skills to develop and market business plans successfully convince others and create solid business plans.
- CO5** Exhibit strong interpersonal skills, empathy, and synergy, delivering constructive feedback to enhance team dynamics.

TEXT BOOKS

1. Powers, L., and T. Knapp. The Official Guide to the GRE General Test. 3rd ed., McGraw-Hill Education, 2019.
2. Gallo, Carmine. Talk Like TED: The 9 Public-Speaking Secrets of the World's Top Minds. St. Martin's Press, 2016.

REFERENCE BOOKS

1. Manhattan Prep. (2021). GRE Reading Comprehension & Essays (7th ed.). Manhattan Prep Publishing.
2. Cialdini, R. B. (2021). Influence, New and Expanded: The Psychology of Persuasion. Harper Business.

WEB REFERENCES

1. <https://www.ets.org/gre/test-takers/general-test/prepare/practice-questions/verbal-reasoning.html>
2. <https://www.linkedin.com/learning/building-your-personal-brand>

ONLINE COURSES / RESOURCES

1. <https://www.coursera.org/learn/critical-thinking-skills>
2. <https://www.coursera.org/learn/negotiation>

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	2	2	
CO3								2	3	-	2	3	3	2
CO4								2	3	-	2	2	2	
CO5								2	3	-	2	3	3	

23HS1302	QUANTITATIVE APTITUDE PRACTICE III	L	T	P	C
		0	0	1	0

COURSE OBJECTIVE:

- Students can refine their problem solving skills by using ratio and proportion, simple and compound interest.
- To improve students ability to use strategies for addressing logical reasoning, surds and indices problems.

Module 1 Simple and Compound interest 3

Simple interest - compound interest - problems on ages - simplification and approximation.

Module 2 Ratio and Proportion 3

Chain rule – percentage - ratio and proportion - profit and loss

Module 3 Surds and Indices 3

surds and indices – clock – cubes – dices – direction - sense.

Module 4 Logical Reasoning II 3

Puzzles – series – coding - decoding – classifications.

TOTAL : 12 PERIODS

COURSE OUTCOME

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

- CO1** Solve problems using ratio and proportion, simple and compound interest, and ease.
- CO2** Comprehend and demonstrate solid knowledge for the surds and indices, as well as logical reasoning exercises.

TEXT BOOKS

1. Aggarwal R.S.(2017). Quantitative Aptitude for Competitive Examinations 3rd edition
New Delhi: S. Chand Publishing.
2. Abhijit guha(2016). Quantitative Aptitude for All Competitive Examinations, 6th edition. Noida: McGraw Hill Education Pvt.Ltd.
3. FACE.(2016).Aptipedia Aptitude Encyclopedia1(Ed.).New Delhi: Wiley Publications.

REFERENCE BOOK

1. Sharma arun.(2016).Quantitative aptitude,7th(Ed.).Noida : McGraw Hill Education Pvt. Ltd.
2. Praveen. R.V 3rd edition, Quantitative aptitude and reasoning, PHI learning publication.

Mode of Evaluation: Online Test

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's t test 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, 10th Edition, 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	3	1		1	1		2	3	3	2
CO2	3	3	3	3	3	1		1	1	1	2	3	3	3
CO3	3	3	2	2	3	1		1	1	1	2	3	3	2
CO4	3	3	2	3	3	1		1	1	1	2	3	3	3
CO5	3	3	2	2	3	3	1	1	1	1	2	3	3	2
CO6	3	3	3	3	3	1		1	1	1	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 %

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.

WEB REFERENCES

1. [https://www.tutorialspoint.com/computer_fundamentals/computer_networking.h
tm](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](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	3	2	2	1	3	1		1	1		2	3	3	2
CO2	3	3	2	2	3	2		1	1		2	3	3	3
CO3	3	3	3	3	3	2		1	1	1	2	3	3	3
CO4	3	3	2	3	3	1		1	1	1	2	3	3	3
CO5	3	3	2	3	3	3	1	2	2	1	3	3	3	3
CO6	3	3	3	2	3	1		1	1	1	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	
40%				60 %

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

COURSE OBJECTIVE:

- 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- 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, Incremental 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**

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

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.

COURSE OUTCOME(S):

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.

1. Rod Stephens, *Beginning Software Engineering*, Wiley, 2015.
2. John F. Dooley, *Software Development, Design and Coding: With Patterns, Debugging, Unit Testing, and Refactoring*, Apress, 2017.
3. Daniel Galin, *Software Quality: Concepts and Practice*, John Wiley & Sons, 2018.
4. Arthur M. Langer, *Guide to Software Development: Designing and Managing the Life Cycle*, Springer, 2016.
5. Gerard O'Regan, *Concise Guide to Software Engineering: From Fundamentals to Application Methods*, Springer Nature, 2022.

REFERENCE BOOKS:

1. David Farley, Modern Software Engineering: Doing What Works to Build Better Software Faster, Addison-Wesley, 2021.
2. John Ousterhout, A Philosophy of Software Design, Yaknyam Press, 2018.
3. Robert C. Martin, Clean Code: A Handbook of Agile Software Craftsmanship, Prentice Hall, 2008.
4. Steve McConnell, Code Complete: A Practical Handbook of Software Construction, Microsoft Press, 2004.
5. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1994.

WEB REFERENCES:

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>

ONLINE COURSES / 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 Hours

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-diagram-tutorial/>
4. <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	3	2	2	1	2	1		1	1	2	3	3	3	2
CO2	3	3	3	2	3	2		1	1	2	3	3	3	3
CO3	3	3	3	2	3	2		1	1	2	3	3	3	3
CO4	3	3	3	3	3	1		1	1	2	3	3	3	3
CO5	3	3	3	3	3	1	1	2	2	2	3	3	3	3
CO6	3	2	3	2	3	1		1	1	3	3	3	3	3

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

23IT1402	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem.
- To get accustomed with various programming constructs such as divide-and-conquer, dynamic Programming, Backtracking and Branch and Bound.
- To understand the limitations of Algorithmic power.
- To learn techniques for solving specific problems more efficiently and for analyzing space and time requirements.
- Solve variety of problems using different design techniques.

UNIT-I INTRODUCTION 9

Notion of an Algorithm - Fundamentals of Algorithmic Problem Solving -Important Problem Types –Algorithm Design Technique- Fundamentals of the Analysis of Algorithmic Efficiency - Asymptotic Notations and their properties-Analysis Framework - Mathematical analysis for Recursive Algorithm- Substitution Method- Master's Theorem-Tree Method - Mathematical analysis for Non-recursive algorithms.

UNIT-II BRUTE FORCE AND DIVIDE-AND-CONQUER 9

Brute Force - String Matching-KMP algorithm -Rabin Karp Algorithm - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology - Binary Search - Merge sort - Quick sort – Randomized Quick Sort - Multiplication of Large Integers-Strassen's Matrix Multiplication.

UNIT-III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

Dynamic programming - Principle of optimality - Computing a Binomial Coefficient – Floyd's algorithm - Multi stage graph - Optimal Binary Search Trees - Knapsack Problem. Greedy Technique - Container loading problem - Prim's algorithm and Kruskal's Algorithm - 0/1 Knapsack problems - Huffman Trees.

UNIT-IV ITERATIVE IMPROVEMENT AND BACKTRACKING 9

Iterative Improvement-The Maximum-Flow Problem-Stable marriage Problem-Backtracking - n- Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem - Graph Coloring Problem.

UNIT-V P, NP CLASSES AND BRANCH AND BOUND 9

Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems-Branch and Bound - LIFO Search and FIFO search - Assignment problem - Knapsack Problem - Travelling Salesman Problem - 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** Understand different algorithmic design strategies.
- CO2** Articulate the process of problem solving and writing algorithms.
- CO3** Design and implementing the problems using algorithmic design paradigms (divide-and-conquer, greedy method, dynamic-programming and Backtracking, Branch and Bound) and apply when an algorithmic design situation calls for it.
- CO4** Analyze the correctness of algorithms using inductive proofs and invariants.
- CO5** Describe the classes P, NP, NP-Hard, NP Complete and appraise to prove that certain problem is P, NP, NP-Hard, NP-Complete.
- CO6** Designing their theoretical knowledge in practice.

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012
2. S. Sridhar, Design and Analysis of Algorithms, Second Edition, Oxford Edition, 2023.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.
3. Harsh Bhasin, Algorithms Design and Analysis, Oxford university press, 2015.

WEB REFERENCES:

1. <https://www.pdfdrive.com/design-analysis-of-algorithms-e33623281.html>
2. <https://www.pdfdrive.com/introduction-to-the-design-and-analysis-of-algorithms-2-vgloop-e17224696.html>
3. <https://www.pdfdrive.com/design-and-analysis-of-algorithms-tutoriale60359577.html>

ONLINE COURSES/RESOURCES:

1. <https://www.javatpoint.com/dynamic-programming>
2. <https://www.simplilearn.com/tutorials/data-structure-tutorial/backtracking-algorithm>
3. [https://optimization.mccormick.northwestern.edu/index.php/Branch_and_bound_\(BB\)](https://optimization.mccormick.northwestern.edu/index.php/Branch_and_bound_(BB))

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	3	2	
CO2	3	3	3	3	3	2			2	2		3	3	3
CO3	3	3	3	3	3	2			2		3	3	3	3
CO4	3	2	3	3	3	2					2	3	3	
CO5	3	2	3	3	3	2					3	3	3	3
CO6	3	3	3	3	3	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	
40%				60 %

23IT1404	OPERATING SYSTEMS WITH LINUX ADMINISTRATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understand the basic concepts and functions of operating systems.
- Learn about process management and CPU scheduling methods.
- Explore memory, storage, and file system management.
- Get introduced to Linux architecture and basic shell commands.
- Perform Red Hat Linux installation and system administration.
- Manage Linux security, networking, and troubleshooting tools.

UNIT - I INTRODUCTION TO OPERATING SYSTEMS 9

Definition and Functions of Operating Systems - Types of Operating Systems: Batch, Multitasking, Multiprogramming, Time-Sharing, Real-Time, Distributed, and Embedded OS - System Components: Kernel, Shell, File System, System Calls
Operating System Structures: Monolithic, Layered, Microkernel, Modular - OS Services and System Boot Process – BIOS to OS

UNIT - II PROCESS AND CPU MANAGEMENT 9

Process Concept – Process Control Block – Context Switching, Threads – Multithreading Models, CPU Scheduling – Scheduling Algorithms, Synchronization: Race Conditions, Critical Section, Semaphores, Monitors

UNIT - III MEMORY, STORAGE AND FILE SYSTEMS 9

Memory Management: Contiguous and Paging, Segmentation, Virtual Memory – Demand Paging – Page Replacement Algorithms, File System Interface and Implementation, Disk Structure – Disk Scheduling – RAID

UNIT - IV LINUX OPERATING SYSTEM CONCEPTS 9

Introduction to Linux and Open-Source Philosophy, Linux Architecture and Kernel Overview, Boot Process and Runlevels, Linux File System Hierarchy (FHS), Basic Shell Commands and Scripting, User and Group Management, File Permissions and Ownership

UNIT - V RED HAT LINUX ADMINISTRATION 9

Installing Red Hat Linux and Package Management (RPM, YUM, DNF), System Initialization (systemd), Network Configuration and Services, Managing Services and Daemons, Disk Partitioning and File System Management, Backup and Restore Techniques, Configuring SSH, FTP, Firewall (firewalld), Introduction to SELinux and Security Policies, Troubleshooting and Log Management

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Recall the basic functions, types, and components of operating systems.
- CO2** Explain the concepts of process management, CPU scheduling, and synchronization techniques.
- CO3** Apply memory and storage management techniques including paging, segmentation, and file systems.

- CO4** Analyze the Linux architecture, boot process, and file system structure using command-line tools.
- CO5** Evaluate system performance and administrative tasks using Red Hat Linux tools and utilities.
- CO6** Create automated backup, restoration, and secure Linux system configurations using Red Hat tools and services.

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, Wiley, 10th Edition, 2022.
2. Andrew S. Tanenbaum, Herbert Bos, Modern Operating Systems, Pearson Education, 5th Edition, 2023.
3. OccupyTheWeb, Linux Basics for Hackers: Getting Started with Networking, Scripting, and Security in Kali, No Starch Press, 2021.
4. Sander van Vugt, Red Hat RHCSA/RHCE 9 Cert Guide: Red Hat Enterprise Linux 9 (EX200 and EX294), Pearson IT Certification, 2023.
5. Brian Ward, How Linux Works: What Every Superuser Should Know, No Starch Press, 3rd Edition, 2023.

REFERENCE BOOKS:

1. William Stallings, Operating Systems: Internals and Design Principles, Pearson Education, 9th Edition, 2023.
2. Tom Callaway, Mark McCarty, Fedora and Red Hat Enterprise Linux: The Complete Guide to RHEL 9, Pearson Education, 2023.
3. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, UNIX and Linux System Administration Handbook, Pearson Education, 5th Edition, 2017 (still relevant and widely cited).
4. Christopher Negus, Red Hat Enterprise Linux 9 Administration, Wiley, 2023.
5. Ramez Elmasri, Daryl Levine, Operating Systems: A Spiral Approach, McGraw-Hill Education, 2021.

CO-PO-PSO MAPPING

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

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

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 – interquartile range.

UNIT- III DESCRIBING DATA II 9

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – 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 – interactive data visualization using Bokeh.

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 of real time application using visualization tools.

TEXTBOOKS:

1. David Cielien, 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	3	3				2	1		2		1	2	3	2
CO2	3	3	2	2	3	2		2	2	1	2	3	3	3
CO3	3	3	3	2	2	3	2	1	3	2	1	3	2	2
CO4	2	2	3	2	3	3	1		3	1	2	2	3	2
CO5	3	2	2	3	3	2	2	3	3	2	2	3	3	3
CO6	2	3	3	2	2	2	3	3	2	3	3	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	
40%				60 %

23IT1411	OPERATING SYSTEMS AND LINUX ADMINISTRATION PRACTICAL LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- Understand core principles and basic functionalities of operating systems.
- Identify components of process scheduling, memory, and file systems.
- Apply basic Linux commands and shell scripting techniques in practical tasks.
- Analyze Linux system structures including users, permissions, and services.
- Evaluate performance and configuration of Red Hat Linux system components.
- Design secure, automated system administration tasks using Linux tools.

LABORATORY EXERCISES

Basic OS Concepts & Simulation

1. Simulate CPU Scheduling Algorithms – FCFS, SJF, Round Robin, Priority Scheduling
2. Implement Process Synchronization using Semaphores
3. Demonstrate Thread Creation and Multithreading in C/Python
4. Implement Page Replacement Algorithms – FIFO, LRU, Optimal
5. Simulate File Allocation Methods – Contiguous, Linked, Indexed
6. Implement Banker's Algorithm for Deadlock Avoidance

Linux Operating System Essentials

1. Introduction to Linux Environment – Terminal usage, file navigation, directory structure
2. Linux File and User Management – Create users, groups, set permissions and ownership
3. Basic Shell Scripting – Conditional statements, loops, and file operations
4. Process and Job Control in Linux – ps, top, kill, nice, cron, at
5. File Compression, Archiving, and Backup using tar and rsync
6. Disk Partitioning and File System Creation using fdisk, mkfs, mount, umount

Red Hat Linux Administration and Security

1. Installation of Red Hat Enterprise Linux (RHEL)
2. Package Management – Install, update, and remove packages using rpm, yum, dnf
3. Network Configuration – Assign static IP, configure hostname and DNS
4. Service and Daemon Management – Start/stop services using systemctl
5. Firewall and Security Configuration – firewalld, enable/disable ports and zones
6. Secure Remote Access – Configure SSH, manage keys, enable passwordless login
7. Backup and Restore Automation using Shell Scripts and cron

TOTAL : 60 PERIODS

COURSE OUTCOME(S):

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

- CO1** Recall basic concepts of operating systems including process, memory, and file management.
- CO2** Explain synchronization mechanisms and multithreading models.
- CO3** Apply Linux commands and shell scripting to manage files and processes.
- CO4** Analyze user and permission management in a Linux system.
- CO5** Evaluate Red Hat Linux services, package management, and system performance.
- CO6** Create automated backup, secure remote access, and firewall configurations in Red Hat Linux.

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, Wiley, 10th Edition, 2022.
2. Andrew S. Tanenbaum, Herbert Bos, Modern Operating Systems, Pearson Education, 5th Edition, 2023.
3. Sander van Vugt, Red Hat RHCSA/RHCE 9 Cert Guide: Red Hat Enterprise Linux 9 (EX200 and EX294), Pearson IT Certification, 2023..

REFERENCE BOOKS:

1. William Stallings, Operating Systems: Internals and Design Principles, Pearson Education, 9th Edition, 2023.
2. Christopher Negus, Red Hat Enterprise Linux 9 Administration, Wiley, 2023.
3. Tom Callaway, Mark McCarty, Fedora and Red Hat Enterprise Linux: The Complete Guide to RHEL 9, Pearson Education, 2023.
4. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, UNIX and Linux System Administration Handbook, Pearson, 5th Edition, 2017.
5. Brian Ward, How Linux Works: What Every Superuser Should Know, No Starch Press, 3rd Edition, 2023.

CO-PO-PSO MAPPING

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

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.** Make use of the basic Statistical and Probability measures for data science.
- CO3.** Perform descriptive analytics on the benchmark data sets.
- CO4.** Perform correlation and regression analytics on standard data sets
- CO5.** Present and interpret data using visualization packages in Python
- CO6.** Implement data Science concept to develop small application.

REFERENCE BOOKS:

1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
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	2	3	1			1		3	3	2	3
CO2	3	3	2	2	2	2					3	3	2	3
CO3	3	3	3	3	3	2					3	3	3	3
CO4	3	3	3	3	3	2					3	3	3	3
CO5	3	2	3	2	3	2			2		3	3	3	3
CO6	3	2	3	3	3	2		3	2	3	3	3	3	3

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

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

COURSE OBJECTIVE:

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

LIST OF TOPICS

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

TOTAL: 30 PERIODS

COURSE OUTCOME(S):

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

- CO1** Understanding 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

TEXT BOOKS:

1. Herbert Schildt, "Java The complete reference", 12th Edition, McGraw Hill Education, 2022.
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", 11th Edition, Prentice Hall, 2020.
- 3.

REFERENCE BOOKS:

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

WEB REFERENCES:

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

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

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

23HS1401	SKILLS FOR CAREER BUILDING AND DEVELOPMENT II	L	T	P	C
		0	0	2	0

COURSE OBJECTIVE

- To equip students to develop profiles and understand the nuances of resume creation.
- To employ group discussion activities to exhibit expertise and abilities.
- To Gain insight into effective interview techniques and acquire hands-on experience through mock interviews.
- To improve presentation skills while exploring potential career opportunities.
- To foster networking skills and build professional connections to enhance career prospects and industry engagement.

Unit I

Professional Ethics- Etiquette- E-Mail Writing

Unit II

Personal Branding- Resume Building and Cover Letter - SOP

Unit III

Purpose and Role of GD in recruitment- GD preparation - Types of GD topics- Mock GDs

Unit IV

Introduction to personal interview- Types of Interviews- PI preparation- Mock Interviews

Unit V

Crafting STAR (Situation, Task, Action, Result) responses- Video Profile

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

- CO1** Develop a distinctive personal brand and craft a compelling, impactful resume.
- CO2** Engage actively in group discussions to maximize their value and outcomes.
- CO3** Tackle personal and technical interviews with confidence and clear preparation.
- CO4** Articulate ideas and perspectives in a structured, coherent manner.
- CO5** Gain insight into industry expectations and explore potential career pathways.

TEXT BOOKS

1. Carnegie, Dale. How to Win Friends and Influence People. Revised ed., Simon & Schuster, 2010.
2. Bolles, Richard N. What Color Is Your Parachute? 2021: A Practical Manual for Job-Hunters and Career-Changers. Ten Speed Press, 2021.

REFERENCE BOOKS

1. Adler, L. (2013). The Essential Guide for Hiring & Getting Hired. Workbench Media.
2. Yate, M. (2020). Knock 'em Dead Job Interview: How to Turn Job Interviews into Job Offers (10th ed.). Adams Media.

WEB REFERENCES

1. <https://www.mindtools.com/pages/article/professionalism.html>
2. <https://www.themuse.com/advice/interviewing>

ONLINE COURSES / RESOURCES

1. <https://www.linkedin.com/learning/developing-your-professional-presence-and-influence>
2. <https://www.coursera.org/learn/career-networking-interviewing>

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	2	2	
CO3								2	3		2	3	3	2
CO4								2	3		2	2	2	
CO5								2	3		2	3	3	

23HS1402	QUANTITATIVE APTITUDE PRACTICE IV	L	T	P	C
		0	0	1	0

COURSE OBJECTIVE:

- Students can improve their problem-solving abilities by applying permutation and combination, probability, alligation, and mixture.
- To improve students ability to use strategies for addressing day sequence and data sufficiency problems.

Module 1 Permutation and Combination, Probability 3

Permutation – combination – probability – Partnership.

Module 2 Alligation, Mixture and Analogy 3

Alligation and mixture – stocks and shares – analogy – symbols and notations.

Module 3 Time and work (advanced) 3

Relative speed - work equivalence - division of wages – multiple pipe problems.

Module 4 Day sequence and Data sufficiency 3

Day sequence - decision making - statement and assumptions - data sufficiency.

TOTAL : 12 PERIODS

COURSE OUTCOME

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

- CO1** Understand the basic concepts of permutation and combination, probability, alligation and mixture.
- CO2** Assist in understanding and exhibiting strong understanding for the advanced problems in relative speed and data sufficiency tasks.

TEXT BOOKS

1. Aggarwal R.S.(2017). Quantitative Aptitude for Competitive Examinations 3rd edition
New Delhi: S. Chand Publishing.
2. Abhijit guha(2016). Quantitative Aptitude for All Competitive Examinations, 6th edition. Noida: McGraw Hill Education Pvt.Ltd.
3. FACE.(2016).Aptipedia Aptitude Encyclopedia1(Ed.).New Delhi: Wiley Publications.

REFERENCE BOOK

1. Sharma arun.(2016).Quantitative aptitude,7th(Ed.).Noida : McGraw Hill Education Pvt. Ltd.
2. Praveen. R.V 3rd edition, Quantitative aptitude and reasoning, PHI learning publication.

Mode of Evaluation: Online Test

SEMESTER V

23IT1501	AUTOMATA THEORY AND COMPILER ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Define the fundamental concepts of automata theory and compiler design.
- Explain the working principles of lexical analyzers and parsers in a compiler.
- Convert regular expressions into finite automata and perform minimization.
- Differentiate various parsing techniques and their applications in syntax analysis.
- Describe the role of intermediate code generation and syntax-directed translation.
- Implement basic code optimization techniques to improve compiler performance

UNIT - I INTRODUCTION TO AUTOMATA THEORY AND REGULAR EXPRESSIONS 9

Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – NFA to DFA – Finite Automata with Epsilon Transitions – Epsilon-NFA to DFA – Kleene's Theorem – Minimization of Automata – Regular Expressions – Equivalence between Regular Expression and Automata – Properties of Regular Expressions

UNIT - II LEXICAL ANALYSIS 9

Introduction – The Structure of Compiler – Evolution of Programming Languages – Application of Compiler Technology – Programming Languages Basics – Lexical Analysis – Role of Lexical Analyzer – Specification and Recognition of Tokens – Lexical Analyzer Generators- LEX Tool.

UNIT - III SYNTAX ANALYSIS 9

Introduction – Context Free Grammar – Top Down Parsing – Recursive Descend Parsing – Predictive Parsing – Non-Recursive Predictive Parsing – Error Recovery – Bottom Up Parsing – LR Parsers – Construction of SLR (1) Parsing Table, Canonical LR (1) Parsing Table and LALR (1) Parsing Table – Parser Generators-YACC Tool.

UNIT - IV INTERMEDIATE CODE GENERATION 9

Symbol Table – Construction – Syntax Directed Definitions – Evaluation Orders for Syntax Directed Definitions – Applications of Syntax Directed Translation – Intermediate Code Generation – Three Address Code – Types and Declarations – Expression Translation – Type Checking – Back Patching

UNIT - V CODE GENERATION AND OPTIMIZATION 9

Issues – Design of Code Generator – Addresses in the Target Code – Basic Blocks in Flow Graph – Simple Code Generator – Peephole Optimization – Machine Independent Optimization – Principal Sources of Optimizations – Bootstrapping a Compiler – Compiling Compilers – Full Bootstrap

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Understand the concept of lexical analysis and construction of deterministic and non-deterministic automata
- CO2** Understand the concept of parsing and construction of parse.
- CO3** Develop an Intermediate Code generator
- CO4** Study programming language design, target machine design and run time environment of compilers.
- CO5** Study about the compiler construction tools.
- CO6** Obtain knowledge to construct a prototype compiler for a subset of a programming language.

TEXT BOOKS:

1. Shivam Saxena, Introduction to Theory of Automata & Compiler Design, Notion Press, 2022.
2. Shyamalendu Kandar, Introduction to Automata Theory, Formal Languages and Computation, Pearson Education India, 2013.
3. S.P.Eugene Xavier, Theory of Automata, Formal Languages and Computation, New Age International Publishers, 2005.
4. K.V.N. Sunitha and N.K. Suresh, Formal Languages and Automata Theory, McGraw Hill Education, 2010.
5. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson, 3rd Edition, 2006.

REFERENCE BOOKS:

1. Michael Sipser, Introduction to the Theory of Computation, Cengage Learning, 3rd Edition, 2012.
2. Peter Linz, An Introduction to Formal Languages and Automata, Jones & Bartlett Learning, 6th Edition, 2016.
3. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Prentice Hall, 2nd Edition, 1997.
4. Dexter C. Kozen, Automata and Computability, Springer, 1997.
5. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill Education, 4th Edition, 2010.

WEB REFERENCES:

1. <https://dl.acm.org/doi/pdf/10.5555/27378382>.
2. <https://www.geeksforgeeks.org/compiler-design-tutorials/>
3. <https://www.javatpoint.com/compiler-tutorial>

ONLINE COURSES / RESOURCES:

1. <https://online.stanford.edu/courses/soe-ycscs1-compilers>
2. https://onlinecourses.nptel.ac.in/noc20_cs13/preview

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1					3	3	2	3
CO2	3	3	3	2	2	1					3	3	3	3
CO3	3	3	3	3	3	2				2	3	3	3	3
CO4	3	3	3	3	3	3				3	3	3	3	3
CO5	3	3	3	2	3	3				3	3	3	3	3
CO6	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	
40%				60 %

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

COURSE OBJECTIVE:

- To understand the basics of JavaScript and importance of MERN stack.
- To understand the role of React in designing front-end components.
- To understand the design issues in the development of backend components using Node.js and Express.
- To understand the advanced features of full stack development.
- To understand the significance of using Mongo DB as a database system.

UNIT - I OPEN SOURCE JAVASCRIPT AND BASICS OF MERN STACK 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 completion of the course, students 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.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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-PSO MAPPING

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

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

23IT1503	EMBEDDED SYSTEMS AND INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understand fundamental concepts and applications of embedded processors.
- Explore hardware and software architectures in embedded systems.
- Learn PIC microcontroller architecture and programming in assembly and C.
- Gain knowledge of ARM processor architecture and Raspberry Pi programming.
- Understand IoT concepts, Arduino programming, and device integration.
- Develop IoT applications using various communication protocols and open platforms.

UNIT - I EMBEDDED AND MICROCONTROLLER CONCEPTS 9

Introduction to embedded processors, Application Areas, Categories of embedded processors, Hardware architecture, Software architecture, Application software, Communication software, Introduction to Harvard & Von Neuman architectures, CISC & RISC Architectures. PIC Microcontrollers: Introduction to PIC microcontrollers, architecture and memory organization, registers, I/O ports, interrupts, timer, instruction sets, PIC programming in assembly and C, Sensor interfacing, motor control, SPI bus protocols.

UNIT - II ARM AND RASPBERRY PI 9

ARM: ARM design philosophy, data flow model and core architecture, registers, program status register, instruction pipeline, interrupts and vector table, operating modes and ARM processor families. Instruction Sets: Data processing instructions, addressing modes, branch, load, store instructions, PSR instructions, and conditional instructions. Raspberry Pi: Raspberry Pi board and its processor, Programming the Raspberry Pi using Python, Communication facilities on Raspberry Pi (I2C, SPI, UART), Interfacing of sensors and actuators.

UNIT - III IOT AND ARDUINO PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT - IV IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT - V APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Identify and describe the concepts and applications of embedded processors.
- CO2** Explain hardware and software architectures in embedded systems.
- CO3** Program PIC microcontrollers using assembly and C for various interfacing tasks.
- CO4** Develop applications using ARM processors and Raspberry Pi, including sensor interfacing.
- CO5** Design and implement IoT solutions using Arduino and relevant communication protocols.
- CO6** Create complete embedded and IoT systems for applications in home automation, agriculture, smart cities, and healthcare.

TEXT BOOKS:

1. Tammy Noergaard, Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, Newnes, 2018.
2. Jonathan W. Valvano, Introduction to Embedded Systems Using the MSPM0+, 2023.
3. Peter Barry and Patrick Crowley, Modern Embedded Computing: Designing Connected, Pervasive, Media-Rich Systems, Morgan Kaufmann, 2012.
4. Wolfram Donat, Learn Raspberry Pi Programming with Python: Learn to Program on the World's Most Popular Tiny Computer, Apress, 2018.
5. Michael Margolis, Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects, O'Reilly Media, 2020.

REFERENCE BOOKS:

1. Andrew N. Sloss, Dominic Symes, and Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software, Morgan Kaufmann, 2004.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, McGraw-Hill Education TAB, 2023.
3. Jack Ganssle, The Art of Designing Embedded Systems, Newnes, 2008.
4. Mark Siegesmund, Embedded C Programming: Techniques and Applications of C and PIC MCUS, Newnes, 2014.
5. Peter Waher, Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3, Packt Publishing, 2018.

WEB REFERENCES:

1. John .B.Peatman , "Design with PIC Microcontroller", Prentice Hall, 1997.
2. SteaveFurber, "ARM system-on-chip architecture", Addison Wesley, 2000.
3. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", Morgan Kauffman/ Elsevier, 2006.

ONLINE COURSES / RESOURCES:

1. <https://www.coursera.org/learn/introduction-embedded-systems>
2. <https://www.coursera.org/specializations/iot>

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2						2	3	2	3
CO2	3	3	3	2	2						2	3	3	3
CO3	3	3	3	3	3					2	3	3	3	3
CO4	3	3	3	3	3	3				3	3	3	3	3
CO5	3	3	3	2	3	3				3	3	3	3	3
CO6	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	
40%				60 %

TEXT BOOKS:

1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 2020.
2. Ian Goodfellow, Yoshua Bengio & Aaron Courville, Deep Learning, MIT Press, 2016.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
5. David L. Poole & Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

REFERENCE BOOKS:

1. Max Tegmark, Life 3.0: Being Human in the Age of Artificial Intelligence, Knopf, 2017.
2. Nick Bostrom, Superintelligence: Paths, Dangers, Strategies, Oxford University Press, 2014.
3. Stuart Russell, Human Compatible: AI and the Problem of Control, Viking, 2019.
4. Kai-Fu Lee, AI Superpowers: China, Silicon Valley, and the New World Order, Houghton Mifflin Harcourt, 2018.
5. Cade Metz, Genius Makers: The Mavericks Who Brought AI to Google, Facebook, and the World, Dutton, 2021.

WEB REFERENCES:

1. <https://www.edx.org/learn/artificial-intelligence>
2. <https://microsoft.github.io/AI-For-Beginners/>

ONLINE COURSES / RESOURCES:

1. <http://nptel.ac.in/>
2. <https://www.udemy.com/topic/artificial-intelligence/>
3. <https://www.coursera.org/learn/artificial-intelligence-education-for-teachers>

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	3	2	2
CO2	3	3	3	3	3						2	3	3	3
CO3	3	3	3	3	3	2				2	3	3	3	3
CO4	3	3	3	3	3	2				2	3	3	3	3
CO5	3	3	3	3	3	3				3	3	3	3	3
CO6	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	
40%				60 %

23CS1511	FULL STACK DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

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 understand and design back end development using Node.js and Express.
- To learn Mongo DB technologies and data management with web application.

LIST OF EXPERIMENTS

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

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, 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	1
CO2	2			3				3			1	3	2	3
CO3	3	2	3		2				3		3	3	3	3
CO4	2	2	2		2				3		2	3	3	3
CO5	3	3	3	3	3				3		3	3	3	3
CO6	3	3	3			3				3	1	3	3	3

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

23IT1512	EMBEDDED SYSTEMS AND INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To learn tools relevant to Embedded System and IoT development.
- To write simple assembly programs that uses various features of the processor.
- To explore Embedded C Programs for different embedded processors.
- To develop simple applications using Arduino/Raspberry Pi/open platform.
- To design and develop IOT application for real world scenario.

LIST OF EXPERIMENTS

PROGRAMMING USING EMBEDDED C - PIC MICROCONTROLLER

1. Interface an LED, relay, and buzzer with PIC microcontroller using Embedded C programming to control their states
2. Interface a 7-segment display with PIC microcontroller using Embedded C programming to control their states
3. Interface a stepper motor with PIC microcontroller using Embedded C programming to control its rotation
4. Interface and program a LCD display with PIC microcontroller using Embedded C programming to display custom text

PROGRAMMING USING EMBEDDED C – ARM PROCESSOR

5. Design a circuit to interface LEDs with ARM processor and program it to flash in a pattern using Embedded C programming
6. Create a circuit to interface a buzzer with ARM processor and program it to turn on and off in response to specific conditions or input signals
7. Establish a connection between digital input devices, such as switches or sensors, and output devices, like LEDs or relays, using ARM processor to control and monitor their states
8. Interface a Digital-to-Analog Converter (DAC) with ARM processor to convert digital signals into analog voltages for various applications, such as audio output or sensor interfacing
9. Interface a stepper motor with ARM processor using Embedded C programming to control its rotation

IOT APPLICATION

10. Interface and program an RGB LED with an Arduino Uno to blink different colors using the Arduino IDE
11. Interface and program an RGB LED with a Raspberry Pi Pico to blink different colors using MicroPython
12. Integrate a pushbutton with an LED in an electronic circuit and program with an Arduino Uno using the Arduino IDE

13. Integrate a pushbutton with an LED in an electronic circuit and program with a Raspberry Pi Pico using MicroPython
14. Interface the DHT11 temperature and humidity sensor with an Arduino Uno using the Arduino IDE
15. Develop simple application – testing temperature, light sensor – IOT Application - using open platform/Raspberry Pi.
16. Mini Project on IoT based Systems
 - (i) Smart Home application.
 - (ii) Smart Agriculture application.
 - (iii) Smart Parking / Traffic Management application.
 - (iv) Health monitoring application.
 - (v) Industry Safety and Security application.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

- CO1** To learn tools relevant to Embedded System and IoT development.
- CO2** To explore Embedded C Programs for different embedded processors.
- CO3** To develop simple applications using Arduino/Raspberry Pi/ open platform.
- CO4** To gain proficiency in interfacing various sensors and actuators with microcontrollers such as Arduino or Raspberry Pi.
- CO5** To design and develop IOT application for real world scenario.
- CO6** To gain practical experience and understanding of wireless communication protocols like Wi-Fi, Bluetooth, and Zigbee.

WEB REFERENCES

1. <https://www.inspirenignite.com/mh/isl803c-internet-of-things-iot-labsyllabus-for-is-8th-sem-2019-pattern-mumbai-university-departmentlevel-optional-course-lab-4/>
2. <https://www.uotechnology.edu.iq/depee/LAB/PDF/Microprocessor%20Laboratory%20II.pdf>
3. <https://www.coursehero.com/file/56324039/Lab-4-Programming-for-datatransfer-between-registers-and-memory-locations1docx/>
4. <https://www.youtube.com/watch?v=A3D2I7Bu7DE>
5. <https://www.javatpoint.com/embedded-system-interrupts-in-8051-microcontroller/>
6. <https://www.elprocus.com/pic-microcontroller-programming-using-c-language/>
7. <https://www.survivingwithandroid.com/learn-iot-creating-a-sensor-project-withraspberry-pi-and-sensors/>
8. <https://www.ibm.com/blogs/cloud-computing/2014/10/08/internet-things-iot-ibmbluemix-growth-innovation/>

CO-PO-PSO MAPPING

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

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

23IT1513	DESIGN THINKING AND SOCIALLY RELEVANT PROJECT DEVELOPMENT	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE:

- To introduce students to the concepts of design thinking and its application to solve real-world problems.
- To enable students to use prototyping and testing techniques to refine their solutions.
- To foster teamwork, communication, and collaborative project development.
- To develop problem-solving and ideation skills through hands-on projects.
- To enhance the understanding of project management practices for successful project execution.

Design Thinking Approach

1. Introduction to Design Thinking and Project Development - Define a project problem statement and identify user needs through initial research.
2. Problem Identification and Solution Ideation - Use brainstorming and mind mapping techniques to ideate possible solutions for a given problem.
3. Prototyping and Testing - Develop a low-fidelity prototype for a chosen project and test it with peers.
4. Collaboration and Teamwork - Create a project plan with defined roles, tasks, and timelines for the team's final project.
5. Final Project Development and Presentation - Develop the final prototype and present the design thinking process, solution, and results to the class.

TOTAL: 30 PERIODS

COURSE OUTCOME(S):

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

- CO1** Apply design thinking principles to solve complex problems
- CO2** Develop prototypes and refine them based on user feedback
- CO3** Collaborate effectively within teams to develop a project from concept to solution
- CO4** Analyze user needs and design solutions that meet those needs
- CO5** Communicate the design process and solution effectively to stakeholders
- CO6** Evaluate the success of a project through testing and iteration

REFERENCE BOOKS:

1. Tim Brown, Change by Design: How Design Thinking Creates New Alternatives for Business and Society, HarperBusiness, 2009
2. Don Norman, The Design of Everyday Things, Basic Books, 2013 (Revised edition)
3. Tom Kelley and David Kelley, Creative Confidence: Unleashing the Creative Potential Within Us All, Crown Business, 2013
4. Jeff Gothelf and Josh Seiden, Lean UX: Applying Lean Principles to Improve User Experience, O'Reilly Media, 2013
5. Eric Ries, The Lean Startup, Crown Business, 2011

CO-PO-PSO MAPPING

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

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

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 OUTCOMES

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

- CO1** Propose solutions for a given problem.
- CO2** Infer the fundamental programming elements in Python language and learn to apply basic control structures in Python
- CO3** Demonstrate the applications of tuple, array and dictionaries

SEMESTER VI

23IT1601	PATTERN RECOGNITION AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Define the key concepts and approaches in pattern recognition
- Identify different pattern recognition techniques like statistical, syntactic, and neural approaches
- Apply machine learning techniques to analyze and interpret data
- Compare supervised and unsupervised learning methods for data classification
- Evaluate the effectiveness of ensemble learning models for improved performance
- Implement reinforcement learning techniques like Q-learning and SARSA

UNIT - I PATTERN RECOGNITION OVERVIEW 9

Typical Pattern Recognition System, Patterns and Features Extraction, Training and Learning in Pattern Recognition system, Different types of Pattern Recognition Approaches – Statistical, Syntactic, Neural.Discriminant functions-STATISTICAL : Parametric estimation - Maximum likelihood estimation, Bayesian parameter estimation, Non-parametric approaches - Parzen window

UNIT - II SYNTACTIC PATTERN RECOGNITION 9

Syntactic Pattern Recognition: Grammar Based Approaches, Elements of Formal Grammars, Parsing Concepts – Parsing Algorithm, Transition Networks in Parsing, Higher Dimensional Grammars, Stochastic Grammars-Hidden Markov models (HMMs) for sequential pattern classification – Discrete HMMs and Continuous density HMMs

UNIT - III MACHINE LEARNING 9

Introduction - Types of Machine Learning - Basic Machine learning pipeline – training, testing and validation. Evaluation Metrics – accuracy, precision, recall, ROC curve. Cross validation, Overfitting, Under fitting, bias-variance tradeoff; SUPERVISED LEARNING: Linear regression - Simple and Multiple Linear regression -Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART) - Bayesian Network, Bayesian Classifier, Support Vector Machines.

UNIT - IV UNSUPERVISED LEARNING 9

Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization(EM), Gaussian Mixture Models, Principal Component Analysis (PCA).

UNIT - V ENSEMBLE AND REINFORCEMENT LEARNING 9

Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking-Reinforcement Learning – SARSA and Q-learning

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Describe the process and components of a pattern recognition system
- CO2** Analyze the advantages and limitations of different pattern recognition approaches
- CO3** Apply supervised learning algorithms like SVM, decision trees, and linear regression
- CO4** Implement clustering algorithms and dimensionality reduction techniques
- CO5** Evaluate ensemble learning techniques and their impact on model performance
- CO6** Analyze and implement reinforcement learning techniques in real-world problems

TEXT BOOKS:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, MTM, 2023.
2. Richard O. Duda, Peter E. Hart, and David G. Stork, Pattern Classification, Wiley-Interscience, 2023.
3. Sergios Theodoridis and Konstantinos Koutroumbas, Pattern Recognition, Academic Press, 2023.
4. Earl Gose, Richard Johnsonbaugh, and Steve Jost, Pattern Recognition and Image Analysis, Prentice Hall, 2023.
5. Robert J. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, Wiley-Interscience, 2023.

REFERENCE BOOKS:

1. Ansel Yoan Rodríguez-González et al., Pattern Recognition: 15th Mexican Conference, MCPR 2023, Springer, 2023.
2. Kamaljeet Kaur, Mastering Pattern Recognition, Independently published, 2023.
3. Pattern Recognition and Computer Vision - PRCV 2023, Springer, 2023.
4. Pattern Recognition Applications and Methods, Springer, 2023.
5. Pattern Recognition, Springer, 2023.

CO-PO-PSO MAPPING

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

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

23IT1604	MODERN DEVOPS AND PRACTICES	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 Artifacts, 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.

CO-PO-PSO MAPPING

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

23IT1602	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE:

- Understand the basics and applications of pervasive computing technologies
- Analyze the evolution and ecosystem of mobile applications and mobile device usage
- Design and implement mobile applications for different devices using Android and iPhone
- Evaluate the performance of various wireless network technologies and mobile telecommunication protocols
- Investigate the design and implementation of medium access control methods in wireless communication

UNIT I	PERVASIVE COMPUTING	6
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Basics and vision – Applications and requirements – Smart devices and services – Smart mobiles, cards and device networks.

UNIT II	MOBILE APPLICATIONS	6
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History – Mobile Ecosystem – Designing for context – Mobile strategy – Mobile applications – Information Architecture – Design – Mobile Web apps vs Native Apps – Adapting to devices – Supporting devices – Application development on Android and iPhone.

UNIT III MEDIUM ACCESS AND TELECOMMUNICATIONS 6

Frequencies – Signals – Antennas – Signal propagation – Media Access Control: Motivation, SDMA, FDMA, TDMA, CDMA – GSM: Mobile services, System architecture, Protocols, Localization and calling, Handover – GPRS.

UNIT IV	WIRELESS NETWORKS	6
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Infrared vs radio transmission – Infrastructure and ad hoc networks – IEEE 802.11 – HIPERLAN – Bluetooth – WiMAX

UNIT V **MOBILE NETWORK AND TRANSPORT LAYERS** **6**

Mobile IP – DHCP – Mobile ad hoc networks – TCP improvements – TCP over 2.5/3G.

TOTAL : 30 PERIODS

COURSE OUTCOME

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

- | | |
|------------|--|
| CO1 | Describe the fundamental concepts of pervasive computing and its applications |
| CO2 | Compare and contrast mobile web applications and native applications in terms of design and implementation |
| CO3 | Implement medium access control techniques like SDMA, FDMA, and CDMA |

- CO4** Evaluate the GSM system and its protocols in the context of mobile services and handover
- CO5** Analyze wireless network protocols like Bluetooth and WiMAX in various mobile applications
- CO6** Demonstrate the configuration and operation of mobile ad hoc networks using Mobile IP and DHCP

TEXT BOOKS:

1. K. S. Gupta, Pervasive Computing: Engineering Smart Systems, Springer, 2023.
2. Dario Salvi, Pieter Van Gorp, Syed Ahmar Shah, Pervasive Computing Technologies for Healthcare: 17th EAI International Conference, PervasiveHealth 2023, Springer, 2024.
3. Aparan N. Mahajan, Sushil Kumar Bansal, Pankaj Nanglia, Shilpa Gupta, Pervasive Computing Advancements and Engineering Applications, Indu Book Services Pvt Ltd, 2023.
4. S. K. S. Gupta, Pervasive Computing in IoT, MDPI, 2023.
5. S. K. S. Gupta, Pervasive Computing: The Mobile World, Springer, 2023.

REFERENCE BOOKS:

1. S. K. S. Gupta, Web and Mobile App Development: A Complete Guide - 2023 Edition, CRC Press, 2023.
2. S. K. S. Gupta, Mobile and Desktop Apps: A Complete Guide - 2023 Edition, CRC Press, 2023.
3. Barry Burd, Android Application Development All-in-One For Dummies, Wiley, 2023.
4. S. K. S. Gupta, Cross-Platform Mobile Application Development, Springer, 2023.
5. S. K. S. Gupta, Effortless Cloud-Native App Development Using Spring Boot and Kubernetes, Packt Publishing, 2023.

MOBILE AND PERVASIVE COMPUTING LAB

30 Hours

LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font, Layout Managers and event listeners.
2. Develop an application that makes use of databases
3. Develop a native application that uses GPS location information
4. Implement an application that creates an alert upon receiving a message
5. Develop an application that makes use of RSS Feed.
6. Create an application using Sensor Manager
7. Create an android application that converts the user input text to voice.
8. Introduction to Flutter
9. Work with API
10. Work with Google Sheet
11. Develop a Mobile application for simple and day to day needs (Mini Project)

CO-PO-PSO MAPPING

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

23IT1603	DEEP LEARNING AND NATURAL LANGUAGE PROCESSING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVE:

- Understand the foundation and evolution of neural networks and deep learning
- Analyze the key computations involved in deep learning, and use them to build and train neural networks
- Apply autoencoders and generative models to solve suitable applications
- Implement text pre-processing techniques and build language models
- Understand word-level and syntax-level knowledge in language processing
- Gain proficiency in computational methods for lexical and vector semantics

UNIT - I INTRODUCTION 6

Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs; Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis

UNIT - II DEEP FEEDFORWARD NETWORKS 6

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout

UNIT - III RECURRENT NEURAL NETWORKS 6

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks –Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders

UNIT - IV TEXT PRE-PROCESSING AND WORD LEVEL 6

Overview: Origins and challenges of NLP Language - Regular Expressions – Words – Corpora – Text Normalization – Minimum Edit distance – N-gram language models; Word Level Analysis: Word classes – Part-of-Speech Tagging: HMM POS tagging; Named Entities (NE): NE Tagging – Conditional Random Field NE recognizer.

UNIT - V SYNTACTIC ANALYSIS AND SEMANTIC ANALYSIS 6

Syntactic Analysis: Constituency – Context-free grammar – Grammar rules – Treebanks; Parsing: Top- down – Bottom- up – Ambiguity – CKY Parsing – Shallow parsing – Dependency parsing; Lexical Semantics -Vector Semantics – Words and Vectors – Cosine similarity – TF-IDF – Positive PMI – Word2vec– Semantic properties of embeddings

TOTAL : 30 PERIODS

COURSE OUTCOME(S):

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

- CO1** Apply convolutional neural networks (CNN) and its variants to real-world applications
- CO2** Analyze and apply deep learning computations for building and training deep neural networks
- CO3** Apply autoencoders and generative models for solving real-world problems
- CO4** Implement text pre-processing and construct language models
- CO5** Apply basic word-level and syntactic-level knowledge in language processing tasks
- CO6** Implement computational methods in lexical and vector semantics for various natural language processing applications

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, The MIT Press, 2021.
2. Daniel Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, 2nd Edition, Prentice Hall, 2008.
3. Christopher D. Manning, Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
4. Francois Chollet, Deep Learning with Python, 2nd Edition, Manning Publications, 2021.
5. Li Deng, Yang Liu, Deep Learning in Natural Language Processing, Springer, 2018.

REFERENCE BOOKS:

1. Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python, O'Reilly, 2009.
2. Nitin Indurkha, Fred J. Damerau, Handbook of Natural Language Processing, 2nd Edition, CRC Press, 2010.
3. Yoav Goldberg, Neural Network Methods for Natural Language Processing, Synthesis Lectures on Human Language Technologies, Morgan & Claypool Publishers, 2017.
4. Taweh Beysolow II, Applied Natural Language Processing: Implementing Machine Learning and Deep Learning Algorithms for Natural Language Processing, Apress, 2018.
5. Matthew Honnibal, Neural Network Methods in Natural Language Processing, Synthesis Lectures on Human Language Technologies, Morgan & Claypool Publishers, 2020.

DEEP LEARNING AND NATURAL LANGUAGE PROCESSING LABORATORY
LIST OF EXPERIMENTS **30 Hours**

1. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
2. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
3. Write a program to construct a skip gram model using NLP
4. Word Generation- generate word forms from root and suffix information
5. Morphology- Understanding the morphology of a word by the use of Add-Delete table
6. Perform Sentiment Analysis with Python.
7. N-Grams Smoothing- to apply add-one smoothing on sparse bigram table.
8. POS Tagging: Hidden Markov Model- to calculate emission and transition matrix which will be helpful for tagging Parts of Speech using Hidden Markov Model.

CO-PO-PSO MAPPING

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

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

23IT1611	PATTERN RECOGNITION AND NEURAL NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- To use the Python packages for developing pattern recognition models
- To gain hands-on experience implementing machine learning algorithms to solve real-world problems
- To implement deep neural network for different applications
- To understand CNN and RNN architecture and the way to evaluate the performance of the models.
- To learn, predict and classify the real-world problems in the paradigms of Deep Learning.
- To build end to end model for real world application

LIST OF EXPERIMENTS

1. Implement simple Mathematical operations in Tensor flow using Colab Laboratory
2. Implement K-Nearest Neighbour non parametric estimation classifier for a sample training dataset stored as .CSV file and Compute the accuracy.
3. Implement Naïve Bayes Parametric model considering medical dataset. Use this model for diagnosis of heart disease and calculate accuracy, precision, and recall metrics
4. Implement Principal Component Analysis (PCA) for Dimensionality Reduction
5. Deep Learning Neural Network: To implement a Deep Learning Model by Fine tuning hyper parameters
6. Perform House Prediction on labelled dataset using Artificial Neural Network
7. Implement the following Pre-Trained Models and evaluate the performance measure
 - i. VGG 16
 - ii. Resnet
8. Apply Convolutional Neural Networks (CNNs) for Image Classification task
9. Implement an RNN architecture for Sentiment Analysis Task
10. Mini Project: Build a Chatbot to identify the context the user is asking and then provide it with the relevant answer.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

- CO1** Implement and analyze machine learning based methods for automatic training of pattern recognition systems
- CO2** Understand the Neural Networks and its usage in pattern recognition applications
- CO3** Gaining insights into optimization techniques and their application in deep learning
- CO4** Handle and pre-process the image and sequential data.
- CO5** Ability to apply CNNs for image processing task and RNNs for sequential analysis
- CO6** Implement Deep Learning algorithms and Solve Real-world problems.

WEB REFERENCES

1. <https://www.deeplearningbook.org/>
2. <http://neuralnetworksanddeeplearning.com/>
3. Download Pattern Recognition and Machine Learning by Christopher M. Bishop (zlib.pub)
4. <https://machinelearningmastery.com/how-to-develop-a-cnn-from-scratch-for-cifar-10-photo-classification/>
5. <https://dzone.com/articles/time-series-forecasting-with-recurrent-neural-netw>
6. <https://www.freecodecamp.org/news/how-to-build-your-first-neural-network-to-predict-house-prices-with-keras-f8db83049159/>
7. http://www.hpc.iitkgp.ac.in/pdfs/AI_HPC.pdf

CO-PO-PSO MAPPING

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

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, 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.

CO-PO-PSO MAPPING

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

Internal Assessment		End Semester Examination
Project Development and Evaluation	Industry Certification	--
60	40	--
100 %		--

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

COURSE OBJECTIVE

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

LIST OF EXPERIMENTS

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

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

- CO1** Construct the schema of the database and modify it
- CO2** Compile a query to obtain the aggregated result from the database.
- CO3** Speculate the concepts of various database objects.
- CO4** Compare the use of procedure and function in database.
- CO5** Use triggers and packages to create applications in the database

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, 7th Edition, 2016

REFERENCE BOOKS :

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

WEB REFERENCES :

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

CO-PO-PSO MAPPING

[illegible]

SEMESTER VII

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.
- Implement data analysis frameworks like Hadoop and NoSQL in cloud environments.

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 SecurityChallenges –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 completion of the course, 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.

TEXT BOOKS:

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 publisher, 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.
David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph",Elsevier,2022.
3. " Kim H. Pries, Robert D. Fulton, Big Data Analytics: A Practical Guide for Managers" CRC Press ,2022.

WEB REFERENCES:

- 1.<https://www.javatpoint.com/cloud-computing-tutorial>
- 2.<https://www.ibm.com/in-en/cloud-computing-tutorial>
- 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>

23CS1701	CRYPTOGRAPHY AND CYBER SECURITY	L	T	P	C
		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.
- Learn to analyze the security of in-built cryptosystems.

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 10

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 8

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 completion of the course, 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.

TEXT BOOKS:

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	3	3
CO2	3	3	3	3	3			2			2	3	3	2
CO3	3	3	3	3	3			3			1	3	3	3
CO4	3	3	3	3	3			3			1	3	2	2
CO5	3	2	3	2	3			2			2	3	3	3
CO6	3	2	3	3	2			1			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	
40%				60 %

23IT1703	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Describe the fundamental concepts and lifecycle of software testing and quality assurance.
- Explain unit testing, black-box testing, and performance testing techniques with tools.
- Apply testing frameworks such as JUnit, PyTest, Selenium, and JMeter in real scenarios.
- Evaluate software quality using metrics, process models, and risk assessment strategies.
- Explore automation, AI-based testing tools, and RPA for software quality improvement.
- Integrate security, quality standards, and compliance requirements into testing workflows.

UNIT - I FUNDAMENTALS OF TESTING AND QUALITY ASSURANCE 9

Software Testing and Quality Concepts – Testing vs Debugging – Software Development and Testing Life Cycles (SDLC, STLC) – QA vs QC – Test Planning and Documentation – IEEE and ISO Standards – Introduction to SQA Framework – SQA Activities – Cost of Quality – Quality Attributes – Software Quality Models (McCall, Boehm, ISO 9126).

UNIT - II UNIT AND STRUCTURAL TESTING TECHNIQUES 9

Types of Unit Testing – Unit Test Frameworks (JUnit, PyTest) – Mocking and Stubbing – Test-Driven Development (TDD) – Code Coverage – Static vs Dynamic Testing – Control Flow, Data Flow Testing – Integration Testing Strategies – Structural Coverage Criteria – Maintainability and Refactor-Friendly Testing Practices.

UNIT - III FUNCTIONAL, PERFORMANCE AND SECURITY TESTING 9

Black Box Testing: Equivalence Partitioning, Boundary Value Analysis – Decision Table & State Transition Testing – Test Case Design – Performance Testing: Load, Stress, Spike, Scalability – Tools: JMeter, LoadRunner – Metrics and Bottlenecks – Security Testing: Penetration Testing, Vulnerability Scanning – OWASP Top 10 – Tools: Burp Suite, ZAP, Metasploit.

UNIT - IV AUTOMATED TESTING AND SQA METRICS 9

Automation Testing Concepts – Types: Regression, UI, Functional – Tools: Selenium, Appium – CI/CD Integration – AI-Based Testing Tools (FireFlink) – Software Quality Metrics: Defect Density, Test Effectiveness – Defect Tracking and Logging – Root Cause Analysis – Risk Management in QA – Test Reviews and Inspections – QA Process Audits.

Software Process Models: Waterfall, Agile, V-Model – Process Improvement Models: CMMI, Six Sigma, TMMi – Quality Standards: ISO 9001, ISO 25010 – Compliance (GDPR, HIPAA) – Use Cases in QA – Best Practices in Quality Engineering – Test Governance.

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Recall software testing and SQA fundamentals, standards, and models.
- CO2** Describe unit testing, structural techniques, and test automation frameworks.
- CO3** Apply black-box, performance, and security testing methods with tools.
- CO4** Analyse and interpret QA metrics, defect reports, and risk assessments.
- CO5** Evaluate software process quality through audits, metrics, and compliance.
- CO6** Design automated testing and RPA-based solutions for quality improvement.

TEXT BOOKS:

1. Aditya P. Mathur, *Foundations of Software Testing: ISTQB Certification*, Pearson Education, 2020.
2. Gary Pollice, *Test-Driven Development: A Practical Guide*, Pragmatic Bookshelf, 2020.
3. Shahid Jameel, *Performance Testing with JMeter 3.0*, Packt Publishing, 2019.
4. Nina S. Godbole, *Software Quality Assurance: Principles and Practice*, Alpha Science, 2020.
5. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, McGraw-Hill, 2021.

REFERENCE BOOKS:

1. Raghavendra S., *JUnit 5 in Action*, Manning Publications, 2020.
2. Kaner, C., Bach, J., *Lessons Learned in Software Testing*, Wiley, 2019.
3. Raj Subrameyer, *Mastering Performance Testing with JMeter*, Wiley, 2021.
4. Jason Arbon, *Appium Essentials*, Packt Publishing, 2020.
5. Owasp Foundation, *OWASP Testing Guide*, Wiley, 2020.

WEB REFERENCES:

1. <https://junit.org/junit5/>
2. <https://nunit.org/>
3. <https://www.istqb.org/>
4. <https://owasp.org/>
5. <https://jmeter.apache.org/>
6. <https://www.selenium.dev/>
7. <https://www.automationanywhere.com/>
8. <https://appium.io/>
9. <https://fireflink.ai/>
10. <https://cmminstitute.com/>

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2										3		
CO2	3	3	2									3	2	
CO3	2	3	3	2								3	3	2
CO4	2	3	3	3	2							3	3	3
CO5	2	2	2	3	3	2				2	2	3	3	3
CO6	1	2	2	3	3	3		2	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	
40%				60 %

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

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

23IT1712	SOFTWARE TESTING AND QUALITY ASSURANCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE

- Enable students to apply software testing techniques and tools for real-world applications.
- Develop skills in designing, automating, and executing test cases using industry-standard frameworks.
- Perform functional, performance, and security testing using appropriate tools.
- Integrate CI/CD pipelines with automated testing for quality assurance.
- Analyse software quality metrics and generate QA reports using AI-based tools.

LIST OF EXPERIMENTS

1. Design black-box test cases using equivalence partitioning and boundary value analysis.
2. Write and execute unit test cases using JUnit and PyTest frameworks.
3. Implement mocking and stubbing with TDD using PyTest-mock or Mockito.
4. Measure code coverage using coverage.py (Python) or JaCoCo (Java).
5. Perform white-box testing using control flow and data flow techniques.
6. Automate functional testing of a login form using Selenium WebDriver.
7. Conduct load and stress testing on a sample web application using Apache JMeter.
8. Perform basic security testing and vulnerability scanning using OWASP ZAP.
9. Integrate automated Selenium tests with GitHub Actions or Jenkins for CI/CD.
10. Run test cases on FireFlink and analyze AI-generated QA metrics and insights.
11. Mini Project:
 - a) Conduct black-box and white-box testing on a calculator app and compare results.
 - b) Create and run PyTest and Selenium test cases for a library management system.
 - c) Build a test automation pipeline using FireFlink integrated with GitHub Actions.
 - d) Analyze FireFlink dashboards and generate QA reports for a sample web application.
 - e) Design a test plan and execute defect-tracked test cases for an online exam portal.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

- CO1** Design and document test cases using black-box and white-box testing techniques.
- CO2** Implement and run unit tests using test frameworks such as JUnit and PyTest.
- CO3** Automate functional testing scenarios using Selenium for web-based applications.
- CO4** Perform performance and load testing using JMeter and analyze system behavior under stress.
- CO5** Conduct security testing using OWASP ZAP and interpret vulnerability reports.
- CO6** Build CI/CD pipelines, integrate AI-based tools like FireFlink, and evaluate software quality metrics.

TEXTBOOKS

1. Aditya P. Mathur, Foundations of Software Testing: ISTQB Certification, Pearson Education, 2020.
2. Gary Pollice, Test-Driven Development: A Practical Guide, Pragmatic Bookshelf, 2020.
3. Shahid Jameel, Performance Testing with JMeter 3.0, Packt Publishing, 2019.
4. Nina S. Godbole, Software Quality Assurance: Principles and Practice, Alpha Science, 2020.
5. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill, 2021.

REFERENCES

1. Raghavendra S., JUnit 5 in Action, Manning Publications, 2020.
2. Cem Kaner, James Bach, Lessons Learned in Software Testing, Wiley, 2019.
3. Raj Subrameyer, Mastering Performance Testing with JMeter, Wiley, 2021.
4. Jason Arbon, Appium Essentials, Packt Publishing, 2020.
5. OWASP Foundation, OWASP Testing Guide, Wiley, 2020.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2										3		
CO2	3	3	2									3	2	
CO3	2	3	3	2								3	3	2
CO4	2	3	3	3	2							3	3	3
CO5	2	2	2	3	3	2				2	2	3	3	3
CO6	1	2	2	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.(Unit 1)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017(Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

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.

ONLINE COURSES / RESOURCES:

1. <http://nptel.ac.in/>
2. <https://www.udemy.com/topic/artificial-intelligence/>
3. <https://www.coursera.org/learn/artificial-intelligence-education-for-teachers>

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

COURSE OBJECTIVE:

- To impart Knowledge on the following topics:
- To understand the fundamental concepts related to visualization data
- To learn foundations for visualization
- To learn foundations for visualization
- To learn interaction concepts and techniques
- To use visualization techniques for research

UNIT - I INTRODUCTION AND DATA FOUNDATION 9

Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

UNIT - II FOUNDATIONS FOR VISUALIZATION 9

Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson's Affordance theory – A Model of Perceptual Processing.

UNIT - III VISUALIZATION TECHNIQUES 9

Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data : Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data : Point-Based Techniques - LineBased Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and NetworksDisplaying Arbitrary Graphs/Networks.

UNIT - IV INTERACTION CONCEPTS AND TECHNIQUES 9

Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control.

UNIT - V RESEARCH DIRECTIONS IN VISUALIZATIONS 9

Steps in designing Visualizations – Problems in designing effective VisualizationsIssues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation , Hardware and Applications

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Understand the fundamental concepts related to visualization data. Learn 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 evolution of AI 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 novel 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 ChengXiangZhai, 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 (2011), 1st ed.
3. "Recommender Systems Handbook" by Francesco Ricci, Lior Rokach, and Bracha Shapira, published by Springer, 2nd edition, 2015
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

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-spectral 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- ResNet architecture-ResNet and skip connections-Inception Network-GoogleNet architecture- Improvement in Inception v2-Video analytics-ResNet 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", 4th edition, Thomson Learning, 2013
2. Vaibhav Verdhhan,(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. 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 albedos.

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 FULL STACK 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 WebAssembly, 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
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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 fundi commercial/non- commercial use.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1.** Identify and describe key Open-Source licenses, such as Apache and BSD.
- CO 2.** Explain how Open-Source operating systems and tools function and contribute to software development.
- CO 3.** Demonstrate the ability to start and maintain an Open-Source project.
- CO 4.** Compare and contrast different Open-Source licensing models and their implications.
- CO 5.** Contribute code to a prominent Open-Source project and understand community collaboration.
- CO 6.** 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 Development 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 AND 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.

23IT1921	CLOUD NATIVE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand cloud computing concepts and architecture.
- To explore containerization technologies like Docker and Kubernetes.
- To develop cloud-native applications with microservices.
- To learn about serverless architecture and cloud platform services.
- To manage and deploy applications using cloud-native development tools.

UNIT - I INTRODUCTION TO CLOUD COMPUTING 9

Overview of Cloud Computing: Definition, Characteristics, and Models (IaaS, PaaS, SaaS), Cloud Service Providers: AWS, Azure, Google Cloud, Cloud Architecture and Design Principles, Cloud-Native Applications vs Traditional Applications, Advantages of Cloud Computing: Scalability, Flexibility, Cost Efficiency, Cloud Deployment Models: Public, Private, Hybrid, and Multi-Cloud

UNIT - II CONTAINERIZATION WITH DOCKER 9

Introduction to Containerization and Virtualization, Docker Architecture and Components, Creating and Managing Docker Containers, Docker Images and Docker Hub, Networking and Volume Management in Docker, Building and Deploying Dockerized Applications, Integrating Docker with Cloud Platforms

UNIT - III ORCHESTRATION WITH KUBERNETES 10

Introduction to Kubernetes: Architecture, Components, Pods, ReplicaSets, Deployments, Services in Kubernetes, Kubernetes Clusters and Nodes, Deploying Applications in Kubernetes. Scaling and Managing Applications in Kubernetes, Advanced Kubernetes Concepts: Helm, ConfigMaps, Secrets, Continuous Deployment with Kubernetes

UNIT - IV SERVERLESS ARCHITECTURE 8

Overview of Serverless Computing: Definition and Benefits, Key Serverless Providers: AWS Lambda, Azure Functions, Building Serverless Applications, Integrating APIs with Serverless Functions, Event-Driven Architecture in Serverless Computing, Managing Serverless Workloads and Costs, Serverless Security Best Practices

UNIT - V DEVELOPING CLOUD-NATIVE APPLICATIONS 9

Microservices Architecture: Concepts and Benefits, Building and Deploying Microservices in Cloud, Cloud-Native Databases: NoSQL, Managed Databases, API Gateway and Service Mesh for Microservices, Cloud-Native CI/CD Pipeline: Jenkins, GitLab, CircleCI, Monitoring and Logging Cloud-Native Applications, Best Practices for Cloud-Native Development

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Understand cloud computing principles and the architecture of cloud-native applications.
- CO2** Implement containerization techniques using Docker for cloud-native development.
- CO3** Manage and orchestrate cloud-native applications using Kubernetes.
- CO4** Design and develop serverless applications in cloud environments.
- CO5** Develop microservices-based cloud-native applications and manage CI/CD pipelines.
- CO6** Optimize cloud-native applications for scalability, performance, and security in cloud environments.

TEXT BOOKS:

1. Kelsey Hightower, Brendan Burns, Joe Beda, Kubernetes Up & Running, O'Reilly Media, 2017.
2. Ben Porter, Docker Deep Dive, Leanpub, 2020.
3. Alex Williams, Cloud Native Transformation, O'Reilly Media, 2021.
4. Mark Nunnikhoven, Architecting Cloud-Native Applications, O'Reilly Media, 2020.

REFERENCE BOOKS:

1. Adrian Cockcroft, Matt Boersma, Microservices Architecture: Make the Architecture Work for You, O'Reilly Media, 2020.
2. Jonas Bonér, Reactive Microservices Architecture, O'Reilly Media, 2019.
3. Mohammad R. Nami, Hands-On Cloud-Native Applications, Packt Publishing, 2021.
4. Nicolas De Loof, Serverless Architectures on AWS, O'Reilly Media, 2020.
5. James Wickett, Cloud-Native DevOps with Kubernetes, O'Reilly Media, 2020.

23IT1922	MICROSERVICES ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understand the fundamentals of Microservices Architecture and its benefits.
- Apply design principles to create and structure microservices-based applications.
- Analyze communication mechanisms between microservices and how they impact system performance.
- Evaluate the security measures and protocols for securing microservices architectures.
- Create solutions for managing data consistency and transaction management in microservices
- Implement deployment, monitoring, and failure resilience techniques in microservices-based systems.

UNIT - I INTRODUCTION TO MICROSERVICES ARCHITECTURE 9

Overview of Microservices Architecture - Monolithic vs. Microservices Architecture
Principles of Microservices, Benefits and Challenges of Microservices, Design Patterns in Microservices, Case Studies of Microservices Adoption

UNIT - II BUILDING MICROSERVICES 9

Introduction to RESTful APIs and HTTP Methods, Designing Microservices using Domain-Driven Design (DDD), Structuring Microservices, Communication between Microservices (Synchronous vs. Asynchronous), API Gateway and Service Discovery, Implementing CRUD operations in Microservices

UNIT - III MICROSERVICES SECURITY AND AUTHENTICATION 10

Securing Microservices Architecture, Authentication and Authorization in Microservices (OAuth, JWT), Securing Microservices with API Gateway, Implementing Service-to-Service Authentication, Handling User Roles and Permissions, Managing Security Vulnerabilities in Microservices

UNIT - IV MICROSERVICES DATA MANAGEMENT 8

Managing Data in Microservices (Database per Service), Database Patterns for Microservices (CQRS, Event Sourcing), Handling Data Consistency in Microservices (CAP Theorem), Transaction Management and Saga Pattern, Data Synchronization and Replication in Microservices

UNIT - V MICROSERVICES DEPLOYMENT AND MONITORING 9

Deploying Microservices using Docker and Kubernetes, Continuous Integration and Continuous Deployment (CI/CD) for Microservices, Monitoring Microservices (Prometheus, Grafana), Logging and Tracing in Microservices (ELK Stack, Jaeger) Handling Failures and Resilience (Circuit Breaker, Retries, Timeouts), Best Practices for Scaling Microservices

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

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

- CO1** Recall the key principles and components of microservices architecture.
- CO2** Demonstrate the ability to build and deploy microservices using design patterns and best practices.
- CO3** Interpret security protocols such as OAuth and JWT for microservices-based systems
- CO4** Assess the use of different data management patterns (CQRS, Event Sourcing) for microservices.
- CO5** Design a scalable and resilient microservices architecture with the integration of monitoring and logging systems.
- CO6** Critique the challenges and benefits of microservices, proposing strategies to overcome limitations.

TEXT BOOKS:

1. Sam Newman, Building Microservices: Designing Fine-Grained Systems, O'Reilly Media, 2021.
2. Richard Rodger, Microservices: From Design to Deployment, Packt Publishing, 2021.
3. Chris Richardson, Microservices Patterns: With Examples in Java, Manning Publications, 2022.
4. Mark Richards & Neal Ford, Fundamentals of Software Architecture: An Engineering Approach, O'Reilly Media, 2021.
5. Vijay K. Garg, Microservices and Cloud-Native Architecture, Wiley, 2020.

REFERENCE BOOKS:

1. Martin Fowler, Microservices: A Software Architectural Approach, Addison-Wesley, 2020.
2. James Lewis & Martin Fowler, Microservices: The Case for Modularity, Addison-Wesley, 2020.
3. Rajiv Gupta, Microservices in Practice: End-to-End Implementation with Spring Boot, Apress, 2022.
4. Eberhard Wolff, Microservices in Action, Manning Publications, 2021.
5. Cesar Vargas, Implementing Microservices with Spring Boot, Packt Publishing, 2021.

23IT1907	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 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 9 **TESTING**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT -V HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1.** Understanding the basic concepts of web application security and the need for it
- CO 2.** Be acquainted with the process for secure development and deployment of web applications
- CO 3.** Acquire the skill to design and develop Secure Web Applications that use Secure APIs
- CO 4.** Be able to get the importance of carrying out vulnerability assessment and penetration testing
- CO 5.** Using the acquired knowledge into practice for testing the vulnerabilities and identifying threats.
- CO 6.** 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, Wiley 13th 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 :

- 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- Blobs

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 ThingsII, 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 ComputingII, 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 Guidell, 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-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 & oncepts
- 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. <https://spark.apache.org/docs/latest/streaming-programming-guide.html>
2. [Kafka.apache.org](https://kafka.apache.org)
3. 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 Engineeringll, O'Reilly Media, Inc., 2016
2. Heather Adkins, Betsy Beyer, Paul Blankinship, Ana Oprea, Piotr Lewandowski, Adam Stubblefield, —Building Secure & Reliable Systemsll, 2020
3. Betsy Beyer, Niall Richard Murphy, David K. Rensin, Kent Kawahara and Stephen Thorne, —The Site Reliability Workbookll, 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/TrainingSiteReliabilityEngineers.pdf>
3. Incident Metrics in SRE - Google - Site Reliability Engineering - <https://static.googleusercontent.com/media/sre.google/en//static/pdf/IncidentMetricsInSre.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 - Ekert 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):

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

- CO1** Describe ethical hacking techniques and penetration testing methodologies
- CO2** Explain footprinting, reconnaissance, and scanning methods
- CO3** Analyze vulnerabilities in different operating systems and networks
- CO4** Demonstrate system hacking techniques and security testing tools
- CO5** Evaluate network protection systems and configure firewalls
- CO6** Investigate wireless network security and wardriving techniques

TEXT BOOKS:

1. William Stallings, Network Security Essentials, Pearson, 2022, 7th Edition
2. Michael T. Simpson, Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2021, 3rd Edition
3. Syngress, The Art of Network Penetration Testing, Elsevier, 2020, 2nd Edition
4. Jon Erickson, Hacking: The Art of Exploitation, No Starch Press, 2021, 3rd Edition
5. Rafay Baloch, Cloud Computing: A Hands-On Approach, McGraw-Hill Education, 2021, 2nd Edition

REFERENCE BOOKS:

1. Kevin Mitnick, The Art of Deception, Wiley, 2020, 2nd Edition
2. Dr. Wenliang Du, Computer Security: Principles and Practice, Pearson, 2021, 4th Edition
3. Richard Bejtlich, The Practice of Network Security Monitoring, Addison-Wesley, 2022, 2nd Edition
4. Chris McNab, Linux Firewalls: Enhancing Security with nftables and Beyond, Wiley, 2020, 3rd Edition
5. Douglas Schweitzer, Data Science and Big Data Analytics, Wiley, 2022, 2nd Edition

23IT1910	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

COURSE 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. Formally Analyzing 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 Methods for 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.
- Evaluate identity management systems and privacy-preserving strategies in social network environments.

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 9 **DATA**

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 9 **MANAGEMENT**

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 9 **ATTACKS**

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):

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

- CO1** Demonstrate an understanding of Cyber-Physical Systems and their applications in industries like automotive and medical.
- CO2** Identify and describe the components of CPS platforms and their communication networks.
- CO3** Apply MATLAB and Simulink for modeling and analyzing CPS performance and control tasks.
- CO4** Analyze and apply formal methods for safety assurance and CPS software verification.
- CO5** Assess CPS vulnerabilities, security threats, and attack models, and evaluate their impact on system performance.
- CO6** Implement security solutions for CPS, including attack detection, prevention, and secure deployment techniques.

TEXT BOOKS:

1. Rajkumar, R., et al., "Cyber-Physical Systems: From Theory to Practice", Wiley, 2024.
2. Kumar, N., "Cyber-Physical Systems: Security and Privacy Challenges", CRC Press, 2023.
3. Zhang, H., & Liu, S., "Introduction to Cyber-Physical Systems: Design and Analysis", Springer, 2023.
4. Lee, E. A., & Seshia, S. A., "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", MIT Press, 2023.
5. Ayoub, M., & Cárdenas, A. A., "Cyber-Physical Systems Security: The Challenges and Solutions", Elsevier, 2024.

REFERENCE BOOKS:

1. Pappas, G. J., & Dey, S., "Cyber-Physical Systems: A Review of Applications, Design, and Security", Springer, 2023.
2. Alur, R., & Henzinger, T. A., "Formal Methods for Cyber-Physical Systems: Theory and Applications", Springer, 2024.
3. Ghosal, A., & Joshi, A., "Security in Cyber-Physical Systems: A Comprehensive Guide", Wiley, 2023.
4. Kim, H., & Kim, S., "Embedded and Cyber-Physical Systems Security", CRC Press, 2023.
5. Gupta, S., & Mehta, S., "Handbook of Cyber-Physical Systems: Design and Security", Wiley, 2024.

23IT1916	THREAT DETECTION AND INCIDENT RESPONSE	L	T	P	C
		3	0	0	3

COURSE 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: 45PERIODS

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: 45PERIODS

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 Vandana Ahuja ;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 1/2 D, 3D applications for the mobile UI.
- CO5** Explore different popular applications of multimedia.
- CO6** Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.

TEXTBOOKS :

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia, Third Edition, Springer Texts in Computer Science, 2021.

REFERENCE BOOKS :

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, Multimedia Computing, Cambridge University Press, 2018.
3. PrabhatK.Andleigh, KiranThakrar, Multimedia System Design, Pearson Education, 1st Edition, 2015.
4. Mohsen AminiSalehi, Xiangbo Li, Multimedia Cloud Computing Systems, Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, 3D Graphics and Animation, Second Edition, New Riders, 2002.
6. Rogers David, Animation: Master A Complete Guide (Graphics Series), Charles River Media, 2006.
7. Rick parent, Computer Animation: Algorithms and Techniques, Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, MireiaAlegre Ruiz, UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native, Packt Publishing, 2022.

23CS1912	STREAMING MEDIA TOOLS AND TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE 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 – Crowdcast

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.

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 Kaufman, 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 – Continuous jet, Multijet; 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

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.

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 **REASONING 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 albedos.

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

REFERENCE BOOKS:

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

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 visualization techniques.

TEXT BOOKS:

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012

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 ,January 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 Chakraborty, 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.

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

What is 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 and observing 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 albedos.

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 and Stephen J. Wright, MIT Press, 2011.
3. Algorithms for Optimization by Mykel J. Kochenderfer and Tim A. Wheeler, MIT Press, 2019.
4. Accelerated Optimization for Machine Learning: First-Order Algorithms by 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 (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, "Robotic Process Automation Rpa A Complete Guide ", 2020

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: teaching 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- DSB SC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSB SC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Super heterodyne Receiver

UNIT - II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM modulation – Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

UNIT - III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter

UNIT - IV NOISE CHARACTERIZATION 9

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de- emphasis for FM

UNIT - V SAMPLING & QUANTIZATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non uniform quantization - quantization noise - Logarithmic Companding – PAM, PPM, PWM, PCM – TDM, F

TOTAL : 45 PERIODS

COURSE 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 AMPLITUDE MODULATION 9

Amplitude Modulation- DSB SC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSB SC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Super heterodyne Receiver

UNIT - II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM modulation – Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

UNIT - III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter

UNIT - IV NOISE CHARACTERIZATION 9

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de- emphasis for FM

UNIT - V SAMPLING & QUANTIZATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non uniform quantization - quantization noise - Logarithmic Companding – PAM, PPM, PWM, PCM – TDM, FDM

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.

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
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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
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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
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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
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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

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 – IEEE 802.15.4 Zigbee – Topology Control – Routing 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 Moraes Cordeiro, Dharma Prakash Agrawal, Ad Hoc and
3. Sensor Networks: Theory And Applications (2nd Edition), World Scientific Publishing, 2011.
4. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks Theory And Practice, John Wiley and Sons, 2010.
5. 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 Moraes 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.