SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution | Approved by AICTE | Affiliated to Anna University | Accredited by NAAC with A++ Grade

Kuniamuthur, Coimbatore – 641008

Phone : (0422)-2678001 (7 Lines) | Email : info@skcet.ac.in | Website : www.skcet.ac.in

Curriculum & Syllabi

Regulation 2022

2023-27 Batch

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

(Batch 2023-2027)

VISION OF THE INSTITUTION

- To Produce Globally Competitive Engineers with High Ethical Values and Social Responsibilities.

MISSION OF THE INSTITUTION

- To impart the highest quality state-of-the-art technical education by providing impetus to innovation, research, and development and empowering students with entrepreneurship skills.
- To instill ethical values, imbibe a sense of social responsibility, and strive for societal well-being.
- To identify the needs of society and offer sustainable solutions through outreach programs.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

VISION OF THE DEPARTMENT

- To be a globally renowned academic department for quality education and research in the field of Cyber security with ethical values and social commitment

MISSION OF THE DEPARTMENT

- To Impart comprehensive technical education to produce highly competent Cyber security professionals and Researchers
- Provide an academic environment with state-of-the-art technological infrastructure to provide scalable cyber security solutions
- Impart ethics, Social responsibility and necessary professional, leadership skills through student centric activities

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	Get recognized as effective professionals for their applied skills, problem solving capabilities and professional skills in the field of cyber security
PEO 2	Enrich skills and adopt emerging cyber security needs to pursue life-long learning and serve the society with social concern and code of ethics

I. PROGRAMME OUTCOMES (POs)

PO 1	**Engineering Knowledge:** Apply the knowledge of basic sciences and engineering fundamentals to solve engineering problems.
PO 2	**Problem Analysis:** Analyze the complex engineering problems and give solutions related to chemical & allied industries
PO 3	**Design/ development of solutions:** Identify the chemical engineering problems, design and formulate solutions to solve both industrial & social related problems.
PO 4	**Conduct investigations of complex problems:** Design & conduct experiments, analyze and interpret the resulting data to solve Chemical Engineering problems.
PO 5	**Modern tool usage:** Apply appropriate techniques, resources and modern engineering & IT tools for the design, modelling, simulation and analysis studies.
PO 6	**The engineer and society:** Assess societal, health, safety, legal and cultural issues and their consequent responsibilities relevant to professional engineering practice.
PO 7	**Environment and sustainability:** Understand the relationship between society, environment and work towards sustainable development.
PO 8	**Ethics:** Understand their professional and ethical responsibility and enhance their commitment towards best engineering practices.
PO 9	**Individual and team work:** Function effectively as a member or a leader in diverse teams, and be competent to carry out multidisciplinary tasks.
PO 10	**Communication:** Communicate effectively in both verbal & non-verbal and able to comprehend & write effective reports.
PO 11	**Project management and finance:** Understand the engineering and management principles to manage the multidisciplinary projects in whatsoever position they are employed.
PO 12	**Life-long learning:** Recognize the need of self-education and life-long learning process in order to keep abreast with the ongoing developments in the field of engineering

II.	PROGRAMME SPECIFIC OUTCOMES (PSOs)
The Graduates of B.E - COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY) programme will be able to:
PSO 1	Attain the policies in information assurance and analyze the factors in an existing system and design implementations to comprehend and anticipate future challenges
PSO 2	Implement innovative cyber security solutions using standard tools, practices and technologies without compromising the privacy of individuals and entities
PSO 3	Use cyber security and cyber forensics software/tools. Design cyber-security strategies and assess cyber-security risk management policies to protect an organization's information and assets.

I. | **II. MAPPING OF PEOs WITH POs**

PEO	POs											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	3	3	3	2	2	–	1	2	1	1	2
2	3	3	3	3	3	2	–	–	2	–	–	2
	1- low, 2 - medium, 3 - high, _-' - no correlation											

III. MAPPING OF PEOs WITH PSOs

	PSO 1	PSO 2	PSO 3
PEO 1	3	3	3
PEO 2	3	3	2

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2022(23-27 Batch)

SEMESTER I					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Theory (Internal 40 Marks & External 60 Marks)					
1	23MA101	Mathematics I	3 / 1 / 2	4	4
2	23TA101	Heritage of Tamils	1 / 0 / 0	1	1
Theory with Practicals (Internal 50 Marks & External 50 Marks)					
3	23IT101	Application Development Practices	1 / 0 / 4	5	3
4	23CS101	Problem Solving using C++	1 / 0 / 4	5	3
5	23EN101	Oral and Written Communication Skills	2 / 0 / 2	4	3
6	23CY101	Networking and Communication	3 / 0 / 2	5	4
Mandatory Course (Internal 100 Marks)					
7	23MC101	Induction Programme	Three Weeks		
			TOTAL	24	18

SEMESTER II					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Theory (Internal 40 Marks & External 60 Marks)					
1	23MA201	Mathematics II	3 / 1 / 0	4	4
2	23AS101	Applied Science	4 / 0 / 0	4	4
3	23TA201	Tamils and Technology	1 / 0 / 0	1	1
Theory with Practicals (Internal 50 Marks & External 50 Marks)					
4	23CY202	Operating Systems	3 / 0 / 2	5	4
5	23CS201	Data Structures and Algorithms	1 / 0 / 4	5	3
6	23CD201	Database Management Systems	1 / 0 / 4	5	3
7	23CY201	Java Programming	1 / 0 / 4	5	3
8	23MC102	Environmental Sciences	1 / 0 / 0	1	0
Practicals(Internal 60 Marks & External 40 Marks)					
9	23AS101	Applied Science Laboratory	0 / 0 / 2	2	2
			TOTAL	33	24

SEMESTER III					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Theory-Blended Learning(Internal 100 Marks)					
1	23GE301	Universal Human Values	3 / 0 / 0	3	3
Theory (Internal 40 Marks & External 60 Marks)					
2	23CY301	Cyber Law and Digital Forensics	3 / 0 / 0	3	3
3	23CY302	Data Analytics and Visualization	3 / 1 / 0	4	4
4	23MA301	Mathematical Foundations for Computer Science	3 / 1 / 0	5	4
Theory with Practicals (Internal 50 Marks & External 50 Marks)					
5	23CS301	Advanced Java Programming	1 / 0 / 4	5	3
6	23IT301	Web Technology using React	1 / 0 / 4	5	3
Mandatory Course-Blended Learning (Internal 100 Marks)					
7	23MCXXX	Mandatory Course: II	2 / 0 / 0	2	0
			TOTAL	**27**	**20**

SEMESTER IV					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Theory (Internal 40 Marks & External 60 Marks)					
1	23CY403	Auditing IT Infrastructure for Compliance	3 / 1 / 0	4	4
Theory with Practicals (Internal 50 Marks & External 50 Marks)					
2	23CY401	Ethical Hacking	3 / 0 / 2	5	4
3	23CY402	Access Control and Identity management	3 / 0 / 2	5	4
4	23AD402	Design and analysis of algorithms	1 / 0 / 4	5	3
5	23IT402	Web Frameworks using REST API	0 / 0 / 4	4	2
6	23AD403	Managing Cloud and Containerization	1 / 0 / 4	5	3
7	23ME305	Design Thinking and Idea Lab	0 / 0 / 2	2	1
			TOTAL	**30**	**21**

SEMESTER V					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Theory (Internal 40 Marks & External 60 Marks)					
1	23CY501	Security Assessment and Risk Analysis	3 / 0 / 0	3	3
2	23CY502	Computational Number Theory for Cryptography	3 / 1 / 0	4	4
3	23CY503	Security Policies and Implementation	3 / 0 / 0	3	3
Theory with Practicals (Internal 50 Marks & External 50 Marks)					
4	23CY504	Cloud Security	2 / 0 / 2	4	4
5	23XXXX	Professional Elective - I	2 / 0 / 2	4	3
6	23XXXX	Professional Elective - II	2 / 0 / 2	4	3
Mini Project (Internal 100 Marks)					
7	23CY505	Application Development	0 / 0 / 6	6	3
			TOTAL	28	23

SEMESTER VI					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Theory (Internal 40 Marks & External 60 Marks)					
1	23CY601	Blockchain Technologies	3 / 0 / 0	3	3
2	23CY602	Enterprise Networking Security and Automation	3 / 0 / 0	3	3
Theory with Practicals (Internal 50 Marks & External 50 Marks)					
3	23CY603	Hacker Technique Tools and Incident Handling	3 / 0 / 2	5	4
4	23CY604	Cyber Attack Simulation and Security Testing	2 / 0 / 2	4	4
5	23XXXX	Professional Elective - III	2 / 0 / 2	4	3
6	23XXXX	Professional Elective - IV	2 / 0 / 2	4	3
Mini Project					
7	23CY605	Capstone Project	0 / 0 / 4	4	2
			TOTAL	27	22

SEMESTER VII					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Theory (Internal 40 Marks & External 60 Marks)					
1	23CYXXX	Open / Emerging/ Industrial Elective - I	3 / 0 / 0	3	3
2	23CYXXX	Open / Emerging/ Industrial Elective - II	3 / 0 / 0	3	3
3	23CYXXX	Open / Emerging/ Industrial Elective- III	3 / 0 / 0	3	3
4	23CYXXX	Professional Elective - V	1 / 0 / 4	5	3
5	23CYXXX	Professional Elective - VI	1 / 0 / 4	5	3
Project(Internal 60 Marks & External 40 Marks)					
6	23CY701	Project Phase I	0 / 0 / 6	6	3
Internship(Internal 100 Marks)					
7	23EES01	Internship	28 Days		2
			TOTAL	25	20

SEMESTER VIII					
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits
Project(Internal 60 Marks & External 40 Marks)					
1	23CY801	Project Phase II	0 / 0 / 24	24	12
			TOTAL		162

S. No.	Stream	Credits/Semester								C	%
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences Including Management (HSMC)	4	7	3	1					15	**9.25**
2	Basic Sciences (BSC)		8							8	**4.9**
3	Engineering Sciences (ESC)			4						4	**2.4**
4	Professional Core (PCC)	10	13	13	20	14	14			84	**51.85**
5	Professional Electives (PEC)					6	6	6		18	**11.11**
6	Open/Emerging/Industry (OEC) / Emerging Elective Courses (EEC)							9		9	**5.55**
7.	Project Work (PROJ)					3	2	5	12	22	**13.5**
8.	Mandatory Course (MC) / Spoken Hindi									Non credit	
	Total	14	28	20	21	23	22	20	12	**162**	

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

S. No.	Course Work - Subject Area	AICTE Suggested Credits	SKCET Credits (160)
**STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM**			
1.	Humanities and Social Sciences (HS), including Management;	16	8
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology;	23	19
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	29	30
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required	59	58
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	12	18
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	9	9
7.	Project Work, Seminar and/or Internship in Industry or elsewhere.	15	22
8.	Mandatory Courses (MC)	Non-credit	Non-credit
Total			160

Minor Variations is allowed as per need of the respective disciplines

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (15 Credits)

S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23TA101	Heritage of Tamils	1 / 0 / 0	1	1
2.	23EN101	Oral and Written Communication Skills	2 / 0 / 2	3	3
3.	23TA201	Tamils and Technology	1 / 0 / 0	1	1
4.	23AS101	Applied Science	4 / 0 / 0	4	4
5.	23AS102	Applied Science Laboratory	0 / 0 / 4	4	2
6.	23GE301	Universal Human Values	3 / 0 / 0	3	3
7.	23ME305	Design Thinking and Idea Lab	0 / 0 / 2	2	1

BASIC SCIENCE COURSES (8 Credits)

S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23MA101	Mathematics I	3 / 1 / 0	4	4
2.	23MA201	Mathematics II	3 / 1 / 0	4	4

	ENGINEERING SCIENCE COURSES (04 Credits)				
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23MA301	Mathematical Foundations for Computer Science	3 / 1 / 0	5	

	PROFESSIONAL CORE COURSES (84 Credits)				
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23IT101	Application Development Practices	1 / 0 / 4	5	3
2.	23CS101	Problem Solving using C++	1 / 0 / 4	5	3
3.	23CY101	Networking and Communication	3 / 0 / 2	4	4
4.	23CY202	Operating Systems	3 / 0 / 2	5	4
5.	23CS201	Data Structures and Algorithms	1 / 0 / 4	5	3
6.	23CD201	Database Management Systems	1 / 0 /4	5	3
7.	23CY201	Java Programming	1 / 0 /4	5	3
8.	23CY301	Cyber Law and Digital Forensics	3 / 1 / 0	3	3
9.	23CY302	Data Analytics and Visualization	3 / 1 / 0	4	4
10.	23CS301	Advanced Java Programming	1 / 0 /4	5	3
11.	23IT301	Web Technology using React	1 / 0 /4	5	3
12.	23CY401	Ethical Hacking	3 / 0 / 2	5	4
13.	23CY402	Access Control and Identity management	3 / 0 / 2	5	4
14.	23CY403	Auditing IT Infrastructure for Compliance	3 / 1 / 0	4	4
15.	23AD402	Design and analysis of algorithms	1 / 0 / 4	5	3
16.	23IT402	Web Frameworks using REST API	0 / 0 / 4	4	2
17.	23AD403	Managing Cloud and Containerization	1 / 0 / 4	5	3
18.	23CY501	Security Assessment and Risk Analysis	3 / 0 / 0	3	3
19.	23CY502	Computational Number Theory for Cryptography	3 / 1 / 0	4	4
20.	23CY503	Security Policies and Implementation	3 / 0 / 0	3	3
21.	23CY504	Cloud Security	2 / 0 / 2	4	4
22.	23CY601	Blockchain Technologies	3 / 0 / 0	3	3
23.	23CY602	Enterprise Networking Security and Automation	3 / 0 / 0	3	3
24.	23CY603	Hacker Technique Tools and Incident Handling	3 / 0 / 2	5	4
25.	23CY604	Cyber Attack Simulation and Security Testing	3 / 0 / 2	5	4

S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Ext/ Int	Cat.
PROFESSIONAL ELECTIVE COURSES (18 Credits)							
ELECTIVE STREAM I – MACHINE LEARNING ENGINEERING							
1	23AD902	Exploratory Data Analysis (EDA) using Python	2/0/2	4	3	50/50	PEC
2	23AD905	Statistical Methods and Basic Machine Learning Models	2/0/2	4	3	50/50	PEC
3	23IT901	Advanced ML Techniques	2/0/2	4	3	50/50	PEC
4	23IT902	NLP	2/0/2	4	3	50/50	PEC
5	23IT903	Computer Vision	1/0/4	5	3	50/50	PEC
6	23AD906	GenAI Advanced Prompt Engineering & LLMs	1/0/4	5	3	50/50	PEC
ELECTIVE STREAM II - DATA ANALYST WITH ML ESSENTIALS							
1	23AD901	Data Storytelling and Visualization	2/0/2	4	3	50/50	PEC
2	23AD902	Exploratory Data Analysis (EDA) using Python	2/0/2	4	3	50/50	PEC
3	23AD903	Problem solving with Analytical & Design Thinking	2/0/2	4	3	50/50	PEC
4	23AD904	PowerBI	2/0/2	4	3	50/50	PEC
5	23AD905	Statistical Methods and Machine Learning Models	2/0/2	4	3	50/50	PEC
6	23AD906	GenAI Advanced Prompt Engineering & LLMs	1/0/4	5	3	50/50	PEC
ELECTIVE STREAM III - CLOUD IT ADMINISTRATION							
1	23CS901	Implementing and Administering Enterprise Networks	2/0/2	4	3	50/50	PEC
2	23CS902	Linux System Administration	2/0/2	4	3	50/50	PEC
3	23CS903	Information Security Systems	2/0/2	4	3	50/50	PEC
4	23CS904	Low-Code No-Code Application Building	2/0/2	4	3	50/50	PEC

5	23CS905	Virtualization, Cloud Computing and SysOps	1/0/4	5	3	50/50	PEC
6	23CS906	Continuous Monitoring and Observability (AWS)	1/0/4	5	3	50/50	PEC
ELECTIVE STREAM IV – CYBER SECURITY							
1	23CS901	Implementing and Administering Enterprise Networks	2/0/2	4	3	50/50	PEC
2	23CS902	Linux System Administration	2/0/2	4	3	50/50	PEC
3	23CS903	Information Security Systems	2/0/2	4	3	50/50	PEC
4	23CY901	Cloud Computing and Containerized Virtual Infrastructure	2/0/2	4	3	50/50	PEC
5	23CY902	Penetration Testing	1/0/4	5	3	50/50	PEC
6	23CY903	Security Operations of Information systems	1/0/4	5	3	50/50	PEC
ELECTIVE STREAM V – FULL STACK SOFTWARE DEVELOPMENT (for Minor)							
1	23CS911	Managing and Querying Database (RDBMS) MySQL / Postgre SQL	2/0/2	4	3	50/50	PEC
2	23CS912	Java / Python: Object-Oriented Programming	2/0/2	4	3	50/50	PEC
3	23IT911	Web Development and UI/UX Essentials	2/0/2	4	3	50/50	PEC
4	23IT912	Build Single-Page Applications using React	2/0/2	4	3	50/50	PEC
5	23IT913	Build Back-end Application using Spring Boot / FAST API	1/0/4	5	3	50/50	PEC
6	23AD906	GenAI Advanced Prompt Engineering & LLMs	1/0/4	5	3	50/50	PEC

INDIAN KNOWLEDGE SYSTEM (02 Credits)					
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23EES01	Internship		28 Days	2

	OPEN/ EMERGING/ INDUSTRY (09 Credits)				
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23CY001	Cyber Security Fundamentals	3 / 0 / 0	3	3
2.	23CY002	Cryptography - Tools and Techniques	3 / 0 / 0	3	3
3.	23CY003	Cyber security Auditing and Assurance	3 / 0 / 0	3	3
4.	23CY004	Web Security	3 / 0 / 0	3	3
5.	23CY005	Operating System Security	3 / 0 / 0	3	3
6.	23CY006	Security Governance, Risk, and compliance	3 / 0 / 0	3	3

	PROJECT WORK (22 Credits)				
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23CY505	Application Development	0 / 0 / 6	6	3
2.	23CY605	Capstone Project	0 / 0 / 4	4	2
3.	23CY701	Project Phase - I	0 / 0 / 6	6	3
4.	23CY801	Project Phase - II	0 / 0 / 24	24	12

PROFESSIONAL ELECTIVE COURSES: VERTICALS				
Vertical I - ML Engineering	Vertical II - Data Analyst with ML Essentials	Vertical III - Cloud IT Administration	Vertical IV - Cybersecurity	Vertical V – Full Stack Software Development (Minor)
Exploratory Data Analysis (EDA) using Python	Data Storytelling and Visualization	Implementing and Administering Enterprise Networks	Implementing and Administering Enterprise Networks	Managing and Querying Database (RDBMS) MySQL / Postgre SQL
Statistical Methods and Basic Machine Learning Models	Exploratory Data Analysis (EDA) using Python	Linux System Administration	Linux System Administration	Java / Python: Object-Oriented Programming
Advanced ML Techniques	Problem solving with Analytical & Design Thinking	Information Security Systems	Information Security Systems	Web Development and UI/UX Essentials
NLP	PowerBI	Low-Code No-Code Application Building	Cloud Computing and Containerized Virtual Infrastructure	Build Single-Page Applications using React
Computer Vision	Statistical Methods and Machine Learning Models	Virtualization, Cloud Computing and SysOps	Penetration Testing	Build Back-end Application using Spring Boot / FAST API
GenAI Advanced Prompt Engineering & LLMs	GenAI Advanced Prompt Engineering & LLMs	Continuous Monitoring and Observability (AWS)	Security Operations of Information systems	GenAI Advanced Prompt Engineering & LLMs

		INTERN (02 Credits)			
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23EES01	Internship		28 Days	2

		VALUE ADDED COURSES (Based on student's interest)					
S. No	Course Code	Course Title	L/T/P		C	SDG Mapping	Sem
1.	23VA101	PEGA Certification	1 / 0 / 0		1	4, 9,12	III
2.	23VA102	Amazon Web Service (AWS)	1 / 0 / 0		1	4, 9,12	IV
3.	23VA103	Google Certified Cloud Professional (GCCP)	1 / 0 / 0		1	4, 9,12	V
4.	23VA104	CISCO Certification	1 / 0 / 0		1	4, 9,12	VI
5.	23VA105	Wipro PRP Certification	1 / 0 / 0		1	4, 9,12	VI

		MANDATORY COURSES (Non-Credits) (Courses conducted either by internal faculty or through MOOCs)			
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C
1.	23MC101	Induction Programme		0	
2.	23MC102	Environmental Sciences	1 / 0 / 0	1	0

L: Lecture   **T:** Tutorial   **P:** Practical   **C:** Credit   **O:** Outside Class hours   **Cat.:** Category

HSMC	**:** Humanities and Social Sciences including Management	**OEC**	**:** Open and Emerging Elective Courses
BSC	**:** Basic Science Courses	**PRJ**	**:** Project Work
ESC	**:** Engineering Science Courses	**INT**	**:** Internship
PCC	**:** Professional Core Courses	**MC**	**:** Mandatory Course
PEC	**:** Professional Elective Courses		

Definition of Credit:

L – Lecture	1 Hr. Lecture (L) per week	1 credit
T – Tutorial	1 Hr. Tutorial (T) per week	1 credit
P - Practical/Practice (Project and Industry based Courses)	1 Hr. Practical (P) per week	0.5 credit

SEMESTER – I

B.E –Computer Science and Engineering (Cyber Security)

23MA101	MATHEMATICS I (COMMON TO ALL BRANCHES)	3/1/0/4
Nature of Course:	J (Problem analytical)	
Pre requisites:	Nil	

Course Objectives:

1.	To use logical notation to define the fundamental data types and structures used in computer algorithms and systems.
2.	To use the concepts of graph theory in practical situations.
3.	To acquire thorough knowledge of fundamental notions of proof's and its application in Cryptography.
4.	To analyse data pertaining to discrete and continuous random variables to interpret the results.
5.	To impart the knowledge of counting principles, to think critically and apply it in real world problems.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Recall the basic concepts of logical laws, structures and probability.	[R]
C101.2	Understand the concepts of proof techniques, structures and random variables.	[U]
C101.3	Apply *the logical and foundational structures of mathematics with an emphasis on* writing proofs.	[AP]
C101.4	Apply the concepts of graph and number theory in cryptography.	[AP]
C101.5	Apply the probability concepts in transition from real problem to a probabilistic model.	[AP]

Course Contents:

MODULE I LOGICAL PROOF'S & FUNCTIONS   **20**
Proofs: Definitions - Proof by cases - Proof by contradiction - Logical formulas - Propositions - Truth table - Logical operators - Tautologies and Contradictions - Contrapositive - Equivalences and implications - Predicates - Free and bound variables - Quantifiers - Universe of discourse - **Sets:** Basic sets - Operations on Sets - Law on Sets (without proof) - Cartesian product of sets. **Relations:** Binary relation -Types of relations and their properties - Relational matrix and graph of a relation - Equivalence relations - Partial ordering relation **Functions:** Classifications of functions - Induction - Ordinary induction and Strong induction - Recursive data types - Definition of recursive and structural induction.

MODULE II NUMBER THEORY & GRAPH THEORY   **20**
Number Theory: Divisibility - Greatest common divisor - Euclid's algorithm - Prime numbers - Fundamental theorem of arithmetic - Modular arithmetic - Remainder arithmetic - Multiplicative inverses and cancelling - Relatively prime - Euler's theorem.- Chinese Reminder Theorem **Graph Theory:** Vertices and Degrees - Types of graphs - Handshaking theorem - Adjacency matrices - Walks and paths - Connectivity - Isomorphism - Directed acyclic graphs and scheduling -Matchings - The Stable marriage problem -Forests and trees - Spanning trees - Minimum weight spanning trees - Prim's algorithm - Kruskal's algorithm

MODULE III COUNTING & PROBABILITY

                                                                                                                                          20

Sums and Asymptotics - Sums of Powers - Harmonic Numbers - Asymptotic Notation -The

TOTAL PERIODS 45

Text Books:	
1.	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.
2.	Koshy. T, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, Second Edition, 2007.
3.	Eric Lehman, F. Thomson Leighton and Albert R. Meyer, "Mathematics for Computer Science", 14thEdition, MIT Open courseware, 2018.
Reference Books:	
1.	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", sixth edition, Pearson Education Pvt Ltd., New Delhi, 2017
2.	Kenneth H. Rosen, "Discrete Mathematics and its Applications", Eighth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Eighth Edition, 2021.
3.	P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, New Delhi, Fifth Edition, 2019.
Web References:	
1.	https://onlinecourses.nptel.ac.in/noc23_cs109/preview
2.	https://onlinecourses.nptel.ac.in/noc23_cs120/preview
3.	https://onlinecourses.nptel.ac.in/noc23_ma77/preview

23TA101	HERITAGE OF TAMILS	1/0/0/1
Nature of Course:	C (Theory Concept)	
Pre requisites:	Nil	

Course Objectives:

1.	To know various concepts of Tamil Language families.
2.	To know about the essentialities of Heritage.
3.	To understand the Aram concepts of Tamils and the cultural influence.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Know about the language families in India, impact of religions and the contribution of Bharathiyar and Bharathidhasan.	[U]
C101.2	Observe the growth of sculpture, making of musical instruments and the role of temples in socio and economic lives.	[U]
C101.3	Understand the significance of folklore and martial arts.	[U]
C101.4	Learn the sangam literature, sangam age and overseas conquest of Cholas.	[U]
C101.5	Understand the contribution of Tamils to Indian Freedom Struggle, role of Siddha medicine and print history of Tamil Books.	[U]

Course Contents:

MODULE I LANGUAGE AND LITERATURE 5

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 Thiru Kural-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 Bharathidasan.

MODULE II HERITAGE – ROCK ART PAINTINGS TO MODERN ART - SCULPTURE 5

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. Folk And Martial Arts:Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance-Sports and Games of Tamils.

MODULE III THINAI CONCEPT OF TAMILS 5

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. Contribution of Tamils to Indian national movement and Indian culture: 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 PERIODS 15

Text Books:		
1.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).	
2.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author).	
3.	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).	
Reference Books:		
1.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL)-Reference Book.	
2.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)	
3.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).	

23IT101	APPLICATION DEVELOPMENT PRACTICES	1/0/4/3
Nature of Course:	F (Theory programming)	
Pre requisites:	Nil	

Course Objectives:

1.	To discuss the essence of agile development methods.
2.	Ability to understand and apply Scrum framework.
3.	Toset up and create a GitHub repository.
4.	To impart the knowledge of web application development platforms.
5.	To create interactive websites using HTML, CSS.
6.	To recognize the user experience design methodologies like Java script for responsive web design.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Relate the concepts of agile software engineering and its advantages in software development.	[R]
C101.2	Demonstrate the roles and responsibilities of Scrum, Lean Software Development and how to setup the GitHub repository.	[U]
C101.3	Analyze the working model and learn basic web concepts to develop Static and Dynamic websites.	[A]
C101.4	Utilize the knowledge of HTML, CSS and Bootstrap using forms to build modern interactive web applications.	[AP]
C101.5	Develop dynamic web pages using HTML5 with validation using Java Script objects and by applying different event handling mechanisms.	[AP]

Course Contents:

MODULE I 15

History of Traditional Software Development Model, Software Development Model and SDLC, "Waterfall Model"-An Overview, Waterfall or Sequential Based Development Model, "Real Life"-Waterfall Model, "Waterfall Model"-Advantages, "Waterfall Model"-Disadvantages, Agile Software Development-Definition, Agile Development Model, Graphical Illustration of Agile Development Model, Why use Agile?, Agile Manifesto and Principles, 12 Principles of Agile Methods, Agile Values, What is NOT an Agile software development?, Foundation of an Agile software development Method, Common Characteristics of Agile Methods, Agile Methods and Practices, When to use Agile Model?, Advantages of Agile Model, Disadvantages of Agile Model, Difference between Agile and Waterfall Model, Agile-Myths and Reality, Agile Market Insight. Introduction to SCRUM, Scrum Roles and Responsibilities, Scrum Core Practices and Artifacts, User Story, Sprint, Release Planning Meeting, Sprint Planning Meeting, Daily Scrum Meeting (Daily Stand up), Sprint Review Meeting, Retrospective, Product Backlog, Sprint Backlog, Burn-Down Chart, Velocity, Impediment Backlog. Definition of "Done", Splitting User Story into Task, Why to Split User Story into Task?, Guidelines for Breaking Down a User Story intoTasks, Examples of Scrum Task Board, Planning Poker®, Planning Poker-Process/Steps, What are Story Points?, How do We Estimate in Story Points?, What Goes into Story Points? Introduction to Extreme Programming, The Rules of Extreme Programming, Extreme Programming (XP)-Principles, Extreme Programming (XP)-Key Terms, Introduction to Lean Software Development, Principles of Lean Software Development, What is Kanban? Introduction to Git- Getting a Git Repository, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Tagging, Git Aliases, Git Branching, Branches in a Nutshell, Basic Branching and Merging, Branch Management, Remote Branches, Rebasing. Introduction to GitHub- Introduction, Set up Git, Create a repository, GitHub Flow, Contribution to Projects, Communicating on GitHub. Linux Basic Commands-Linux Basic Commands, Linux File Permissions, Basic System Administration, Process Management, Archival. Linux Shell Script-Shell Basics, Writing firstscript, Conditional statements, Loops, Command line arguments, Functions & file manipulations, Background

processes, Scheduling processes-At, batch & Cron-Networking.

MODULE II   15
HTML Basics-Understand the structure of an HTML page, New Semantic Elements in HTML 5, Learn to apply physical/logical character effects, Learn to manage document spacing. Tables Understand the structure of an HTML table, Learn to control table format like cell spanning, cell spacing, border. List- Numbered List, Bulleted List, Working with Links, Understand the working of hyperlinks in web pages, Learn to create hyperlinks in web pages, Add hyperlinks to list items and table contents. Image Handling- Understand the role of images in web pages, Learn to add images to web pages, Learn to use images as hyperlinks. Frames-Understand the need for frames in web pages, Learn to create and work with frames.
HTML Forms for User Input Understand the role of forms in web pages, Understand various HTML elements used in forms, Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box. New Form Elements-Understand the new HTML form elements such asdate, number, range, email, search and data list, Understand audio, video, article tags.

MODULE III   15
Introduction to Cascading Style Sheets-What CSS can do, CSS Syntax, Types of CSS. Working with Text and Fonts-Text Formatting, Text Effects, Fonts. CSS Selectors-Type Selector, Universal Selector, ID Selector, Class selector. Colors and Borders-Background, Multiple Background, Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border, Implementing CSS3 in the "Real World"-Modernizr, HTML5 Shims, SASS, and Other CSS Preprocessors, CSS Grid Systems, CSS Frameworks. Introduction to Bootstrap Introduction, Getting Started with Bootstrap, Bootstrap Basics, Bootstrap grid system, Bootstrap Basic Components, Bootstrap Components, Page Header, Breadcrumb, Button Groups, Dropdown, Nav & Navbars. JavaScript Essentials-Var, Let and Const keyword, Arrow functions, default arguments, Template Strings, String methods, Object de-structuring, Create, apply, prototype, bind method, Spread and Rest operator, Typescript Fundamentals, Types & type assertions, Creating custom object types, function types, Typescript OOPS-Classes, Interfaces, Constructor, Decorator & Spread Operator, Difference == & === , Asynchronous Programming in ES6, Promise Constructor, Promise with Chain, Promise Race.

TOTAL PERIODS(Theory) 45

LIST OF EXPERIMENTS

1. Design a web page using HTML basic tags.
2. Develop web site with suitable contents and links.
3. Design web pages using lists and tables.
4. Build a web client-side Login, Registration form and Dashboard with drop down menus.
5. Develop a HTML form and validation using HTML5 features.
6. Create a website using HTML: To embed an image map in a web page. To fix the hot spots. Show all the related information when the hot spots are clicked.
7. Apply style specification in HTML page using CSS.
8. Develop dynamic web application using HTML, CSS and JavaScript.

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 75

Text Books:	
1.	Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley India Pvt. Limited, 2020.
2.	Jeff Sutherland, "Scrum the Art of Doing Twice the Work in Half the Time", Random House Publisher,1stEdition, 2015.
3.	Scott Chacon, Ben Straub, "Pro GIT", CreateSpace Independent Publishing Platform, 2017.
Reference Books:	
1.	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2ndEdition, 2014.
2.	Mike Cohn, "User Stories Applied: For Agile Software", Addison Wesley,2ndEdition, 2016.
3.	Russ Ferguson, "Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development", Apress Publishers, 3rdEdition, 2019.
Web References:	
1.	https://www.coursera.org/specializations/agile-development
2.	https://www.edx.org/learn/agile
3.	https://nptel.ac.in/courses/106/105/106105182/

23CS101	PROBLEM SOLVING USING C++	1/0/4/3
Nature of Course:	K (Problem Programming)	
Pre requisites:	Nil	

Course Objectives:

1.	To learn the fundamental programming concepts and methodologies which are essential to build good C++ programs.
2.	To gain knowledge on control structures and functions in C++.
3.	To provide the basic object-oriented programming concepts and apply them in problem solving.
4.	To introduce file streams and operations for storing data permanently.
5.	To know generic programming paradigm.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Illustrate the fundamental concepts and methodologies required to develop a program for given problems.	[U]
C101.2	Develop a program for real-time problems with pointers and objects.	[AP]
C101.3	Apply the Constructors, destructors, and Overloading concepts to solve the solve.	[AP]
C101.4	Develop C++ programs with Interfaces, Exception and File processing	[AP]
C101.5	Implement the concepts on file streams, I/O and Lambda Expression.	[AP]

Course Contents:

MODULE I C++ PROGRAMMING FUNDAMENTALS 15

C vs C++, Basic of OOPS, the main () function, Header files, Basic Input and Output (I/O) using cin and cout, Variable, Constant. **Operators:** Arithmetic Operators, Assignment Operators, Relational Operators, Logical Operators, Bitwise Operators, Other Operators, Operator Precedence. **Control Statements:** if, if else and Nested if else, switch case, break and continue, Loops-for loop, while loop, do while loop, goto. **Arrays and Strings:** 1D array, 2D array, Strings, String functions. **Function:** Basics, call by value, call by reference & return by reference, Inline function, overloading Functions, inline Functions, Recursive Functions. **Pointers:** Pointer, Dynamic Memory Allocation.

MODULE II OBJECT ORIENTED CONCEPTS 15

Classes and Objects, public, private, protected. **Constructors and destructors:** Overloaded Constructor, Copy Constructor, Shallow Copying Deep Copying. **Overloading:** this' Pointer, structs vs Classes, Friends of a class, Operator Overloading, Inheritance, Overloading vs Overriding, Polymorphism, Virtual Functions, Pure Virtual Functions and Abstract Classes.

MODULE III FILES AND GENERIC PROGRAMMING 15

Abstract Classes as Interfaces, Exception, Files, Streams and I/O, STL, Generic Programming, Lambda Expression.

TOTAL PERIODS (Theory) 45

LIST OF EXPERIMENTS

1. Practice of C Programming using Branching and Iterative constructs.
2. Programs using arrays and strings.
3. Programs using Functions.
4. Programs using Structures and Pointers.
5. Programs using classes and objects.
6. Programs using constructor and destructor.
7. Programs using method overloading, operator overloading and polymorphism concepts.
8. Programs using friend class.
9. Programs using virtual functions and abstract class.
10. Programs using inheritance concepts.
11. Programs using exception handling concept.
12. Programs using Files.
13. Mini project

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 75

Text Books:

1.	E Balagurusamy," Object Oriented Programming With C++", 4th Edition, Tata McGraw-Hill Education, 2008.
2.	YashavantP. Kanetkar, "Let us C++", BPB Publications, 2020.
3.	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.

Reference Books:

| 1. | Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2015. |
| 2. | John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016. |

Web References:

| 1. | https://www.geeksforgeeks.org/c-plus-plus/ |
| 2. | http://web.stanford.edu/class/cs106l/ |

23EN101	ORAL AND WRITTEN COMMUNICATION SKILLS	2/0/2/3
Nature of Course:	Theory Skill Based	
Pre requisites:	Basics of English Language	

Course Objectives:

1.	To empower students to comprehend different aspects of communication using LSRW skills.
2.	To highlight the essential aspects of effective oral and written communication necessary for professional success.
3.	To expand the skills of the students in preparing job search artefacts and negotiating their use in GDs and interviews.
4.	To enable students to communicate contextually in specific, personal and professional situations with courtesy.
5.	To enrich students to carry out day-to-day communication at the workplace and facilitate efficient interpersonal communication.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Remember and expand writing skills through guided activities.	[R]
C101.2	Apply communication skills in a corporate environment.	[AP]
C101.3	Analyse and collaborate better with colleagues, building stronger professional and personal relationships.	[A]
C101.4	Apply technical writing skills to write letters, emails and prepare technical documents.	[AP]
C101.5	Analyse and communicate effectively in personal and professional situations.	[A]

Course Contents:

MODULE I READING   **10**
Reading techniques-Skimming and scanning-Cloze reading-Reading and understanding technical articles-Reading for detailed comprehension: Email and letters-Reading advertisements Table completion: Interpreting charts and graphs-Verbal reasoning-Comprehending reviews Reading and responding to instant messages.

MODULE II WRITING   **10**
Formal letters (Sales letter, calling for quotations, seeking clarification, placing an order, complaint letter, inviting, accepting and declining letters)-Emails-Minutes of meeting-Professional report writing-Proposal Writing-Resume / job application letter-Case study.

MODULE III LISTENING   **10**
Situational listening-Listening about an experience-Listening about short extracts Listening an interview-Conversational speaking. Speaking: Conversational Speaking-Decipher the picture given and answer the question posed along withit-Decipher the mind map given and speak about it-Listen to the questions posed and answer them appropriately.

TOTAL PERIODS (Theory)   **30**

LIST OF EXPERIMENTS

1. Develop client server-based TCP applications using UNIX socket programming functions.
2. Develop client server based UDP applications using UNIX socket programming functions.
3. Simulation of data link and network layer protocols.
4. Performance analysis of TCP and UDP protocol using simulation tool.
5. Performance analysis of routing protocols using simulation tool.
6. Demonstrate the working of network tools such as Ping, TCPDump, Traceroute, Netstat.
7. Analyze the network traffic using Wireshark tool/Packet tracer tool.

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 60

Text Books:

1.	A S Tanenbaum, DJ Wetherall, "Computer Networks", 6thEdition, Prentice-Hall, 2021.
2.	Behrouz A. Forouzan, "Data communication and Networking", 5thEdition, Tata McGraw-Hill, 2013.
3.	Andrei Gurtov, Madhusanka Liyanage, Mika Ylianttila, Software Defined Mobile Networks (SDMN) Beyond LTE Network Architecture, Wiley, 2021

Reference Books:

1.	Peterson & Davie, "Computer Networks, A Systems Approach", 6thEdition, Elsevier, 2021.
2.	JF Kurose, KW Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Addison Wesley, 2021.
3.	Xingqin Lin, Namyoon Lee5G and Beyond Fundamentals and Standards, Springer, 2021

Web References:

1.	. https://www.geeksforgeeks.org/network-and-communication/
2.	https://www.britannica.com/science/computer-science/Networking-and-communication
3.	https://www.ibm.com/docs/en/aix/7.2?topic=management-network-communication-concepts

23CY101	**NETWORKING AND COMMUNICATION**	**3/0/2/4**
Nature of Course:	C (Theory Practical)	
Pre requisites:	Nil	

Course Objectives:

1.	To study different layers of ISO/OSI reference architecture.
2.	To understand the network topology.
3.	To study the concepts of data link layer and Network layer Protocols
4.	To understand the types of protocols in Transport layer.
5.	To study advanced application layer protocols.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Summarize the functionality and protocols operating in each layer of OSI model.	[U]
C101.2	Compare network topology, devices, and transmission medium.	[U]
C101.3	Analyse error control, flow control and routing protocols.	[A]
C101.4	Analyse IP, TCP and UDP header formats.	[A]
C101.5	Analyse Network traffic characteristics and congestion control mechanism.	[A]

Course Contents:

MODULE I FUNDAMENTALS OF NETWORKING 15

Data Communication-The OSI Model-TCP/IP Protocol Suite-Addressing-Transmission Media Networking devices-Network Topologies. Networking Devices: Hubs, Bridges, Switches, Routers and Gateways, Network Security Fundamentals. Case study: A comparative analysis of TCP/IP and OSI models in real-world network implementations.

MODULE II NETWORK LAYER 15

Encoding-Error Detection-Reliable Transmission-MAC protocols-CSMA/CD-CSMA/CA. Circuit Switching-Packet Switching-Bridges and LAN Switches: Spanning Tree algorithm-Internetworking IPv4-Subnetting-IPv6-Routing Techniques: Distance vector (RIP)-Link state (OSPF)–Interdomain Routing (BGP). Case study: IP address planning and subnetting for a geographically dispersed organization.

MODULE III TRANSPORT LAYER AND APPLICATION LAYER 15

UDP-TCP-Congestion Control and Resource Allocation: TCP Congestion Control-Congestion Avoidance Mechanisms-Quality of Service: Integrated Services-Differentiated Services-Network Traffic Analysis. Domain Name System-Electronic Mail (SMTP, MIME, IMAP)-File Transfer (FTP) WWW (HTTP). Emerging Technologies in Networking (5G, edge computing, etc.), Securing web applications, Mobile Phone security, Data Tracking. Case study: Evaluating the impact of 5G and edge computing on the future of network communication.

TOTAL PERIODS (Theory)   45

LIST OF EXPERIMENTS

1. Develop client server based TCP applications using UNIX socket programming functions.

2. Develop client server based UDP applications using UNIX socketprogramming functions.

3. Simulation of data link and network layer protocols.

4. Performance analysis of TCP and UDP protocol using simulation tool.

5. Performance analysis of routing protocols using simulation tool.

6. Demonstrate the working of network tools such as Ping, TCPDump, Traceroute, Netstat.

7. Analyze the network traffic using Wireshark tool/Packet tracer tool.

TOTAL PERIODS(Lab)

TOTAL PERIODS

Text Books:	
1.	A S Tanenbaum, DJ Wetherall, "Computer Networks", 6thEdition, Prentice-Hall, 2021
2.	Behrouz A. Forouzan, "Data communication and Networking", 5thEdition, Tata McGraw-Hill, 2013.
3.	Andrei Gurtov, Madhusanka Liyanage, Mika Ylianttila, Software Defined Mobile Networks (SDMN) Beyond LTE Network Architecture, Wiley, 2021
Reference Books:	
1.	Peterson & Davie, "Computer Networks, A Systems Approach", 6thEdition, Elsevier, 2021.
2.	Xingqin Lin, Namyoon Lee5G and Beyond Fundamentals and Standards, Springer, 2021
3.	JF Kurose, KW Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Addison Wesley, 2021.
Web References:	
1.	https://www.geeksforgeeks.org/network-and-communication/
2.	https://www.britannica.com/science/computer-science/Networking-and-communication
3.	https://www.ibm.com/docs/en/aix/7.2?topic=management-network-communication-concepts

23MC101	INDUCTION PROGRAMME	1/0/0/0
Nature of Course:	Induction Programme	
Pre requisites:	Nil	

Course Objectives:		
1.	To have broad understanding of society and relationships.	
2.	To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being	
3.	To incorporate meta skills and values	

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Explore academic interest and activities	[AP]
C101.2	Work for excellence	[AP]
C101.3	Promote bonding and give a broader view of life and character	[AP]

Course Contents:

PHYSICAL ACTIVITY
Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module. (CO mapping: C101.1, C101.2, C101.3)

CREATIVE ARTS (students can select any one of their choices):
Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on. .(CO mapping: C101.1, C101.2, C101.3)

UNIVERSAL HUMAN VALUES:
Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community-local and global-and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills. .(CO mapping: C101.1, C101.2, C101.3)

LITERARY AND PROFICIENCY MODULES:
Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage with societal institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of Reading, writing, speaking-debate, role play etc. Communication and computer skills. (CO mapping: C101.1, C101.2, C101.3)

LECTURES BY EMINENT PEOPLE:
Teaching with Lectures......It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts. (CO mapping: C101.1, C101.2, C101.3)

VISIT TO LOCAL AREAS:
Traveling is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near college to learn new things. Eg. Meditation centre/orphanage/Hospital. (CO mapping: C101.1, C101.2, C101.3)

FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION:
Hod's of different branches will present about their department followed by department visit to view various facilities available at their department, new innovations from students and faculties etc. (CO mapping: C101.1, C101.2, C101.3)

SEMESTER - II

23MA201	MATHEMATICS II	3/1/0/4
Nature of Course:	J (Problem analytical)	
Pre requisites:	Nil	

Course Objectives:

1.	To study the basic probability concepts
2.	To apply mathematical linear programming techniques to solve constrained problems.
3.	To formalize the notion of strategic thinking and rational choice by using the tools of game theory
4.	To acquaint the student with transform techniques which are used in variety of engineering fields.
5.	To introduce the concepts of Group theory.

Course Outcomes

Upon completion of the course, students shall have ability to

C201.1	Recall the concepts of basic probability	[R]
C201.2	Formulate and analyze the existence of solutions to optimization problems	[U]
C201.3	Formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.	[AP]
C201.4	To apply game theory in searching, auctioning and trading.	[AP]
C201.5	Apply Fourier transform to discrete time sequence and use of group theory and coding theory in communication.	[AP]

Course Contents:

MODULE I PROBABILITY THEORY **20**
Deviation from mean-Markov's theorem-Chebyshev's theorem-properties of variance-sums of random variables-Gambler's ruin-Random walk on graphs-Chebyshev's inequality-weak law of large numbers Vander Waerden's theorem-Chernoff bounds-Deviation on sum of independent random variables-other versions of Chernoff Bound.

MODULE II LINEAR PROGRAMMING & GAME THEORY **20**
Basics of Linear Programming-Formulations of Linear Programming Problems-The Simplex Method-Linear Programming in Matrix Form-Two phase method-Duality-The Transportation Problem-Game theory: Introduction-Zero-Sum Matrix Games-payoff matrix-The Minimax and Maximin theorem-mixed strategies-graphic solution of games.

MODULE III FOURIER ANALYSIS & GROUP CODES **20**
Fourier series-Discrete Fourier transform-Computing using convolution of sequences using Fast Fourier transform-Fourier transforms modulo p and faster integer multiplication. Concept and simple Applications of Groups, subgroups, cosets-linear codes-error correcting codes-hamming codes-perfect codes.

TOTAL PERIODS 60

Text Books:	
1.	H.Pishro-Nik, "Introduction to probability, statistics, and random processes", Kappa Research LLC, 2014.
2.	Hamdy A. Taha, Operations Research: An Introduction, 10th Edition, Pearson,2019.
3.	T Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGrawHill, New Delhi, 2007.
Reference Books:	
1.	S.C. Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, twelth edition, Sulthan Chand and sons,2014.
2.	Eric Lehman, F.Thomson Leighton and Albert R.Meyer, Mathematics for Computer Science, 14thEdition, MIT Open courseware, 2018.
3.	Kanti Swarup, P.K.Gupta, Manmohan, Operations research, 2nd Edition, Sultan Chand and Sons, 2015
Web References:	
1.	https://archive.nptel.ac.in/courses/111/105/111105090/
2.	https://archive.nptel.ac.in/courses/110/104/110104063/
3.	https://archive.nptel.ac.in/courses/111/101/111101164/

23AS101	APPLIED SCIENCE	4/0/0/4
Nature of Course:	E (Theory based)	
Pre requisites:	Fundamental knowledge in applied sciences	

Course Objectives:

1.	To learn the fundamental, concepts of physics and apply this knowledge to both scientific and engineering problems.
2.	To make the students enrich basic knowledge in various fields such as Electrostatics and magnetism.
3.	To understand the principle and applications of electrochemistry and Polymer science, and explore the knowledge of various energy sources and storage devices.
4.	To understand the concepts of photo-physical and photochemical processes in spectroscopy.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Understand the principles of electrostatics and problems relating to electric field and electric potential.	[U]
C101.2	Realize the nature of magnets, properties and the magnetic effect of electric current.	[U]
C101.3	Describe the nature of electromagnetic wave and its propagation through different media and interfaces involved in different situations.	[AP]
C101.4	Understand the principle and working of reference electrodes, energy storage devices and polymer products in engineering fields.	[U]
C101.5	Interpret the principle and working of analytical techniques.	[AP]

Course Contents:

MODULE I ELECTROSTATICS   **15**

Charges and their conservation; Coulomb's law-superposition principle. Electric field-electric field due to a point charge, electric field lines; electric dipole, electric field intensity due to a dipole-behaviour of a dipole in a uniform electric field. Electric potential-potential difference-electric potential due to a point charge and dipole-equipotential surfaces-electrical potential energy of a system of two point charges. Electric flux Gauss's law and its applications. Electrostatic induction-capacitor and capacitance-dielectrics-electric polarisation-parallel plate capacitor with and without dielectric-applications of capacitor-energy stored in a capacitor-Capacitors in series and in parallel-Van de Graaff generator.

MODULE II MAGNETISM   **15**

Definitions of fundamental terms-Magnetic field around a current carrying conductor-Direction of magnetic field and current-Biot-Savart law and its application: Magnetic field due to Line charge-Ampere's law and its application: magnetic field due to a solenoid. Electromagnetic Induction and Alternating Current: Electromagnetic induction-Faraday's law-induced emf and current-Lenz's law. Self-induction-Mutual induction-self-inductance of a long solenoid-mutual inductance of two long solenoids. Methods of inducing emf-(i) by changing magnetic induction (ii) by changing area enclosed by the coil and (iii) by changing the orientation of the coil. AC generator-(Single phase, three phase). Eddy current-applications-transformer Alternating current-AC circuit with resistance-AC circuit with inductor-AC circuit with capacitor-LCR series circuit-Resonance and Q-factor-power in AC circuits.

MODULE III CHEMISTRY OF BATTERIES AND POLYMERS   **15**

Chemistry of batteries-Introduction-Cells and its types-emf series-Nernst equation and its applications. Reference electrodes-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Discussion of energy storage-Lead acid,Nickel cadmium and Lithium-ion batteries-Energy Sources-Fuel cells (H_2-O_2). Polymers-Classifications-addition and condensation polymerization-free radical mechanism. Atomic and molecular Spectroscopy: Beer Lambert's law, principle, instrumentation, and applications of electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and

atomic spectrum-Flame emission spectroscopy (FES).	
	TOTAL PERIODS 45

Text Books:	
1.	Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2017.
2.	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11thedition,Wiley, 2018.
3.	Gaur, R.K. and Gupta, S.L., "Engineering Physics", DhanpatRai Publishers, 2017.
Reference Books:	
1.	Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics" S. Chand& Co Ltd, 2018.
2.	R. Wolfson, "Essential University Physics", Volume 1 & 2. Pearson, 2020.
3.	S.O. Kasap, "Principles of Electronic Materials and Devices", McGraw Hill Education, 2017.
Web References:	
1.	https://nptel.ac.in/courses/115101005
2.	https://www.udemy.com/course/electrostatics-1-electric-charges-fields-and-related-laws/
3.	https://openlearninglibrary.mit.edu/courses/course-v1:MITx+8.02.1x+1T2019/about

23TA201	TAMILS AND TECHNOLOGY	1/0/0/1
Nature of Course:	C (Theory Concept)	
Pre requisites:	Nil	

Course Objectives:

1.	To know about weaving, ceramic, design and construction technologies in sangam age.
2.	To know the significance of technologies such as manufacturing, agriculture and irrigation.
3.	To understand the development of Scientific Tamils and Tamil Computing.

Course Outcomes

Upon completion of the course, students shall have ability to

C201.1	Describe about the weaving industry in sangam age and ceramic technology.	[U]
C201.2	Observe the design of houses, sculptures and construction of temples.	[U]
C201.3	Relate the various manufacturing materials and stone types in Silappathikaram.	[U]
C201.4	Understand the significance of agriculture and irrigation technology in ancient period.	[U]
C201.5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.	[U]

Course Contents:

MODULE I WEAVING AND CERAMIC TECHNOLOGY 5

Weaving Industry during Sangam Age-Ceramic technology Black and Red Ware Potteries (BRW)-Graffiti on Potteries. Design and Construction Technology: 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.

MODULE II MANUFACTURING TECHNOLOGY 5

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.Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu 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.

MODULE III SCIENTIFIC TAMIL & TAMIL COMPUTING 5

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 PERIODS 15

Text Books:	
1.	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).
2.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
3.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author).
Reference Books:	
1.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
2.	Social Life of the Tamils-The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3.	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL- (in print)

23CY202	OPERATING SYSTEMS	3/0/2/4
Nature of Course:	F (Theory Programming)	
Pre requisites:	Nil	

Course Objectives:

1.	To identify the structure and functions of Operating System.
2.	To describe the OS mechanisms to handle processes and threads.
3.	To experiment CPU scheduling policies, synchronization techniques and deadlock handling in real time problems.
4.	To articulate Memory management schemes.
5.	To discuss Device Management, I/O and File systems concepts.

Course Outcomes

Upon completion of the course, students shall have ability to

C202.1	Review the basic concepts and functions of operating systems.	[U]
C202.2	Interpret the processes and threads in operating systems for real world problems.	[U]
C202.3	Examine CPU scheduling algorithms, process synchronization mechanisms and deadlock handling methods.	[AP]
C202.4	Practice memory management techniques including virtual memory and page replacement algorithms.	[AP]
C202.5	Illustrate the concepts related to mass storage, I/O and file system.	[AP]

Course Contents:

MODULE I INTRODUCTION 15

Defining Operating Systems-User view-System view-Computer-System organization-Computer System Architecture-Operating System Operations-Resource Management-Virtualization-Computing Environments-OS Services-System Calls-Overview of Operating System Specific applications-OS Structures-System Boot. Process: Concept-Scheduling-Operations. Thread: Overview-Multicore Programming-Multithreading Models.

MODULE II PROCESS & MEMORY MANAGEMENT 15

CPU Scheduling-Process Synchronization: Synchronization Tools-Classic Problems of Synchronization Deadlocks: System Model-Deadlock in Multithreaded Applications-Deadlock Characterization-Methods for Handling Deadlocks-Prevention-Avoidance-Detection-Recovery. Main memory: Background Contiguous Memory Allocation-Paging-Structure of the Page Table-Swapping. Virtual memory Background-Demand Paging-Copy-on-Write-Page Replacement-Allocation of Frames-Thrashing Memory Compression.

MODULE III FILE MANAGEMENT, I/O AND STORAGE 15

File-System Interface: File concept-Access methods -Directory Structure-Protection. File System Implementation: File System Structure-Directory implementation -Allocation Methods-Free Space Management. File system Internals: File Systems-File System mounting -Partitions and Mounting-File Sharing. I/O Systems: Overview-I/O Hardware. Mass Storage Structure: Overview-HDD Scheduling-NVM Scheduling-Storage Device Management-Storage Attachment. Case Study: NAND flash storage system, IPC in windows.

TOTAL PERIODS 45

LIST OF EXPERIMENTS

1. Study of Basic Linux Commands, proc file system of linux, disk I/O, buffer caches, disk monitoring tool
2. Implementation of Shell Programming
3. Implementation of Unix System Calls
4. Implementation of Non Pre emptive and Pre emptive CPU Scheduling Algorithms
5. Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
6. Implementation of Banker's Algorithm for Deadlock Avoidance
7. Implementation of Memory Allocation and Management Techniques
8. Implementation of Page Replacement Techniques
9. Implementation of File organization Techniques and study on modern file systems like ZFS, btrfs, ext4 etc.
10. Implementation of Disk Scheduling Algorithms. Compare CPU and Disk Scheduling algorithms in terms of the number of voluntary and involuntary context switches.

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 75

Text Books:	
1.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts" 10th Edition, John Wiley, 2018
2.	D.M Dhamdhere, "Operating Systems"- A Concept based Approach, 3rdEdition, McGraw Hill,2017

Reference Books:	
1.	Andrew S. Tanenbaum, Modern Operating Systems 5thEdition, Pearson Education, 2016.
2.	William Stallings, "Operating Systems- Internals and Design Principles", 8thEdition, Pearson Publications, 2014.

Web References:	
1.	https://www.studocu.com/sg/course/nanyang-technological-university/operating-systems/1390534
2.	https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
3.	https://www.gatevidyalay.com/operating-system/

23CS201	DATA STRUCTURES AND ALGORITHM	1/0/4/3
Nature of Course:	F (Theory Programming)	
Pre requisites:	Problem Solving using C++	

Course Objectives:

1.	To introduce list data structure and its applications.
2.	To impart the importance of stacks and queues in problem solving.
3.	To provide knowledge on Tree and Graph data structures.
4.	To discuss the role of hashing in information storage and retrieval.

Course Outcomes

Upon completion of the course, students shall have ability to

C201.1	Implement the basic data structures like array and LinkedList.	[AP]
C201.2	Solve real world problems efficiently by applying stack and queue data structures.	[AP]
C201.3	Enumerate the applications with tree data structures.	[AP]
C201.4	Discuss the importance of hashing techniques in information storage.	[U]
C201.5	Employ graph algorithms for solving real time computing problems and analyze them.	[A]

Course Contents:

MODULE I LINKED LIST & STACK 15

Linked List: Array vs Linked list- Types of linked list- Singly, Doubly and Circular Linked list- Applications of linked list. Stack: Stack Model, Array and Linked list implementation of Stack-Applications of Stack- Infix, Prefix and Postfix expressions- infix to postfix conversion- Expression Evaluation- Balancing Parenthesis.

MODULE II QUEUE AND TREES 15

Queue: Queue Model, Array and Linked list implementation of Queue-Priority Queue- Applications of Queue. Trees: Binary Tree- Binary Search Tree- Insertion, Deletion, Traversal- Inorder, Preorder, Postorder, Level order traversal.

MODULE III GRAPHS AND HASHING 15

Graphs: Weighted and Directed graphs- Adjacency matrix and list implementation- Traversal- Breadth First Search & Depth First Search. Hashing: Direct Address Table, Hash function, Collision resolution techniques, Linear Probing, quadratic probing, double hashing.

TOTAL PERIODS(Theory) 45

LIST OF EXPERIMENTS

1. Implementation of Singly, Doubly and Circular Linked List.
2. Implementation of Stack using Arrays.
3. Implementation of Stack using Linked List.
4. Implementation of Stack applications
5. Implementation of Queue using Arrays.
6. Implementation of Queue using Linked List.
7. Implementation of Queue applications.
8. Implementation of Hashing techniques
9. Implementation of Binary Search Tree.
10. Implementation of Graph Traversal algorithms.

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 75

Text Books:

1.	Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.
2.	Anany Levitin, Introduction to the design & analysis of algorithms, 3rd Edition, Pearson Education, 2021.
3.	Michael T. Goodrich, "Data Structures and Algorithms in C++", 2nd Edition, Wiley Publication, 2011.

Reference Books:

1.	Seymour Lipschutz," Data Structures by Schaum Series",2ndEdition, Tata McGraw Hill, 2013.
2.	Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles",5thEdition, CareerMonk,2016
3.	Debasis Samanta, "Classic data structures", Prentice Hall of India, 2ndEdition,2014.

Web References:

1.	https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms
2.	https://www.edx.org/course/data-structures-algorithms-using-c

23CD201	DATABASE MANAGEMENT SYSTEMS	1/0/4/3
Nature of Course:	D (Theory Programming)	
Pre requisites:	Nil	

Course Objectives:

1.	To introduce fundamental concepts of Data Base Management Systems and concepts of Relational Data Models.
2.	To explain Relational algebra, Relational calculus and Normalization.
3.	To implement different relational model constraints and SQL queries.
4.	To manage Database using transactions, concurrency and query optimization.

Course Outcomes

Upon completion of the course, students shall have ability to

C201.1	Discuss the basic concepts and various data models used in database design	[U]
C201.2	Illustrate Relational algebra, Relational calculus and Normalization.	[AP]
C201.3	Write SQL commands and Subqueries with Constraints.	[AP]
C201.4	Determine Appropriate transactions, views, cursors and triggers to perform the given task.	[AP]
C201.5	Analyze database storage structures, query processing and recovery system.	[A]

Course Contents:

MODULE I INTRODUCTION   **15**

Introduction to DBMS, Characteristics of DBMS, DBMS vs File Systems, need for DBMS, Three Level DBMS Architecture, Data Models-Introduction, Benefits, and Phases, ER Diagrams-Symbols, Components, Relationships, Weak entities, Attributes, Cardinality, Relational Algebra, Domain Relational Calculus, Tuple Relational Calculus, Normalization-1NF, 2NF, 3NF, BCNF, 4NF

MODULE II CONSTRAINTS AND SQL COMMANDS   **15**

DDL Commands-Create, Drop, Alter, Truncate, Rename, Keys-primary Key, Foreign Key DML Commands Select, Insert, Update, Delete, Any, All, In, Exists, Non Exists, Union, Intersection, Subqueries-nested, correlated, Joins-Inner, Outer, and Equi, Functions-SUM, COUNT, AVG, MIN, MAX, Clauses-Group By, Having By, Embedded SQL, Dynamic SQL, Transaction Concepts-Transaction model-ACID Properties Serializability-Transactions as SQL statements.

MODULE III QUERIES AND TRANSACTIONS   **15**

Creation and Dropping of Views, Creation and Execution of Stored Procedures Cursors and Triggers-Opening, Fetching and Closing, Creation , Insertion, Deletion and Updating Database Applications: Payroll Processing Systems, Railway Reservation Systems, Bank Management System Introduction, Storage media and file structures, B+ Tree Hashing-static and Dynamic, Introduction to Query Processing-Issues in query optimization-Steps in query processing, Concurrency control and transactions, Lock based protocols Recovery System-Failure classification.

TOTAL PERIODS (Theory) 45

LIST OF EXPERIMENTS

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views
7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
8. Mini Project (Application Development)
   - i) IT Training Group Database
   - ii) Blood Donation System
   - iii) Salary Management System
   - iv) Traffic Light Information System

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 75

Text Books:

1.	Abraham Silberschatz, Henry F Korth, S Sudarshan, "Data base System Concepts", 7thEdition, McGraw hill, 2020.
2.	Vijay Krishna Pallaw, "Database Management Systems", 2ndEdition Asian Books Private Limited, 2010.
3.	Mark L. Gillenson, "Fundamentals of Database Systems", 7thEdition, Wiley India Pvt. Limited, 2008.

Reference Books:

1.	Raghu Ramakrishnan, Johannes Gehrke, Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw-Hill Education, 2017
2.	C. Date, "SQL and Relational Theory", O'Reilly Media, Incorporated, 2011.

Web References:

1.	http://www.sqlcourse.com/
2.	https://www.w3schools.com/sql/
3.	https://www.geeksforgeeks.org/dbms/

23CY201	JAVA PROGRAMMING	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

1.	To understand the basic concepts of core java.
2.	To employ different types of modifiers and Control statements
3.	To implement and interpret Arrays and Strings concepts
4.	To implement streams and java console formatting features

Course Outcomes

Upon completion of the course, students shall have ability to

C201.1	Infer the basic concepts of java programming.	[U]
C201.2	Illustrate the usage of different aspects of Controls statements in real world scenarios.	[AP]
C201.3	Apply Array and strings in real time environment.	[AP]
C201.4	Analyse and Interpret String Buffer and StringBuilder Classes	[A]
C201.5	Utilize the functionalities of streams and java console class.	[AP]

Course Contents:

MODULE I INTRODUCTION TO JAVA **5**

Java Architecture-JVM, JRE & JDK, Keywords, Features of Java, Console input and output statements, variables and Identifiers, Scope of Variables, Data types, Type Conversion, Comments, Command Line Arguments, Access Modifiers Operators-Unary Operator-Arithmetic Operator-Shift Operator-Relational Operator-Bitwise Operator-Logical Operator-Ternary Operator and Assignment Operator. Decision Statements-if Statements, if-else Branching, switch Statements.

MODULE II LOOPS, ARRAY & STRINGS **5**

Looping Statements: using for loop, using while Loops, Using do Loops. Jump Statements: using break and continue, Unlabelled Statements, Labelled Statements. Arrays: Declaration, Instantiation and Initialization of Java Array, Types of Array-Single Dimension array, multi-dimension array Strings: String, StringBuilder, and String Buffer, The String Class, Important Facts About Strings and Memory, Important Methods in the String Class, The String Buffer and StringBuilder Classes, Important Methods in the String Buffer and StringBuilder Classes, File Navigation and I/O.

MODULE III JAVA I/O **5**

Streams: Types of Streams, The Byte-stream I/O hierarchy, Character Stream Hierarchy, Random Access File class, The java.io. Console Class, Serialization, Dates, Numbers, and Currency, Working with Dates, Numbers, and Currencies, Parsing, Tokenizing, and Formatting, Locating Data via Pattern Matching, Tokenizing.

TOTAL PERIODS(Theory) 15

LIST OF EXPERIMENTS

1. Implementation of simple java program using Command Line Arguments
2. Implementation of simple java programs using decision making statements
3. Implementation of simple java programs using Looping statements
4. Implementation of Simple java programs using Jump statements
5. Implementation of 1D Array
6. Implementation of 2D Array
7. Implementation of String functions
8. Implementation of simple java program using Streams
9. Implementation of simple java program using Date and Number classes
10. Implementation of simplejava program using Tokenizing

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 45

Text Books:

1.	Herbert Schildt, "Java: The Complete Reference", 9th edition, Tata McGraw Hill, 2014.
2.	Kathy Sierra, "Head First Java: A Brain-Friendly Guide, 2nd Edition, Oreilly, 2009.
3.	Herbert Schildt, "Java A Beginner's Guide, Create, Compile and Run Java Programs Today", 8th edition, Tata McGraw Hill, 2020.

Reference Books:

1.	PaulDeitel, Harvey Deitel," Java How To Program", 10th Edition, Prentice Hall Publications, 2014.
2.	Y. Daniel Liang," Introduction to Java Programming", 9th Edition, Prentice Hall Publications, 2015.
3.	Ed Roman, RIma Patel, Sriganesh, Gerald Brose, "Mastering Enterprise JavaBeans" 3rdedition, Wiley, 2005.

Web References:

1.	http://www.nptel.ac.in
2.	http://www.javaworld.com
3.	https://www.learnjavaonline.org/

23MC102	ENVIRONMENTAL SCIENCES	2/0/0/0
Nature of Course	C (Theory Concept)	
Pre requisites	Basics in Environmental Studies	

Course Objectives:

1.	To learn the integrated themes on various natural resources.
2.	To gain knowledge on the type of pollution and its control methods.
3.	To have an awareness about the current environmental issues and the social problems.

Course Outcomes

Upon completion of the course, students shall have ability to

C102.1	Recall and play an important role in transferring a healthy environment for future generation.	[E]
C102.2	Illustrate the importance of natural resources and conservation of biodiversity	[E]
C102.3	Interpret and analyze the impact of engineering solutions in a global and societal context.	[E]
C102.4	Apply the gained knowledge to overcome pollution problems.	[E]
C102.5	Apply the gained knowledge in various environmental issues and sustainable development.	[E]

Course Content:

MODULE I NATURAL RESOURCES 10

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources - Renewable and non-renewable energy sources Land resources- Soil erosion and desertification – Role of an individual in conservation of natural resources.

MODULE II ENVIRONMENTAL POLLUTIONS 10

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Greenhouse effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedy. Water pollution c. Soil pollution - Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

MODULE III SOCIAL ISSUES AND THE ENVIRONMENT 10

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard.

TOTAL PERIODS 30

Text Books:

1.	Anubha Kaushik and C P Kaushik "Perspectives in Environmental Studies"4th Edition, New Age International (P) Limited, Publisher Reprint 2014. New Delhi
2.	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2015.

	Reference Books:
1.	Tyler Miller, Jr., "Environmental Science", Brooks/Cole a part of Cengage Learning, 2014.
2.	William Cunningham and Mary Cunningham, "Environmental Science", 13th Edition, McGraw Hill,2015.
3.	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Third Edition, Pearson Education, 2014.
	Web References:
1.	http://nptel.ac.in/courses/120108002
2.	http://nptel.ac.in/courses/122106030
3.	http://nptel.ac.in/courses/120108004/

23AS102	APPLIED SCIENCE LABORATORY	0/0/4/2
Nature of Course	E (Skill based)	
Pre requisites	Basic Applied Science laboratory skills	

Course Objectives:

1.	To carry out experiments to understand the basic laws of magnetism.
2.	To Understand of how objects become electrically charged and how electrical charge is transferred from one object to another.
3.	To understand the principles and applications of electrochemistry and learning electro analytical methods, and explore the knowledge of various energy sources and storage devices.
4.	To understand the concepts of photo-physical and photochemical processes in spectroscopy.

Course Outcomes

Upon completion of the course, students shall have ability to

C102.1	To determine the magnetic field around a current carrying conductor.	[E]
C102.2	To determine the rate of growth or decay in a resistor-capacitor circuit and to estimate the resonant frequency and Q-factor.	[E]
C102.3	To determine the relationship between the magnetic flux density and the magnetizing field strength and to find the specific resistance of the wire.	[E]
C102.4	To determine the pH, single electrode potential using reference electrodes and Electroplating process based on electrolytic cell.	[E]
C102.5	Interpret the principle and working of Spectroscopic technique.	[E]

LIST OF EXPERIMENTS

1. Determination of Magnetic field along the axis of current carrying coil-Stewart and Gee method.
2. Determination of characteristics of RC circuit to find the time constant.
3. Determination of characteristics of LCR circuits.
4. Determination of Hysteresis loss.
5. Determine the Specific resistance-Carey fosters bridge
6. Determination of strength of strong acid by pH metry.
7. Estimation of dissolved oxygen in waste water using Winkler's method.
8. Determination of single electrode potential of Zinc and Copper by Potentiometric method.
9. Determination of cathode efficiency of Nickel using electroplating process.
10. Spectrophotometry-Estimation of iron in sample water.

TOTAL PERIODS(Lab) 30

Text Books:

1.	Anoop Sing Yadav "Applied Physics Lab Manual" Vayu Education of India Publisher, 2018.
2.	Sesha Sai Kumar Vemula, Manual for Experiments in Engineering Physics, LAP LAMBERT Academic Publishing 2017
3.	C. S. Robinson, Dr. Ruby Das, "A text book of Engineering practical physics", Laxmi Publications Pvt. Ltd., 2016.

Reference Books:

1.	Dr. Ruby Das and Prashant Kumar Sahu,A Textbook of Engineering Physics Practical , 2016,2nd Edition

2.	American Public Health Association et al, Standard Methods for the Examinations of Water and Waste Water, APHA. 2017.
3.	Dr. Ruby Das and Prashant Kumar Sahu,A Textbook of Engineering Physics PracticaI , 2016,2nd Edition

Web References:

1.	https://vlab.amrita.edu/
2.	https://bop-iitk.vlabs.ac.in/basics-of-physics/
3.	http://vlabs.iitb.ac.in/

SEMESTER III

23GE301	UNIVERSAL HUMAN VALUES	3/0/0/3
Nature of Course:	Descriptive	
Pre requisites:	Interpersonal Communication and Value Sciences	

Course Objectives:

1.	Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.
2.	Understanding (or developing clarity) of the harmony in the human being, family, society,and nature/existence.
3.	Strengthening of self-reflection.
4.	Development of commitment and courage to act.
5.	Helping the students to appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
6.	Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
C301.2	Apply responsibilities towards their commitments (human values, human relationship and human society).	[AP]
C301.3	Apply what they have learnt to their own self indifferent day-to-day settings in real life, at least a beginning would be made in this direction.	[AP]
C301.4	Analyze ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[A]
C301.5	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in nature.	[U]

Course Contents:

MODULE I COURSE INTRODUCTION – NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION, UNDERSTANDING HARMONY IN THE HUMAN BEING-HARMONY IN MYSELF!   **15**

Self-evaluation of the students-Pre-test of UHV-Purpose and motivation for the course. Self-Exploration-Its content and process-A look at basic Human Aspirations. Understanding Happiness and Prosperity correctly-Understanding the needs of Self('I') and 'Body'-Understanding the Body as an instrument of 'I'(being the doer, seer and enjoyer)-Understanding the characteristics and activities of 'I' and harmony in 'I'-Understanding the harmony of 'I' with the Body-Social activities-Waste Management-Water Conservation-Soil Pollution-Physical Health and related activities-Lectures by eminent persons-Literary activities.

MODULE II UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY – HARMONY IN HUMAN-HUMAN RELATIONSHIP, UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE-WHOLE EXISTENCE AS COEXISTENCE   **15**

Understanding values in human relationship-Understanding the harmony in the society (society being an extension of family): - Visualizing a universal harmonious order in society-Understanding the harmony in Nature. -Understanding Existence as Coexistence of mutually Interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence-Buddy Program-Relationships-Homesickness-Managing peer pressure-Projects-Socially responsible engineers-Visit to local areas (orphanages, special children)-Physical activities(games).

MODULE III IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS		**15**

Natural acceptance of human values-Definitiveness of Ethical Human Conduct-Basis for Humanistic Education-Humanistic Constitution and Humanistic Universal Order-Competence in professional ethics Case studies of typical holistic technologies, management models and eco-friendly production systems Strategy for transition from the present state to Universal Human Order-Sum up: Self-evaluation of the students-Post test of UHV.

TOTAL PERIODS 45

Text Books:

1.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2.	Rajni Setia, Priyanka Sharma, "Human Values", Genius Publication", Jaipur, 2019.

Reference Books:

1.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2.	The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
3.	India Wins Freedom-Maulana Abdul Kalam Azad.

Web References:

1.	https://examupdates.in/professional-ethics-and-human-values/
2.	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html
3.	https://www.yourmorals.org/schwartz.2006.

23CY301	CYBER LAW AND DIGITAL FORENSICS	3/0/0/3
Nature of Course:	H(Theory)	
Pre requisites:	Nil	

Course Objectives:

1.	To Understand various types of cybercrime based on taxonomy and classifications.
2.	To Explore the underlying causes and motivations behind cybercrimes as governed by the Information Technology Act, 2000.
3.	To Investigate the advantages of open-source tools in digital forensics, including cost-effectiveness, transparency, and community support.
4.	To Gain proficiency in using TestDisk & PhotoRec for recovering lost partitions and deleted files
5.	To Employ Bulk Extractor to extract valuable information from digital devices, focusing on large scale data processing.

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Identify the fundamentals of Cybercrime.	[U]
C301.2	Discover the causes of crime the Information Technology Law.	[U]
C301.3	Interpret the benefits and principles of using open-source tools in digital forensics	[AP]
C301.4	Analyze the learning tools such as TestDisk & PhotoRec, R-Linux, and SystemRescue.	[A]
C301.5	Analyze Bulk Extractor and CAINE for advanced data extraction and integrated forensic analysis	[A]

Course Contents:

MODULE I INTRODUCTION TO CYBER CRIME AND IT LAW   **15**

Introduction to Cybercrime: Taxonomy of Cyber Crime, Classifications of cybercrime, Causes of Cyber Crime, Impact and Effects of Cyber Crimes, Information Technology Act, 2000, Objectives and Scope of Information Technology Act, 2000, Applicability of Information Technology Act, 2000, Information Technology (Amendment) Act, 2008, Recompense of Information Technology Law, Limitation of Information Technology Law.

MODULE II DIGITAL FORENSICS   **15**

Introduction to Digital Forensics. Introduction to Open-Source. Benefits of Open-Source Tools, Disk and File System Analysis, Media Analysis Concepts, The Sleuth Kit, Partitioning and Disk Layouts, Special Containers, Hashing, Carving, and Forensic Imaging. Windows Systems and Artifacts, Linux Systems and Artifacts. Case studies in cybercrime and digital forensics.

MODULE III DIGITAL FORENSIC TOOLS   **15**

Introduction to Data Recovery Techniques and tools, Study of tools like TestDisk & PhotoRec, R-Linux, and SystemRescue. Digital forensics using open-source tools-File system analysis with Autopsy, Data acquisition with FTK Imager Lite, and Memory forensics with Volatility Framework. Advanced forensic analysis using Bulk Extractor and CAINE, and metadata analysis with ExifTool.

TOTAL PERIODS   45

Text Books:

1.	CS Mamta Binani, Cyber Crime Law and Practice, The Institute of Company Secretaries of India, 2023.
2.	Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Elsevier, 2023.

3.	Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation," John–Wiley and Sons, 2021.

Reference Books:

1.	Hacking: Computer Hacking, Security Testing, Penetration Testing, and Basic Security by Gary Hall, Erin Watson 2022.
2.	Cybercrime: Investigation and the Digital Forensic" by Thomas J. Holt, Adam M. Bossler, and Kathryn C. Seigfried-Spellar, Second Edition, Routledge Publishers,2022

Web References:

1.	https://www.tutorialspoint.com/ethical_hacking/
2.	https://www.geeksforgeeks.org/last-minute-notes-Cybercrime/
3.	https://www.coursera.org/learn/ethical-hacking-essentials-ehe?action=enroll

23CY302	DATA ANALYTICS AND VISUALIZATION	3/1/0/4
Nature of Course:	C (Theory Concept)	
Pre requisites:	Nil	

Course Objectives:

1.	To learn data collection and preprocessing techniques for data science
2.	To Understand and practice analytical methods for solving real life problems.
3.	To study data exploration techniques
4.	To learn different types of data and its visualization
5.	To study different data visualization techniques and tools

Course Outcomes

Upon completion of the course, students shall have ability to

C302.1	Understand the fundamental concepts and principles of data science	[U]
C302.2	Understand the handling and manipulating data using matrices, including representing relations between data.	[U]
C302.3	Apply data preprocessing methods on open access data and generate quality data for analysis	[AP]
C302.4	Apply and analyze classification and regression data analytical methods for real life	[AP]
C302.5	Apply different data visualization techniques using Tableau and Power BI to understand the data.	[AP]

Course Contents:

MODULE I   **20**

Defining data science and big data, Recognizing the different types of data, Gaining insight into the data science process, Data Science Process: Overview, Different steps, Machine Learning Definition and Relation with Data Science Introduction to Big Data Platform-Challenges of conventional systems-Web data-Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting-Modern data analytic tools. Statistical concepts: Sampling distributions, resampling, statistical inference, prediction error.

MODULE II   **20**

Data Analysis Theory and Methods: Clustering-Overview, K-means-overview of method, determining number of clusters, Association Rules-Overview of method, Apriori algorithm, evaluation of association rules. Regression-Overview of linear regression method, model description. Classification-Overview, Naïve Bayes classifier Decision Tree, Entropy, Creating a Decision Tree, Random Forests Neural Networks: Perceptron's, Feed-Forward Neural Networks, Backpropagation.

MODULE III   **20**

Data Visualization: Basic principles, ideas, and tools for data visualization. Tableau-An Interactive Analytics platform, Tableau Product Suite. How to connect to a data source using Tableau interface. Tableau interface and basic terminologies. Harness the power of your data. Build interactive dashboards. How to Install Power BI desktop? Preparing data with Power BI. Data visualization using Power BI.

     TOTAL PERIODS   **60**

Text Books:

1.	Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2.	Jiawei Han, Micheline Kamber and Jian Pei, " Data Mining: Concepts and Techniques", Third Edition. ISBN 0123814790, 2011.

3.	Information Dashboard Design: Displaying Data for At-a-Glance Monitoring Second Edition by Stephen Few, 2013
Reference Books:	
1.	Bill Franks, ¯Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley and SAS Business Series, 2012.
2.	"Learning Tableau 2020: Make Business Intelligence Quicker and Easier by Learning to Understand Your Data with Tableau" by Joshua N. Milligan (Published in 2020)
3.	"Mastering Power BI: Power BI Beginner to Pro: Learn to Master Power BI and Power BI Desktop" by Jason Lengstorf (Published in 2020)
Web References:	
1.	https://towardsdatascience.com/introduction-to-data-science-6ed95e926e11
2.	https://www.datacamp.com/community/tutorials/data-science-introduction
3.	https://www.datavisualizationsociety.com/introduction-to-data-visualization/

23MA301	MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE	3/1/0/4
Nature of Course:	B (100% Analytical)	
Pre requisites:	Nil	

Course Objectives:

1.	To realize that the subject evolves as a generalization of solving a system of linear equations.
2.	To simplify the complexity in high-dimensional data using Principal component analysis
3.	To Gain practical experience in programming tools for data sciences
4.	To apply quantitative modelling and data analysis techniques to the solution of real-world business problems
5.	To explore the societal and ethical implications of computational systems.

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Recall the basic concepts of differentiation in image transformation.	[R]
C301.2	Understand the practical importance of solving differential equations in climate Sciences.	[U]
C301.3	Utilize Matrix decomposition techniques to perform data analysis.	[AP]
C301.4	Utilize Correlation and regression techniques in data science.	[AP]
C301.5	Apply numerical techniques to obtain approximate solutions of ODE and PDE in climate sciences.	[AP]

Course Contents:

MODULE I LINEAR TRANSFORMATIONS   **20**
Automatic Differentiation: Univariate Functions-Scalar Valued Multivariate functions-Jacobins Linear Transformations-Matrix-Inverses-Solving Equations-Solving equations using the Newton Method-Taking Advantage of Structure: Rank of a matrix Eigen Values and Eigenvectors-Principal Component Analysis Singular-Value Decomposition.

MODULE II DATA SCIENCE   **20**
Data science-Root means square distance: Mean-Standard deviation-Correlation-Scatter diagram Regression: Linear Model-Optimization: Simulation-Monte Carlo methods in simulation-Curve fitting: Method of least squares-Method of group averages

MODULE III DIFFERENTIAL EQUATIONS   **20**
Data Visualization: Basic principles, ideas, and tools for data visualization. Tableau-An Interactive Analytics platform, Tableau Product Suite. How to connect to a data source using Tableau interface. Tableau interface and basic terminologies. Harness the power of your data. Build interactive dashboards. How to Install Power BI desktop? Preparing data with Power BI. Data visualization using Power BI.

    TOTAL PERIODS 60

Text Books:

1.	Guttag, John," Introduction to Computation and Programming Using Python: With Application to Understanding Data", 2nd ed, MIT Press, 2016.
2.	Erwin Kreyszig," Advanced Engineering Mathematics", 13thEdition, John Wiley & Sons, Inc.
3.	Peter J. Denning, Matti Tedri," Computational Thinking, MIT Press,2019

Reference Books:	
1.	Gilbert Strang, Introduction to linear algebra, 5thedition.
2.	B. S. Grewal, Higher Engineering Mathematics, 43rdedition.
3.	I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers",8thedition, Pearson Education.
Web References:	
1.	https://www.youtube.com/channel/UC9IuUwwE2xdjQUT_LMLONoA
2.	https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data science-fall-2016/
3.	https://archive.nptel.ac.in/courses/111/104/111104032/

23CS301	ADVANCED JAVA PROGRAMMING	1/0/4/3
Nature of Course:	F (Theory Programming)	
Pre requisites:	Java Programming	

Course Objectives:

1.	To provide insight knowledge of OOP concepts and usage of this, static, super, and final keywords.
2.	To discuss about different type of Collection Frameworks.
3.	To demonstrate threads, JDBC & exception handling with real world examples.
4.	To illustrate designing of GUI applications using swing component.

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Illustrate the OOPs concepts like Constructors, Inheritance, Polymorphism and the usage of this, static, super, and final keywords.	[AP]
C301.2	Apply the concepts of Exception Handling in real world applications and usage of collection frameworks.	[AP]
C301.3	Develop Multithreaded applications.	[AP]
C301.4	Develop GUI Applications using swing component and to explain the concept of Servlets.	[AP]
C301.5	Develop java application to interact with database by using relevant JDBC Driver.	[AP]

Course Contents:

MODULE I INTRODUCTION TO OOPS   **5**

Class and Object, Encapsulation and Abstraction, Inheritance, Polymorphism, Message Passing, Keywords: this, super, static, final, extends and implements. Method Signature and Prototype, Mutator Methods and Accessor Methods, Var-Arg Method, hashCode() and toString() methods. Immutable Objects Vs Mutable Objects, User defined Immutable Class, Constructors: Introduction, Default Constructor, User Defined Constructors, Constructor Overloading, Instance Variable, Instance Methods, Instance Block and Instance Flow Of Execution. Regular Expressions (RegEx). Inheritance Introduction, Types of Inheritance, Up Casting, Down Casting, IS-A Relationship & HAS-A Relationship, Composition Vs Aggregation, Polymorphism: Method Overloading, & Method Overriding.

MODULE II ABSTRACTION, EXCEPTION HANDLING & COLLECTIONS   **5**

Abstraction: Abstract Methods and Abstract classes. Interfaces, abstract classes and Interfaces, Concrete Methods Vs Abstract Methods, Differences between classes, abstract classes and Interfaces, Marker Interfaces Exception-try catch block, Finally Block, Exception Hierarchy, Multiple Exceptions In a Catch Block, Parameterized Try Block, Overriding Methods And Exception. Creating Your Own Exception, The Assert Keyword, The Generics Framework, Collections: Set, List, Map & Tree, The Iterator Interface. Working with Hashtable Collection Threads: Introduction to Threads, Creating and Starting Threads, Basic Thread Control Methods. Multithreading, Working with Multiple, threads, Thread Life Cycle, Thread Priorities, Synchronizing Methods.

MODULE III SWINGS, SERVLETS & JDBC   **5**

Swings: Introduction, JLabel, JButton, JTextField ,JTextArea, JPasswordField, JCheckbox, JComboBox, JRadioButton, JScrollBar, JMenuItem and JMenu. JDBC: Drivers, CURD operations, Database connectivity Servlets: Overview of Servlets , Servlet Life Cycle, Servlet Request and Response , web.xml and its need, Servlet Configuration, Session Tracking

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS

1. Implementation of default and parameterized constructors.
2. Implementation of method overloading and overriding.
3. Implementation of Inheritance.
4. Implementation of Abstract and Interface concepts.
5. Programs using collection Interface.
6. Implementation of multithreading Concepts.
7. Program to handle multiple exception using try, catch and finally block.
8. Implementation of swing components.
9. Implement Simple application using servlets.
10. Implement CURD operation using JDBC.

TOTAL PERIODS(LAB) 30

TOTAL PERIODS 45

Text Books:	
1.	Herbert Schildt, "Java: TheCompleteReference",12thedition, Mc craw Hill, 2021.
2.	Robert Liguori, Patricia Liguori, "Java 8 Pocket Guide", O'Reilly Media, 2014.
3.	Shagun Bakliwal, Hands-on Application Development using Spring Boot, bpb publisher, 2021.

Reference Books:	
1.	Paul Deitel, Harvey Deitel, "Java How To Program",10th Edition, Prentice Hall Publications,2014.
2.	Cay S. Horstmann and GaryCornell, "Core Java, Vol.2: Advanced Features", 9th Edition, Prentice Hall,2013

Web References:	
1.	https://www.javatpoint.com/java-tutorial
2.	https://www.geeksforgeeks.org/java/
3.	http://www.javatpoint.com/java-tutorial

23IT301	WEB TECHNOLOGY USING REACT	1/0/4/3
Nature of Course:	F (Theory Programming)	
Pre requisites:	Java Programming	

Course Objectives:	
1.	To discuss the essence of front-end development skills.
2.	To understand and use JavaScript in client-side web applications.
3.	To impart the knowledge of React components used in web application development.
4.	To deploy and test the React App used in Web Applications.

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Demonstrate the client-side JavaScript application development with React library.	[U]
C301.2	Construct the single page applications in React.	[AP]
C301.3	Apply the react features including components and forms.	[AP]
C301.4	Analyse the functionality of front-end UI applications using React.	[A]
C301.5	Examine the responsive react applications with CSS	[A]

Course Contents:

MODULE I INTRODUCTION   **5**

Fundamentals of React- Requirements, JavaScript Essentials, Event loop, Node.js Fundamentals, Traditional Programming Limitations, React JSX, Overview of frameworks, libraries for client side Web applications, React DOM, Component Instantiation, Environment Setup for React Application, NPM commands, VS Code extensions for ES6, Handler Function- React(formatting and check styles), Hello world app in React, React Essential Features and Syntax, React App Project Directory Structure, Overview of Webpack, Babel, React Component Basic, Create React Component, Understanding JSX, Limitations of JSX, Working with Components and Reusing Components.

MODULE II REACT COMPONENTS AND STYLES   **5**

React Components- Props and State, Understanding and using Props and State, Handling Events with methods, Manipulating the State, Two way data-binding, Functional (Stateless) VS Class (Stateful) Components, Parent- Child Communication, Dynamically rendering contents, Showing Lists, List and keys, Styling Components, CSS Styling, Scoping Styles using Inline Styles, Limitations of inline styles, Inline Styles with Radium, Google Material UI, Installing Material UI, Material UI App Bar, Material UI's Toolbar, Custom React Nav Bar. CSS Material UI Buttons, Using Material UI- Rendering a Button, Material UI Card, Material UI Checkbox, Material UI Grid Component, Material UI Icon Button, Material UI Paper Component, Style Material UI Components with my own CSS, UI Templates for Business, Typography Usage, Debugging React Apps, Understanding React Error Messages, Handling Logical Errors, Debugging React apps using google developer tools and React DevTool. Understanding Error Boundaries, React Component life cycle, Updating life cycle hooks, Pure Components, React' s DOM Updating Strategy, Returning adjacent elements, Fragments, React Component in Details, Higher Order Components, Passing unknown Props, Validating Props, Using References, React Context API, Updated Lifecycle hooks

MODULE III DEPLOYING AND TESTING WEB APPLICATIONS   **5**

React Projects, Demo apps, HTTP Requests/Ajax Calls, HTTP Requests in React, Introduction of Axios package, HTTP GET Request, fetching & transforming data, HTTP POST, DELETE, UPDATE, Handing Errors, Adding/Removing Interceptors, Creating/Using Axios instances, Redux, React Thunk, Difference between Thunk & other, React hooks, Application Using React & Redux , React Routing, Routing and SPAs, Setting Up the Router Package, react-router vs react-router-dom, Preparing the Project For Routing, Switching Between Pages. Routing-Related Props, The "withRouter" HOC & Route Props, Passing & extracting

route/query parameters, Using Switch to Load a Single Route, Navigating Programmatically. React Forms and Form Validation, Creating a Custom Dynamic Input Component, Setting Up a JS Config for the Form, Dynamically Create Inputs based on JS Config, Adding a Dropdown Component. Handling User Input, Handling Form Submission, Adding Custom Form Validation, Fixing a Common Validation, Adding Validation Feedback, Showing Error Messages, Handling Overall Form Validity, Deploying React App to the Web, Testing React apps with Jasmine & implementing JEST.

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS

1. Create a Stateless Functional Component
2. Create a Stateful Class Component
3. Implementation of Conditional Rendering using Class Component
4. Implementation of Communication (Parent-child) between Components
5. Create material UI Card using React
6. Design a Custom Navigation bar using React
7. Implementation of React component to handle HTTP requests
8. Implementation of a Dropdown component using React
9. Implementation of Routing in React
10. Implementation of FORM validation in React

TOTAL PERIODS(LAB) 30

TOTAL PERIODS 45

Text Books:

1.	Robin Wieruch, "The Road to React", 2022 Kindle Edition.
2.	Alex Banks, Eve Porcello. "Learning React: Modern Patterns for Developing React Apps", O'Reilly Media,2020.

Reference Books:

1.	Adam Bouch, "React and React Native", Packt Publishing, 3rd Edition, 2020.
2.	Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Pearson Education, 2nd Edition, 2018
3.	Adam Boduch, Roy Derks "React and React Native: A Complete Hands-on Guide to Modern Web and Mobile Development with React.js", Packt Publishing, 2020.

Web References:

1.	https://www.coursera.org/learn/front-end-react
2.	https://www.geeksforgeeks.org/full-stack-development-with-react-node-js-live/
3.	https://www.edx.org/learn/front-end-web-development

SEMESTER IV

23CY403	AUDITING IT INFRASTRUCTURE FOR COMPLIANCE	3/1/0/4
Nature of Course:	H (Theory Technology)	
Pre requisites:	Cyber Security Essentials	

Course Objectives:		
1.	To comprehend the importance of IAM	
2.	To analyse the risks and build appropriate authentication in Identity and Access Management	
3.	To perform case studies of Identity and Access Management	

Course Outcomes

Upon completion of the course, students shall have ability to

C403.1	Understand the role of information systems security compliance.	[U]
C403.2	Analyse the IT audit for compliance and, standards and frameworks.	[A]
C403.3	Apply the parameters required to conduct and report on an IT infrastructure audit for organizational compliance.	[AP]
C403.4	Describe information security systems compliance requirements within the seven domains of an IT infrastructure.	[U]
C403.5	Understand the qualifications, ethics, and certification organizations for IT auditors al-time scenarios	[U]

Course Contents:

MODULE I INFORMATION SECURITY COMPLIANCE AUDIT **15**
The Need for Information Systems Security Compliance-Overview of U.S. Compliance Laws-Scope of an IT Infrastructure Audit for Compliance-Auditing Standards and Frameworks.

MODULE II TECHNICAL ASPECTS OF IT COMPLIANCE AUDITING **15**
Planning an IT Infrastructure Audit for Compliance-Conducting an IT Infrastructure Audit for Compliance-Writing the IT Infrastructure Audit Report-Compliance Within the User Domain-Compliance Within the Workstation Domain-Compliance Within the LAN Domain.

MODULE III PRACTICAL APPLICATION AND COMPLIANCE REPORTING **15**
Compliance Within the LAN-to-WAN Domain-Compliance Within the WAN Domain. Compliance Within the Remote Access Domains-Compliance Within the System / Application Domain-Ethics, Education, and Certification for IT Auditors.

TOTAL PERIODS 45

Text Books:	
1.	Robert Johnson, Martin M. Weiss, Michael G. Solomon, Auditing IT Infrastructures for Compliance, Third Edition, Paperback with Navigate eBook Access: ISBN: 978-1-284-23660-6 | 398 pages | © 2023, Navigate eBook Access Only: ISBN: 978-1-284-24880-7 | © 2023.
2.	Dimitris N. Chorafas , IT Auditing methods with strategic approaches and examples of Sarbanes-Oxley (SOX) compliance - helpful to broaden audit context beyond infrastructure.
3.	Jerald Savin - Routledge , The Practitioner Guide to reliable information Automation

Reference Books:	
1.	Lynford Graham, Complying with Sarbanes-Oxley Section 404, 16 March 2010, ISBN:9780470603994.
2.	Gerardus Blokdyk, Compliance Considerations A Clear and Concise Reference, ISBN-13-978 0655507499.

3.	Amit M. Mehta – Auditing Information systems , A practical approach textbook (free online)

Web References:

1.	https://www.csoonline.com/article/2120384/what-is-iam-identity-and-access-management explained.amp.html
2.	https://www.gartner.com/en/information-technology/glossary/identity-and-access-management-iam
3.	https://www.digitalguardian.com/blog/what-identity-and-access-management-iam

23CY401	ETHICAL HACKING	3/0/2/4
Nature of Course:	E (Theory Skill based)	
Pre requisites:	Nil	

Course Objectives:

1.	To gain comprehensive knowledge and practical skills in ethical hacking.
2.	To develop advanced skills in ethical hacking techniques.
3.	To acquire in-depth knowledge and practical expertise in ethical hacking.

Course Outcomes

Upon completion of the course, students shall have ability to

C401.1	Remember basic Linux Commands and their usages.	[R]
C401.2	Understand ethical hacking methodologies and techniques to identify security vulnerabilities.	[U]
C401.3	Classify advanced ethical hacking techniques to secure systems and prevent attacks.	[U]
C401.4	Analyse the knowledge of wireless network hacking, cryptographic attacks, and social engineering for effective threat mitigation.	[A]
C401.5	Apply the digital forensics techniques to investigate and respond to security incidents.	[AP]

Course Contents:

MODULE I LINUX REVIEW AND FUNDAMENTALS 15

Linux boot process-Linux files and directories-Linux logs-Advanced Linux command usage-Windows boot process-Windows files and directories-Windows command line-Advanced Windows topics-Active directory familiarization-Windows infrastructure-PowerShell command line. Case Study: Working advanced Commands in Ubuntu

MODULE II IMPORTANCE OF ETHICAL HACKING 15

Introduction-Ethical Hacking Methodology and Phases-Foot printing and Reconnaissance Techniques-Scanning Networks and Enumerating System Information-Vulnerability Assessment and Penetration Testing-Wireless Network Hacking and Security-Web Application Security and Hacking-Social Engineering Attacks and Countermeasures-Malware Analysis and Reverse Engineering-Sniffing and Spoofing Techniques-Cryptography and its Role in Ethical Hacking-Mobile Device Hacking and Security-Case Study: Study of Penetration and Other Tools.

MODULE III LINUX PRIVILEGE ESCALATION AND CLIENT MANAGEMENT 15

Advanced Web Application Security Testing-SQL Injection Attacks and Prevention-Cross-Site Scripting (XSS) Attacks and Countermeasures-Exploiting Buffer Overflows-Advanced Network Enumeration and Fingerprinting-Bypassing Authentication Mechanisms-Wireless Network Attacks and Countermeasures-Advanced Cryptographic Attacks-Advanced Malware Analysis Techniques-Advanced Packet Sniffing and Analysis-Web Services Security Testing. Case Study: Study of Malware Analysis Tools.

TOTAL PERIODS (Theory) 45

LIST OF EXPERIMENTS

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basic commands in Kali.
3. Practice the tool burp suite.
4. Practice the tools like n map, Ghidra's.
5. Using FOCA / Search Dignity tools, extract metadata and expanding the target list
6. Aggregates information from public databases using online free tools like Paterva's Maltego.
7. Information gathering using tools like Robtex

8. Scan the target using tools like Nessus. 9. View and capture network traffic using Wireshark. 10. Automate dig for vulnerabilities and match exploits using Armitage **TOTAL PERIODS(LAB)** **TOTAL PERIODS**	

Text Books:

1.	Don jones, Learn Windows PowerShell in a Month of Lunches, Manning Publications,2011, ISBN: 9781617290213
2.	Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook Second Edition, John Wiley & Sons, Inc,2011, ISBN: 978-1-118-02647-2
3.	Wil Allsopp, Advanced Penetration Testing, John Wiley & Sons, Inc,2017, ISBN: 978-1-119-36768-0.

Reference Books:

1.	Daniel J. Barrett, Linux Pocket Guide, O'Reilly Media, Inc,2004. ISBN: 0-596-00628-4.
2.	Pavel Yosifovich, Alex Ionescu, Mark E. Russinovich, and David A. Solomon, Windows Internals Seventh Edition Part 1 System architecture, processes, threads, memory management, and more, Microsoft Press, 2017, ISBN: 978-0-7356-8418-8.
3.	Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters, The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory, John Wiley & Sons, Inc.2014, ISBN: 978 1-118-82509-9

Web References:

1.	https://www.tutorialspoint.com/ethical_hacking/index.htm
2.	https://www.youtube.com/watch?v=Z068odTDKq0
3.	https://www.w3schools.in/ethical-hacking/tutorials/

23CY402	ACCESS CONTROL AND IDENTITY MANAGEMENT	3/0/2/4
Nature of Course:	H (Theory Technology)	
Pre requisites:	Cyber Security Essentials	

Course Objectives:		
1.	To comprehend the importance of IAM	
2.	To Analyze the risks and build appropriate authentication in Identity and Access Management	
3.	To perform case studies of Identity and Access Management	

Course Outcomes

Upon completion of the course, students shall have ability to

C402.1	Summarize the role of IAM with the appropriate regulations(Module1)	[U]
C402.2	Analyze the various Standards which align with IAM concepts(Module1)	[A]
C402.3	Apply the steps in the technique of identity and risk assessments(Module2)	[AP]
C402.4	Explain about Access Control Methodologies (Module3)	[U]
C402.5	Model IAM concepts in Real-time scenarios(Module3)	[AP]

Course Contents:

MODULE I INTRODUCTION TO ACCESS CONTROL AND IDENTITY MANAGEMENT   15
Introduction to Access Control and Identity Management-Authentication and Authorization-Access Control Models-Access Control Attacks and Countermeasures-Role-Based Access Control (RBAC)-Attribute-Based Access Control (ABAC)-Access Control Lists (ACLs) and Permissions. Case Study: Implementing Attribute Based Access Control (ABAC) in a Healthcare System.

MODULE II INTRODUCTION TO PHYSICAL SECURITY INDUSTRY   15
Introduction to Physical Security Concepts-Risk Assessment and Management-Security Surveys and Site Assessments-Access Control Systems-Intrusion Detection Systems-CCTV Systems-Perimeter Protection-Physical Security Lighting-Lock and Key Management-Security Personnel Management-Emergency Response and Evacuation Planning-Security Technology Integration-Regulatory and Legal Considerations-Project Management and-Security Industry future trends. Case Study: Enhancing Campus Security through Integrated Physical Security

MODULE III   CIAM TOOLS   15
 Jump Cloud-User and Group Management-Device Management:-Single Sign-On (SSO)-Multi-Factor Authentication (MFA)-LDAP and RADIUS Integration-Directory-as-a-Service-Security Best Practices-Lifecycle Management-API Integration-Reporting and Auditing-Troubleshooting and Support-Case Study: Implementing Secure Single Sign-On (SSO) and Multi-Factor Authentication (MFA) with JumpCloud for a Growing Enterprise.

TOTAL PERIODS (Theory)   45

LIST OF EXPERIMENTS

1. Designing an Access Control System.
2. Conducting a Risk Assessment of an Access Control System.
3. Configuring an Active Directory Domain Controller.
4. Managing Windows Accounts and Organizational Units.
5. Configuring Windows File System Permissions.
6. Configuring a Remote Access VPN.
7. Encrypting and Decrypting Files with Public Key Infrastructure.
8. Scanning an Active Directory Domain Controller for Vulnerabilities.

9. Enabling Audit Trails to Enforce Accountability.
10. Applying the Security Policy Framework to an Access Control Environment.

TOTAL PERIODS(LAB)

TOTAL PERIODS

Text Books:	
1.	Masha Garibyan, Simon McLeish and John Paschoud, "Access and Identity Management for Libraries: Controlling access to online information", Facet Publishing, 2014 www.facetpublishing.co.uk.
2.	Charles Swanson, "Professional Security Management A Strategic Guide", Routledge publication, ISBN-978-0 367-33961-6.
3.	Gerardus Blokdyk,"CIAM Authentication A Complete Guide- 2020 Edition", 5STARCooks.

Reference Books:	
1.	Mike Chapple, "Access Control and Identity Management, 3rd Edition,2020 Edition", Jones & Bartlett Learning, ISBN: 9781284198362.
2.	Truett A. Ricks, Bobby E. Ricks, Jeffrey Dingle, "Physical Security and Safety A Field Guide for the Practitioner", CRC Press 2014, ISBN 9781482227024.

Web References:	
1.	https://www.csoonline.com/article/2120384/what-is-iam-identity-and-access-management explained.amp.html
2.	https://www.gartner.com/en/information-technology/glossary/identity-and-access-management-iam
3.	https://www.digitalguardian.com/blog/what-identity-and-access-management-iam

23AD402	DESIGN AND ANALYSIS OF ALGORITHMS	1/0/4/3
Nature of Course:	I (Problem Concepts)	
Pre requisites:	Data Structures and Algorithms	

Course Objectives:

1.	To understand the techniques for analyzing the computer algorithms.
2.	To learn the paradigms for designing the algorithms.
3.	To analyze the efficiency of various algorithm design techniques / paradigms for the same problem.
4.	To understand the graphical algorithms for solving problems.

Course Outcomes

Upon completion of the course, students shall have ability to

C402.1	Illustrate the searching and sorting algorithms.	[U]
C402.2	Interpret the design principles of greedy and pattern searching algorithms with examples.	[AP]
C402.3	Explore problem-solving methodology used in Backtracking	[A]
C402.4	Analyse the time and space complexities of dynamic programming strategy in solving complex problems.	[A]
C402.5	Employ range query and graph algorithms in real world problems.	[AP]

Course Contents:

MODULE I SORTING, SEARCHING AND STRING ALGORITHMS   **5**

Time Complexity Analysis-Mathematical Analysis of Recursive and Non-Recursive algorithms Searching & Sorting, Divide and Conquer-Bubble sort, Insertion sort, Selection sort, Binary search, quick sort, merge sort, Heaps & Hashing-Binary heap, heapsort-Greedy Algorithms-Activity selection problem, Fractional Knapsack, String Algorithms-Naive algorithm, Rabin Karp algorithm, KMP algorithm, Z algorithm, Manacher's algorithm-Huffman coding.

MODULE II GREEDY AND DYNAMIC PROGRAMMING   **5**

Backtracking-Rat in a maze, Permutation and Combination, N Queen problem and Problems on Backtracking, Knight's Tour Problem, Subset Sum, M-Colouring Problem, Hamiltonian Cycle Problem, Sudoku Solver, Sieve of Sundaram, Prime Numbers after P with Sum. Dynamic Programming-Greedy vs Dynamic programming, Top-down and bottom-up approach, Longest Common Subsequence, longest increasing subsequence, Edit distance, 0-1 Knapsack, Coin change problem, Minimum Cost Path, Subset Sum Problem, Maximum Size Square Sub Matrix with all 1s, Longest Palindromic Subsequence.

MODULE III TREE AND GRAPH ALGORITHMS   **5**

Range query Algorithms-Range Minimum Query (Brute Force Approach). Segment Tree, Range Minimum Query on the Constructed Segment Tree, Range Minimum Query Using Sparse Table. Graph Algorithms-Single source shortest path algorithm, Floyd warshall's Algorithm-Minimum Spanning Tree.

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS

1. Implementation of Linear, Binary Search and Tries.
2. Implementation of Sorting Algorithms-Bubble, Insertion, Selection, Merge Sort, Quick sort, Heap Sort.
3. Implementation of Greedy Algorithms.
4. Implementation of Pattern Searching Algorithms.
5. Implementation of Backtracking Algorithms.
6. Implementation of Dynamic Programming.

7. Implementation of Range Query Algorithms.
8. Implementation of Minimum Spanning Tree.
9. Implementation of Shortest path Algorithms.
10. Implementation of Maximum Flow Minimum cut Algorithm.

TOTAL PERIODS(LAB) 30

TOTAL PERIODS 45

Text Books:	
1.	AnanyLevitin, "Introduction to Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2012.
2.	Thomas H. Cormen, Charles E. Leiserson, R. L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009
Reference Books:	
1.	Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms/ C++", 2nd Edition, Universities Press, 2019.
2.	Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rd Edition, 2008.
Web References:	
1.	https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
2.	https://www.coursera.org/learn/introduction-to-algorithms
3.	https://timroughgarden.org/videos.html

23IT402	WEB FRAMEWORKS USING REST API	0/0/4/2
Nature of Course:	L (Programming)	
Pre requisites:	Java Programming	

Course Objectives:

1.	To impart the knowledge of REST APIand HTTP methods used in Spring Boot Framework.
2.	To implement LIKE queries using JPA and handle CRUD operations with JPQL.
3.	To develop the various relational mapping with JPA Repository.
4.	To deploy Spring Rest controller API.

Course Outcomes

Upon completion of the course, students shall have ability to

C402.1	Create simple applications with REST API and handle HTTP methods.	[AP]
C402.2	Create a simple Spring Application and inject the literal values by setter injection methods.	[AP]
C402.3	Apply LIKE queries using JPA to Various applications.	[AP]
C402.4	Build application using Spring Boot with JPA repository.	[A]
C402.5	Analyse and create applications with Spring Rest Controller API to perform CRUD operations.	[A]

LIST OF EXPERIMENTS

1. Display the information about the current weather in a certain location using RESTful API use a weather forecast provider such as openweathermap.org.
2. Create your own app that embeds the information about flights, hotels and rental cars using Skyscanner API.
3. Create a simple Spring Application and inject the literal values by setter injection. So, create a simple class Employee having three attributes Id, Name, and Designation. Create setter methods for these attributes and a simple method to print the details of the student.
4. Create a simple payroll service that manages the employees of a company. Store employee objects in a database, and access them (via something called JPA).
5. Create a simple payroll service that manages the employees of a company. Perform the following LIKE queries using query methods with the keywords Containing, Contains, IsContaining, StartsWith and Ends With.
6. Create a simple payroll service that manages the employees of a company. Perform the following LIKE queries using query methods with the keywords NotContains, NotContaining and NotLike.
7. Create a Spring Boot application with Student entity and Student JPA repository. Use Spring Rest Controller API to perform CRUD operations on Student data.
8. Build a simple Rest API application called Donors. This application manages blood donors information and allows its users to Add a new donor, update existing donor information, view existing donors and delete a donor information from the application.

TOTAL PERIODS(LAB) 60

TOTAL PERIODS 60

Text Books:

1.	Kirupa Chinnathambi, "A Hands-On Guide to Building Web Applications Using React and Redux", Addison-Wesley Professional, 2018.
2.	Raja CSP Raman, Ludovic Dewailly, "Building RESTful Web Services with Spring 5", Packt Publishing, 2018.

3.	Leonard Richardson, Sam Ruby "RESTful Web Services" O'Reilly Media,2008.
Reference Books:	
1.	Ranga Karanam, "Master Java Web Services and REST API with Spring Boot", Packt Publishing, 2018.
2.	Balaji Varanasi, Sudha Belida, "Spring REST", Apress, 2015.
Web References:	
1.	. https://www.freecodecamp.org/news/how-to-build-a-rest-api-with-spring-boot-using-mysql-and-jpa f931e348734b/
2.	https://github.com/scbushan05/book-api-spring-boot
3.	https://www.geeksforgeeks.org/spring-value-annotation-with-example/

23AD403	MANAGING CLOUD AND CONTAINERIZATION	1/0/4/3
Nature of Course:	F (Theory Programming)	
Pre requisites:	Data Base Management Systems	

Course Objectives:

1.	To understand the evolution of AWS from the existing technologies.
2.	To have knowledge on AWS security and various scaling methods.
3.	To team the necessary skills for design, develop and deploy services in creating with the help of docker.
4.	To implement automated system update and DevOps lifecycle
5.	To understand virtualization and provide the perfect security for the entire infrastructure.

Course Outcomes

Upon completion of the course, students shall have ability to

C403.1	Demonstrate the basic global infrastructure of the AWS Cloud.	[AP]
C403.2	Identify an appropriate solution using AWS Cloud services for various use cases.	[U]
C403.3	Interpret how the components of Docker containers support compute container implementations.	[AP]
C403.4	Examine common Infrastructure Servers, Availability and Scalability.	[A]
C403.5	Learn why automation, culture, and metrics are essential to a successful DevOps project.	[U]
C403.6	Analyze various cloud models and apply them to solve problems.	[A]

Course Contents:

MODULE I MANAGING CLOUD USING AWS   **5**
Introduction, Future of AWS, Services-AWS EC2, AWS S3-Cloud storage, Types, Benefits, AWS IAM AWS Security, Working of IAM, Components AWS CloudFront Working, Benefits. Introduction, Snapshots vs AMI, Different scaling plans. Introduction, Benefits, Algorithms used for load balancing. Case study: E commerce Website Infrastructure on AWS.

MODULE II CONTAINERIZATION USING DOCKERS   **5**
Docker, Containers, Usage of containers, Terminology, Docker Run Static sites, Docker Images, Docker File, Docker on AWS, Docker Network, Docker Compose, Development Workflow, AWS EC Services. Case study: Microservices Architecture for a Social Media Application using Docker and AWS.

MODULE III DEVOPS   **5**
Introduction, Test Driven Development, Continuous Integration, Code coverage, Best Practices, Virtual Machines vs Containers, Rolling Deployments, Continuous Deployment, Auto Scaling. Case Study: Open Stack, Cloud based ML Solutions in Healthcare. Case study: Cloud-Based Machine Learning Solutions in Healthcare.

TOTAL PERIODS(Theory) 15

LIST OF EXPERIMENTS

1. Study of Hosted Hypervisor and Bare Metal Hypervisor.
2. Install a Virtualbox/ VMware Workstation with different flavours of linux or windows S
3. Implementation of Virtual Machine(S) and create a Virtual Datacenter.
4. Configuration of Virtual Internetworking Components.
5. Configuration of Virtual Internetworking Components.
6. Install a docker engine and docker client on windows.

7. Creation and removal of container, container images.
8. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim
9. Find a procedure to transfer the files from one virtual machine to another virtual machine Using VMWare
10. Install Google App Engine. Create a hello world app and other simple web applications using python / java

TOTAL PERIODS(LAB) 30

TOTAL PERIODS 45

Text Books:	
1.	Mark Wilkins, "Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud", 2019.
2.	Sean P. Kane, Karl Matthias, "Docker: Up & Running: Shipping Reliable Containers in Production", O'Reilly Media Inc, 2015.
3.	Jennifer Davis and Ryn Daniels, "Effective DevOps: Building aCulture of Collaboration, Affinity, and Tooling at Scale", 2016, O'Reilly Media Inc.
Reference Books:	
1.	Ardian, "Using Docker: Developing and Deploying Software with Containers", O'Reilly Media Inc, 2015.
2.	Jonathan Bartlett – Apress (2023), Cloud native applications with docker and Kubernetes , ISBN: 9781484288757
3.	Deepak Vohra – Apress (2017) , Kubernetes management design patterns: with docker, coreOS and other platforms
Web References:	
1.	https://cloudacademy.com/course/introduction-to-devops/intro-3/
2.	https://awscloud.in/

23ME305	DESIGN THINKING AND IDEA LAB	0/0/2/1
Nature of Course:	Practical	
Pre requisites:	Nil	

Course Objectives:

1.	To Accelerate development of indigenous products to promote "Make in India" Campaign.
2.	To encourage aspiring Engineers and Researchers to actualize their ideas under one roof.
3.	To Impart multidisciplinary education and research among all stakeholders
4.	To promote experiential learning and entrepreneur skills.

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Describe all the skills associated with the tools and inventory associated with the IDEA Lab.	[R]
C301.2	Associate useful mechanical and electronic fabrication processes.	[U]
C301.3	Apply necessary skills to build useful and standalone system/ project with enclosures.	[AP]
C301.4	Develop Innovative products which are useful for a student in preparing for an engineering career.	[C]
C301.5	Devise necessary skills to create print and electronic documentation for the system/project.	[E]

LIST OF EXPERIMENTS

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit
2. Machining of 3D geometry on soft material such as soft wood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/ cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure

TOTAL PERIODS(LAB) 30

TOTAL PERIODS 30

Text Books:

1.	Shalini Rahul Tiwari & Rohit Rajendra Swarup - Wiley India (2024) , design thinking : A comprehensive textbook, ISBN: 9789357468640
2.	Srinivasan R, Prof. Dr. Mohammed Ismail & Arulmozhi Srinivasan, S. Chand Publishing (2025) **ISBN:** 9789369580149
3.	Tony Morgan & Lena J. Jaspersen, SAGE Publications Ltd (2022), design thinking for student projects.

Reference Books:

1.	AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), ISBN: 978-9391505332

2.	E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.
Web References:	
1.	https://www.innovationtraining.org/
2.	https://www.erdster.co.in/

SEMESTER V

23CY501	SECURITY ASSESSMENT AND RISK ANALYSIS	3/0/0/3
Nature of Course:	C (Theory Concept)	
Pre requisites:	Nil	

Course Objectives:

1.	Understand secure software design principles and architecture.
2.	Apply risk management strategies to mitigate software security risks.
3.	Learn cryptographic methods and authentication models in enterprise systems.
4.	Analyze security challenges in enterprise systems, including e-commerce platforms.
5.	Develop skills for security testing and quality assurance

Course Outcomes

Upon completion of the course, students shall have ability to

C501.1	Understand the principles of secure software design and its architecture.	[U]
C501.2	Apply risk management frameworks to address software security risks.	[AP]
C501.3	Implement cryptographic techniques and authentication models.	[AP]
C501.4	Analyze security architectures and identify vulnerabilities.	[A]
C501.5	Apply security testing to analyze and ensure software reliability.	[AP]

Course Contents:

MODULE I SECURE SOFTWARE DESIGN AND ARCHITECTURE **15**

Computer security, principles of secure software, trusted computing base, etc, threat modeling, advanced techniques for mapping security requirements into design specifications. Secure software implementation, deployment and ongoing management. Software design and an introduction to hierarchical design representations. Difference between high-level and detailed design. Handling security with high-level design. General Design Notions. Security concerns design at multiple levels of abstraction, Design patterns, quality assurance activities and strategies that support early vulnerability detection, Trust models, security Architecture & design reviews.

MODULE II SOFTWARE ASSURANCE AND RISK MANAGEMENT **15**

Software Assurance Model: Identify project security risks & selecting risk management strategies, Risk Management Framework, Security Best practices/ Known Security Flaws, Architectural risk analysis, Security Testing & Reliability (Penn testing, Risk Based Security Testing.

MODULE III ENTERPRISE SOFTWARE SECURITY AND CRYPTOGRAPHY **15**

Software Security in Enterprise Business: Identification and authentication, Enterprise Information Security, Symmetric and asymmetric cryptography, including public key cryptography, data encryption standard (DES), advanced encryption standard (AES), algorithms for hashes and message digests. Authentication, authentication schemes, access control models, Kerberos protocol, public key infrastructure (PKI), protocols specially designed for e-commerce and web applications, firewalls and VPNs. Security development frameworks. Security issues associated with the development and deployment of information systems, including Internet-based e-commerce, e-business, and e-service systems.

TOTAL PERIODS 45

Text Books:	
1.	W. Stallings, Cryptography and network security: Principles and practice, 5 th Edition, Upper Saddle River, NJ: Prentice Hall., 2011
2.	C. Kaufman, r. Perlman, & M. Speciner, Network security: Private communication in a public world, 2 nd Edition, Upper Saddle River, NJ:Prentice HalL, 2002
3.	C. P. Pfleeger, S. L. Pfleeger, Security in Computing, 4 th Edition, Upper Saddle River, NJ:Prentice Hall, 2007.
Reference Books:	
1.	T4. M. Merkow, & J. Breithaupt, Information security: Principles and practices. Upper Saddle River, NJ:Prentice Hall, 2005.
2.	Gary McGraw, Software Security: Building Security In, Addison-Wesley, 2006.
Web References:	
1.	https://csrc.nist.gov
2.	https://owasp.org
3.	https://www.microsoft.com/en-us/securityengineering/sdl
4.	https://www.coursera.org/learn/software-security

23CY502	**COMPUTATIONAL NUMBER THEORY FOR CRYPTOGRAPHY**	3/1/0/4
Nature of Course:	C (Theory Concept)	
Pre requisites:	Nil	

Course Objectives:

1.	To understand and learn a complete introduction to some basic concepts and results in abstract algebra and elementary number theory.
2.	To identify the algorithms for primality testing, with an emphasis on the Miller-Rabin test, the elliptic curve test, and the AKS test.
3.	To Learn and apply algorithms such as trial division, Pollard's ρ method, elliptic curve method, and quadratic sieve for factorization.
4.	To Develop the ability to solve discrete logarithm problems using advanced techniques.
5.	To understand and analyze the principles of secret-key cryptography, focusing on RSA, and elliptic curve-based schemes.

Course Outcomes

Upon completion of the course, students shall have ability to

C502.1	Understand and learn a complete introduction to some basic concepts and results in abstract algebra and elementary number theory.	[R]
C502.2	Identify the algorithms for primality testing, with an emphasis on the Miller-Rabin test, the elliptic curve test, and the AKS test.	[A]
C502.3	Learn and apply algorithms such as trial division, Pollard's ρ method, elliptic curve method, and quadratic sieve for factorization.	[AP]
C502.4	Solve discrete logarithm problems using advanced techniques.	[A]
C502.5	Understand and analyze the principles of secret-key cryptography, focusing on RSA, and elliptic curve-based schemes.	[A]

Course Contents:

MODULE I ELEMENTARY OPERATIONS   **20**

Fundamentals-BasicAlgebraicStructures-DivisibilityTheory-ArithmeticFunctions - Congruence Theory - Primitive Roots -Elliptic Curves. Complexity of basic operations like additions, multiplications for integers and polynomials. Computational Number Theory: Basic Tests - Miller-Rabin Test- Elliptic Curve Tests - AKS Test.

MODULE II INTEGER FACTORIZATION AND DISCRETE LOGARITHMS   **20**

Basic Concepts- Trial Divisions Factoring -ρ and p − 1 Methods - Elliptic Curve Method - Continued Fraction Method - Quadratic Sieve. Discrete Logarithms: Basic Concepts- Baby-Step Giant-Step Method - Pohling – Hellman Method – Index Calculus – Theory of Elliptic Curves - Elliptic Curve Discrete Logarithms.

MODULE III MODERN CRYPTOGRAPHY   **20**

Secret-Key Cryptography: Cryptography and Cryptanalysis-Classic Secret-Key C Cryptography - Modern Secret-Key Cryptography. Integer Factorization Based Cryptography - RSA Cryptography - Elliptic Curve Discrete Logarithm Based Cryptography: Basic Ideas - Elliptic Curve Diffie-Hellman-Merkle Key Exchange Scheme - Elliptic Curve Massey - Omura Cryptography.

    TOTAL PERIODS: 60

Text Books:	
1.	Song Yan, ‾Computational Number Theory and Modern Cryptography‖, Wiley Publications (P), Higher Education Press, UK,2013.
2.	Victor Shoup A, *"Computational Introduction to Number Theory and Algebra",* Cambridge University Press,2008.
3.	Joachim Von Zur Gathen, Jurgen Gerhard, ‖Modern Computer Algebra‖, Cambridge University Press,2008
Reference Books:	
1.	Bach & Shallit, ‾Algorithmic Number Theory‖, The MIT Press
2.	Rudolf Lidl,Harald, ‾Encyclopedia of Mathematics and Its Applications Finite Fields‖, Cambridge University Press, 2003
Web References:	
1.	https://nptel.ac.in/courses/106103015/
2.	https://people.csail.mit.edu/madhu/FT05/
3.	https://onlinecourses.nptel.ac.in/noc25_cs14/preview
4.	https://www.coursera.org/learn/number-theory-cryptography

23CY503	**SECURITY POLICIES AND IMPLEMENTATION**	**3/0/0/3**
Nature of Course:	C (Theory Concept)	
Pre requisites:	Nil	

Course Objectives:

1.	To gain knowledge of Security Policy Frameworks
2.	To identify potential security threats and vulnerabilities and security problems in current software issues
3.	To describe security policies to address evolving challenges and technological advancements.
4.	To examine the importance of documentation for policy implementation and enforcement.
5.	To be able to implement the best practices of software security Policies.

Course Outcomes

Upon completion of the course, students shall have ability to

C503.1	Identify the role of an information systems security (ISS) policy framework in overcoming business challenges.	[AP]
C503.2	Understand the relationship between regulatory compliance requirements and information system security policies.	[U]
C503.3	Explain how security policies help mitigate risks and support business processes in various domains of a typical IT infrastructure.	[U]
C503.4	Describe how to design, organize, implement, and maintain IT security policies.	[AP]
C503.5	Identify the issues related to security policy implementations and the keys to success.	[AP]

Course Contents:

MODULE I NEED OF IT SECURITY POLICY FRAMEWORKS **15**
Introduction to Information Systems Security, Information Assurance, Governance, Information Systems Security Policies, Creating Policies, The Seven Domains of IT Infrastructure, Security Policies mitigate within the Seven Domains. Information Security Policy Implementation Issues: The role of Human Resources Policies**,** Policy Roles, Responsibilities and accountability.

MODULE II TYPES OF POLICIES AND APPROPRIATE FRAMEWORKS **15**
Introduction, Program Framework Policy, Information Assurance Considerations, Information Systems Security Considerations. User Domain Policies: The weakest Link in the information Security Chain, Seven Types of Users, Acceptable Use policy (AUP), The Privileged Level Access Agreement (PAA), Security Awareness Policy (SAP). IT Infrastructure Security Policies: Workstation Domain Policy, LAN Domain Policies, LAN -to-WAN Domain Policies, WAN Domain Policies, Remote Access Domain Policies, System/Application Domain Policies, Telecommunication Domain Policies, Cloud Security Domain Policies. Data Classification and Handling Policies and Risk Management Policies: Data Classification Policies, Data Handling Policies, Risk Assessment Policies. Incident Response Team (IRT) Policies: Introduction, Business Impact Analysis (BIA) Policies, Procedures for Incident Response, Disaster Recovery Plan Policies.

MODULE III IMPLEMENTING AND MAINTAINING AN IT SECURITY POLICY FRAMEWORK   **15**

IT Security Policy Implementations - Target state, Executive Buy-in, Cost and Impact, policy language, Employee Awareness and Training, Information Dissemination, Policy Implementation Issues, Governance and Monitoring. IT Security Policy Enforcement: Organizational Support for IT Security Policy Enforcement, An Organizational Right to Monitor User Actions and Traffic, Legal Implications of IT Security Policy Enforcement. IT Policy Compliance and Compliance Technologies Creating a Baseline Definition for Information Systems Security, Automated IT Security Policy Compliance, Compliance Technologies and Solutions

TOTAL PERIODS: 45

Text Books:	
1.	Robert Johnson, Chuck Easttom, ‑Security Policies and Implementation Issues‖, 3rd Edition, Jones & Bartlett Learning,2022.
2.	Thomas R. Peltier, ‑Information Security Policies and Procedures‖, 2nd Edition, Auerbach,2003.
Reference Books:	
1.	Sari Greene, ‑Security Policies and Procedures: Principles and Practices‖, 1st Edition, Pearson Publishing, 2005.
2.	William Stallings, ‑Network Security Essentials", Pearson Education, 6th Edition, 2018.
Web References:	
1.	https://www.nist.gov/cyberframework
2.	https://www.iso.org/isoiec-27001-information-security.html
3.	https://www.sans.org/reading-room
4.	https://csrc.nist.gov/publications/sp
5.	https://www.securitymagazine.com/

23CY504	CLOUD SECURITY	2/0/2/4
Nature of Course:	(Theory, Analytical)	
Prerequisites:	Network security and cryptography and cloud computing	

Course Objectives:

1.	Understand the importance of security in Cloud Computing.
2.	Understand the cloud security and privacy issues
3.	Understand the Threat Model and Cloud Attacks
4.	Understand the Data Security and Storage
5.	Analyze Security Management in the Cloud.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C504.1	Appreciate the importance of security in a cloud environment	[U]
C504.2	Distinguish the various cloud security and privacy issues.	[U]
C504.3	Analyze the various threats and Attack tools	[A]
C504.4	Able to understand the Data Security and Storage	[U]
C504.5	Analyze the Security Management in the Cloud.	[A]

Course Contents:

Module I IMPORTANCE OF CLOUD SECURITY 10

Security Concepts in Cloud, Confidentiality, privacy, integrity, authentication, Defense in depth, least privilege, Importance of Security in PaaS, IaaS , SaaS, TaaS User authentication in the cloud, Cryptographic Systems, Symmetric cryptography, stream ciphers, block ciphers, modes of operation Multi-Tenancy issues,
X.509 certificates, OpenSSL

Module II CLOUD SECURITY AND PRIVACY ISSUES 10

Introduction, Cloud Security Goals/Concepts, Cloud Security Issues, Security Requirements for Privacy, Privacy Issues in Cloud. Security over FoG and edge computing. Infrastructure Security: The Network Level, the Host Level, the Application Level, SaaS, PaaS, IaaS, TaaS Application Security,

Module III THREAT MODEL AND CLOUD ATTACKS 10

Introduction, Threat Model- Type of attack entities, Attack surfaces with attack scenarios, A Taxonomy of Attacks, Attack Tools-Network-level attack tools, VMlevel attack tools, VMM attack tools, Security Tools, VMM security tools. Security Management in the Cloud- Security Management Standards, Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.

TOTAL PERIODS(Theory) 30

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of Linux or Windows OS on top of Windows 7 or 8.
2. Install a C compiler in the virtual machine created using VirtualBox and execute simple programs.
3. Install Google App Engine. Create *hello world* app and other simple web applications using Python/Java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch a virtual machine using TryStack (Online OpenStack Demo Version).
8. Install Hadoop single node cluster and run simple applications like wordcount.

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 60

Text Books:

1	Cloud Security Attacks, Techniques, Tools, and Challenges by Preeti Mishra, Emmanuel S Pilli, Jaipur R C Joshi Graphic Era, 1st Edition published 2022 by CRC press.
2	Cloud Computing with Security Concepts and Practices Second Edition by Naresh Kumar Sehgal Pramod Chandra, P. Bhatt John M. Acken, 2 nd Edition Springer nature Switzerland AG 2020
3	Cloud Security and Privacy by Tim Mather, Subra Kumaraswamy, and Shahed Lati First Edition, September 2019.

Reference Books:

1	Essentials of Cloud Computing by K. Chandrasekaran Special Indian Edition CRC press.
2	Cloud Computing Principles and Paradigms by Rajkumar Buyya, John Wiley.

Web References:

1	https://www.hcltechsw.com/bigfix/secure-infrastructur automation? utm_source= google&utm_medium=cpc&utm_campaign
2	https://www.cisa.gov/sites/default/files/publications/Cloud%20Security%20Technical%20Reference%20Architecture.pdf

23CY505	APPLICATION DEVELOPMENT	0/0/6/3
Nature of Course	F (Theory Programming)	
Pre-Requisite	Cloud Computing	

Course Objectives:

1	To discuss the essence of front-end development skills.
2	To impart the knowledge of React components used in Spring boot development platforms.
3	Ability to understand and use Setup Cloud API.
4	To deploy and test the React App used in Spring Boot.
5	To learn the Spring Cloud concepts using Docker.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C505.1	Identify the basic concepts and design issues of React.	[R]
C505.2	Understand the principles of process and Spring boot.	[U]
C505.3	Illustrate the approaches in scheduling and Spring Cloud to apply in real world problems.	[AP]
C505.4	Apply concepts of Micro services Communication to the issues that occur in Real time applications.	[AP]
C505.5	Identify issues related to Docker, API Gateway.	[AP]
C507.1	Examine common React, Availability and Scalability.	[A]

Course Contents:

MODULE I REACT INTRODUCTION 30

Components, Routes, State, Props, hooks, Higher Order Functions, Axios and Services, Ant Design. Redux: Core Concept, Data Flow, Store, Actions, Pure function, Reducers, Devtools, Middleware, Webpack, Redux Integration. Spring boot: Annotations, Beans, Configuration, HTTP Methods, Crud, Postman Overview. Spring Security: Authentication, Authorization, Security Implementation. Configure Security, Authentication Manager, HTTP Security, Circular Reference Error. JWT Implementation: JWT Overview, JWT Libraries, Helper Methods, Token Generation and Validation, Implementing JWT Authorization, Filter. OAUTH Implementation: Introduction, Sample flow, Authorization code grant type flow, Implicit grant flow, Password Grant Type flow, Client, Credential Grand type flow, Refresh token Grand type flow, Validating token,Oauth2 integration with Spring Security. Building Micro services : Monolith Architecture and Challenges of Monolith Architecture,What is Micro services & How It Solves the Challenges of Monolith Architecture, Micro services Architecture Benefits and Best Practices, Understanding Spring Cloud and It's Important Modules,Micro service Applications and It's Port Mapping

MODULE II MICROSERVISES COMMUNICATION OVERVIEW 30

 Micro services Communication using Rest Template, Micro services Communication using Web Client, Micro services Communication using Spring Cloud Open Feign - Understanding service Registry – Spring Cloud Netflix Eureka Server Implementation, Update on Using Spring Boot 3 Version, Register Micro service as Eureka Client, Update on using Spring Boot 3 Version, Register Micro service as Eureka Client, Running Multiple Instances of Micro service, Load Balancing with Eureka, Open Feign and Spring Cloud Load Balancer API gateway using Spring Cloud gateway: Understanding API Gateway - Create and Set up API Gateway Micro service, Update on Using Spring Boot 3 Version, Register API-Gateway as Eureka Client to Eureka Server, Configuring API Gateway Routes and Test using Postman Client, Using Spring Cloud Gateway to Automatically Create Rout.

MODULE III CENTRALIZED CONFIGURATIONS USING SPRING CLOUD CONFIG SERVER 30

 How to Use Spring Cloud Config Server, Create and Setup Spring Cloud Config Server Project in IntelliJ IDEA, Update on Using Spring Boot 3 Version, Register Config-Server as Eureka Client, Set up Git Location for Config Server, Refactor Department-Service to use Config Server, Refactor Employee-Service to use Config Server, Refresh Use case - No Restart Required After Config Changes,REACT Frontend Micro service: Create React App using Create React App Tool, Adding Bootstrap in React Using NPM, Write HTTP Client Code to Connect React App with API-Gateway (REST API Call), Create a React Component and Integrate with API Gateway Microservice, RabbitMQ Core Concepts: RabbitMQ Architecture, Install and Setup RabbitMQ using Docker, Explore RabbitMQ using RabbitMQ Management UI, Create and Setup Spring Boot 3 Project in IntelliJ, Connection Between Spring Boot and RabbitMQ,, Configure RabbitMQ in Spring Boot Application, Create RabbitMQ Producer, Create REST API to Send Message, Create RabbitMQ Consumer,, Configure RabbitMQ for JSON Message Communication, Create RabbitMQ Producer to Produce JSON Message, Create REST API to Send JSON Object, Create RabbitMQ Consumer to Consume JSON Message,, Dockering Spriing boot App : Install Docker Desktop, General Docker Workflow, Create Spring Boot Project and Build Simple REST API, Create Docker file to Build Docker Image, Build Docker Image from Dockerfile

Course Guidelines:

1. Students choose a project topic from a list of approved options or propose their own idea from the area specified in the content and Faculty Coordinator/guide approval required for student-proposed projects
2. Number of students in the project team should be maximum of 4 and Every student shall have a project guide.
3. The entire semester shall be utilized by the students to do their project work by receiving the directions from the project guide.
4. Teams should submit a project proposal, including objectives, scope, timeline, and resources and Faculty Coordinator/guide reviews and approves the proposal.
5. Students should choose projects in line with the Departmental Mission, Vision, and Program Outcomes.
6. Students should attend periodic reviews to present the progress of the project to faculty and peers' team and Evaluation is based on project outcomes, presentation quality, and teamwork.
7. Teams submit a final project report, including results, conclusions, and recommendations as specified in the guidelines issued by the COE.
8. Students should not be involved in unethical behavior, such as plagiarism, copyright violations, etc while working on projects and when submitting project reports.
9. Every student team will be required to prepare and submit two (2) copies plus (no. of students) copies of the Project report of typical length 30 – 60 pages (excluding Appendices).

A final external project viva-voce examination will be conducted to evaluate the student's Individual and team performance based on project outcomes, presentations, reports, and teamwork by an Internal and External Examiners.

TOTAL PERIODS   90

Text books:

1	Merih Taze, ˉEngineers Survival Guide: Advice, tactics, and tricks after a decade of working at Facebook, Snapchat‖, Microsoft Paperback – November 28, 2021.
2	Gerardus Blokdyk, ˉSecure Microservices A Complete Guide‖, Edition Paperback – July 17, 2021.
3	Theo H King, ˉAws: The Ultimate Guide from Beginners to Advanced For the Amazon Web Services‖, (2020 Edition), Paperback - Import, 21 December 2019.

Reference books:

1	Craig zacker, ˉExam ref pl-900 Microsoft power platform‖, paperback – 8 February 2021

Web References:

1	https://awscloud.in/

SEMESTER – VI

23CY601	**BLOCK CHAIN TECHNOLOGIES**	3/0/0/3

Nature of Course:	C (Theory Concept)

Pre requisites:	Ethical Hacking

Course Objectives:

1	To Understand the foundational principles of blockchain technology
2	To apply the principles and features of Distributed Ledger Technology (DLT)
3	To Evaluate the structure and functionality of smart contracts
4	To Differentiate between various blockchain ecosystems
5	To Explore advanced blockchain protocols and token economies

Course Outcomes

Upon completion of the course, students shall have ability to

C601.1	Explain the architecture, design principles, and challenges of blockchain technology	[U]
C601.2	Illustrate the structure and functioning of Distributed Ledger Technologies.	[AP]
C601.3	Demonstrate the development and lifecycle of smart contracts, and apply them in domain-specific use cases like healthcare and property transfer using DLT platforms	[UP]
C601.4	Analyze different types of blockchain ecosystems and their governance models by identifying roles, interactions, and strategic implications of ecosystem components	[A]
C601.5	Differentiate and analyze blockchain protocols, token types, and token economy structures, with emphasis on legal frameworks and their application in blockchain-based projects.	[A]

Course Contents:

MODULE I FOUNDATIONS OF BLOCKCHAIN   15

Blockchain Architecture – Challenges – Applications – Blockchain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - peer-to-peer network – Abstract Models - GARAY model - RLA Model - Proof of Work (PoW) - Proof of Stake (PoS) based Chains - Hybrid models. Origin of Ledgers – Types and Features of Distributed Ledger Technology (DLT) - Role of Consensus Mechanism - DLT Ecosystem - Distributed Ledger Implementations

MODULE II SMART CONTRACTS   15

Blockchain - Ethereum - Public and Private Ledgers – Registries – Ledgers - Practitioner Perspective: Keyless Technologies, Transparency as a Strategic Risk, Transparency as a StrategicAsset, Usage of Multiple IDs - Zero Knowledge Proofs - Implementation of Public and Private Blockchain- Anatomy of a Smart Contracts - Life Cycle - Usage Patterns - DLT-based smart contracts -Use Cases: Healthcare Industry and Property Transfer - Decentralization versus Distribution - Centralized-distributed (Ce-Di) organizations - Decentralized-distributed (De-Di) organizations - Decentralized Autonomous Organizations: Aragon, DAOstack, DAOhaus and Colony.

MODULE III BLOCKCHAIN ECOSYSTEM AND PROTOCOLS	**15**

One-Leader Ecosystem - Joint Venture or Consortia Ecosystems - Regulatory Blockchain Ecosystems - Components in Blockchain Ecosystem: Leaders, Core Group, Active Participants, Users, Third-Party Service Providers - Governance for Blockchain Ecosystems- Ethereum tokens – Augur - Golem - Understanding Ethereum tokens - App Coins and Protocol Tokens - Blockchain Token Securities Law Framework - Token Economy - Token sale structure - Ethereum Subreddit

TOTAL PERIODS 45

Text books:

1.	Dhillon, V., Metcalf, D., and Hooper, M, Blockchain enabled applications, 2017, 1st Edition, CA: Apress, Berkeley.
2.	Imran Bashir, ‖Mastering Blockchain - A technical reference guide to the inner workings of blockchain, from cryptography to DeFi and NFTs‖, Packt Publishing Ltd, Fourth Edition, 2023

Reference Books:

1.	Diedrich, H., Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations, 2016, 1st Edition, Wildfire publishing, Sydney.
2.	Wattenhofer, R. P, Distributed Ledger Technology: The Science of the Blockchain (Inverted Forest Publishing), 2017, 2nd Edition, Create space Independent Pub, Scotts Valley, California, US

Web References:

1.	https://www.ibm.com/
2.	https://ethereum.org/en/developers/docs/smart-contracts/
3.	https://www.sciencedirect.com/science/article/pii/S0160791X21001747

23CY602	**ENTERPRISE NETWORKING SECURITY AND AUTOMATION**	3/0/0/3
Nature of Course:	C (Theory Concept)	
Pre requisites:	Ethical Hacking	

Course Objectives:

1	To configure advanced routing and switching protocols.
2	To resolve common issues with routing and switching protocols and identify threats to enhance network security.
3	To implement IPv4 Access Control Lists (ACLs).
4	To configure Network Address Translation (NAT) services.
5	To explain virtualization, software-defined networking, and automation

Course Outcomes

Upon completion of the course, students shall have ability to

C602.1	Explain and apply the configuration procedures for advanced routing and switching protocols.	[AP]
C602.2	Analyse and resolve routing and switching issues while identifying security threats.	[A]
C602.3	Demonstrate the implementation of IPv4 ACLs for network security.	[AP]
C602.4	Configure and verify NAT services to support IPv4 address scalability.	[AP]
C602.5	Explain the concepts of virtualization, software-defined networking, and automation.	[U]

Course Contents:

MODULE I SINGLE-AREA OSPFv2 & NETWORK SECURITY   15
OSPF Concepts – Features, Link-State Operation, Packet Types, Neighbor Adjacencies, Database Synchronization, DR/BDR Election, Router ID, Configuration, Network Types, and Verification. OSPF Optimization - Cost Metric Adjustments, Failover, Recovery, and Default Route Propagation. Cybersecurity Basics - Network Attacks, Threat Actors, Reconnaissance, Access Attacks, DoS/DDoS, IP Vulnerabilities, ICMP Attacks, Address Spoofing, TCP/UDP Vulnerabilities. Cryptography & ACLs – Data Confidentiality, Hashing, Encryption, Packet Filtering, Wildcard Masks, ACL Types, Placement, Configuration, and Interface Security.

MODULE II: NAT, WAN, VPN, QoS, AND NETWORK MANAGEMENT   15
NAT for IPv4 – Characteristics, Address Space, Terminology, Types, NAT64, Advantages, Configuration, and Verification. WAN Concepts – Purpose, Types, Carrier Connections, Operations, Standards, Terminology, Devices, Connectivity Options, and Internet-Based Solutions. VPN and IPsec Concepts – VPN Technology, Benefits, Types, IPsec Protocols, Encryption, Authentication, and Secure Key Exchange. QoS Concepts - Network Performance, Traffic Prioritization, Congestion, Delay, Jitter, Queuing Algorithms, Models, and Implementation. Network Management – Device Discovery, Time Synchronization, SNMP, Syslog, Router & Switch Maintenance, and IOS Image Management.

MODULE III: NETWORK DESIGN, TROUBLESHOOTING, VIRTUALIZATION & AUTOMATION   15
Network Design – Scalable networks, hierarchical models, redundancy, failure domains, hardware selection. Network Troubleshooting – Documentation, methodologies, tools, and layered diagnostic approaches. Network Virtualization - Cloud computing, virtualization, SDN, controllers, and infrastructure

abstraction.Network Automation – Automation fundamentals, data formats, APIs, configuration management, Cisco DNA Centre. Case Study – Implementing automation in a virtualized enterprise, analysing scalability, security, and efficiency.

TOTAL PERIODS 45

Text Books:

1.	Enterprise Networking, Security, and Automation Companion Guide (CCNAv7), by Cisco Networking Academy, Cisco Press, July 2020.
2.	CCNA 200-301 Portable Command Guide, 5th Edition, by Cisco Networking Academy, Cisco Press, 2020.

Reference Books:

1.	Routing TCP/IP, Volume 1 - by Jeff Doyle and Jennifer Carroll
2.	Network Warrior - by Gary A. Donahue (O'Reilly Media)
3.	IPv6 Essentials - by Silvia Hagen (O'Reilly Media)

Web References:

1.	https://community.cisco.com/t5/routing/need-advise-for-ospf-failover-design/td-p/5154500
2.	https://www.cisco.com/c/en/us/support/docs/ip/network-address-translation-nat/217208-understanding-nat64-and-its-configuratio.html
3.	https://www.cloudflare.com/learning/network-layer/what-is-ipsec/

23CY603	**HACKER TECHNIQUES TOOLS AND INCIDENT HANDLING**	**3/0/2/4**
Nature of Course:	C (Theory Concept)	
Pre requisites:	Ethical Hacking	

Course Objectives:		
1	To understand Hacker Techniques and Incident Handling	
2	To secure Wireless and Web Networks Against Hacker Tactics	
3	To understand the Defensive Strategies for Linux Penetration Testing and Social Engineering	

Course Outcomes

Upon completion of the course, students shall have ability to

C603.1	Interpret the role and significance of Public Key Infrastructure (PKI) in ensuring secure communication. (Module 1)	[U]
C603.2	Evaluate the risks associated with open ports and services on a network and prioritize them based on their potential impact. (Module 1)	[A]
C603.3	Explain the vulnerabilities associated with wireless LANs, including eavesdropping, spoofing, and man-in-the-middle attacks. (Module 2)	[U]
C603.4	Utilize techniques such as SQL injection and cross-site scripting (XSS) to demonstrate vulnerabilities in web servers and web applications. (Module 2)	[AP]
C603.5	Utilize incident response plans and procedures to effectively respond to cybersecurity incidents, including identifying and containing security breaches, preserving evidence, and restoring systems and data. (Module 3)	[AP]

Course Contents:

Module – I EXPLORING HACKER TECHNIQUES 15

Hacker Techniques Tools and Incident Handling - Ethical Hacking and Penetration Testing - Exploring the OSI Reference Model – Symmetric Encryption – Asymmetric Encryption – Purpose of Public Key Infrastructure – Hashing – Physical Security and its Controls – Port Scanning – Identifying access machines - Mapping open ports - Enumeration and Computer System Hacking

Module – II WIRELESS & WEB SECURITY: HACKER TACTICS 15

The importance of wireless security - Securing Bluetooth - Securing Wireless LANs - Threats to Wireless LANs - Wireless Hacking Tools - Protecting Wireless networks - Attacking Web Servers - Examining a SQL Injection – Vandalizing Web Servers – Database Vulnerabilities – Malware – Sniffers, Session Hijacking and Denial of Service Attacks

Module – III DEFENSIVE STRATEGIES: NAVIGATING LINUX PENETRATION TESTING AND 15

SOCIAL ENGINEERING

Linux Penetration Testing - Social Engineering - Types of Social Engineering attacks - Technology and Social Engineering - Best practices for Passwords - Incident Response and Defensive Technologies - Incident Response Plans – Planning for Disaster Recovery – Evidence Handling and Administration – Intrusion Detection Systems - The purpose of firewalls - Honeypots - The role of Controls - Security Best Practices.

TOTAL PERIODS(Theory) 45

LAB EXERCISES

1. Generate key pairs, encrypt a file using public key, and decrypt using the corresponding private key.
2. Utilize hashing libraries such as MD5, SHA-256.
3. Scan a network to identify active hosts and open ports, analyze the results, and understand potential vulnerabilities.
4. Use enumeration tools like enum4linux, NSE scripts in Nmap.
5. Use Wi-Fi access points and tools like Aircrack-ng.
6. Configure and secure a wireless network using WPA2, detect and mitigate rogue access points.
7. Perform attacks like SQL injection, cross-site scripting (XSS), and understand the impact of vulnerable web applications.
8. Analyze malware behavior, identify persistence mechanisms, and understand how malware communicates with command and control servers.
9. Perform penetration testing on Linux systems, exploit vulnerabilities, and harden the system against attacks.
10. Simulate social engineering attacks, analyze human vulnerabilities, and develop countermeasures such as security awareness training.

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 75

Text books:	
1.	Sean Philip Oriano, Michael G. Solomon, ̄Hacket Techniques, Tools, and Incident Handling‖, Jones and Bartlett Learning, 2020,
2.	Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws‖, 2011.

Reference Books:	
1.	Michael Sikorski, Andrew Honig, ̄Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software", 2012.
2.	David Kennedy, Jim O'Gorman, Devon Kearns, ̄Metasploit: The Penetration Tester's Guide", 2011.
3.	N. K. McCarthy, ̄The Incident Response Pocket Guide", 2010.

Web References:	
1.	https://intellicomp.net/it-services-blog/hacking-methods/
2.	https://www.rapid7.com/fundamentals/types-of-attacks/
3.	https://www.computerworld.com/article/2563639/wireless-hacking-techniques.html

23CY604	CYBER ATTACK SIMULATION AND SECURITY TESTING	3/0/2/4
Nature of Course:	C (Theory Concept)	
Pre requisites:	Ethical Hacking	

Course Objectives:

1	To understand the foundational concepts of ethical hacking and the legal, ethical, and regulatory frameworks guiding penetration testing practices (e.g., ISO 27001, NIST, HIPAA).
2	To analyze and apply industry-standard security assessment methodologies such as PTES, OSSTMM, and NIST SP 800-115 for conducting effective penetration tests.
3	To perform advanced reconnaissance and exploitation techniques on networks, web applications, wireless systems, and cloud infrastructures using tools like Nmap, Metasploit, and SET.
4	To investigate post-exploitation techniques including privilege escalation, credential dumping, and persistence strategies to simulate real-world attacker behavior.
5	To develop professional penetration test reports aligned with CVSS scoring, MITRE ATT&CK framework, and organizational compliance requirements for both technical and executive stakeholders.

Course Outcomes

Upon completion of the course, students shall have ability to

C604.1	Analyze and perform reconnaissance, enumeration, and fingerprinting techniques for offensive security	[U]
C604.2	Exploit system and web-based vulnerabilities using professional-grade tools and frameworks	[A]
C604.3	Simulate red team operations targeting modern network, cloud, and wireless infrastructures	[U]
C604.4	Generate detailed technical and management-level penetration test reports with proper scoring and mitigation	[AP]
C604.5	Apply cybersecurity laws, ethics, and compliance standards to penetration testing practices in real scenarios	[AP]

Course Contents:

MODULE I FUNDAMENTALS OF PENETRATION TESTING AND TARGET ENUMERATION **15**
Introduction to cyber offense and ethical hacking- Legal, ethical, and regulatory aspects (ISO 27001, NIST 800-53, PCI-DSS, HIPAA)- Types of penetration testing: white-box, black-box, and grey-box approaches- Security assessment methodologies: PTES (Penetration Testing Execution Standard), OSSTMM, NIST SP 800-115. Open Source Intelligence (OSINT) techniques: Shodan, Maltego, Google Dorking-Active reconnaissance: Nmap scanning, Masscan, Netcat usage, and banner grabbing-Service enumeration: SMB, SNMP, FTP, SMTP, and HTTP fingerprinting-Threat intelligence collection and digital footprint mapping

MODULE II VULNERABILITY EXPLOITATION TECHNIQUES AND WIRELESS ATTACKS 15

Exploiting network services and protocols (SMB, RDP, SSH misconfigurations)-Web exploitation techniques: SQL Injection, Cross-Site Scripting (XSS), Remote Code Execution (RCE), Cross-Site Request Forgery (CSRF)-Password-based attacks: Brute-force, dictionary attacks, rainbow table usage-Post- exploitation steps: privilege escalation, credential dumping, persistence mechanisms- WEP/WPA cracking, Evil Twin attacks, deauthentication attacks- Social engineering: phishing, spear-phishing, payload creation and delivery using SET (Social Engineering Toolkit)-Cloud penetration testing: IAM role manipulation, insecure storage exploitation (AWS S3, Azure Blob), and credential abuse-API hacking and mobile penetration testing introduction

MODULE III REPORTING AND ADVANCED RED TEAM OPERATIONS 15

Vulnerability scoring and classification: CVSS (v3.1), risk heatmaps, OWASP risk rating-Red teaming lifecycle: planning, execution, reporting, and evasion techniques-Adversary emulation using MITRE ATT&CK framework and the Cyber Kill Chain model-Report writing for executive and technical audiences: compliance and business alignment

TOTAL PERIODS(Theory) 45

LAB EXERCISES:

1. Setting Up a Penetration Testing Lab Environment

Objective: Configure a controlled test environment for safe exploitation.
- Tools: VirtualBox/VMware, Kali Linux, Metasploit, OWASP Juice Shop, DVWA
- Tasks: Install Kali Linux and vulnerable targets, verify network communication, snapshot environment
- Outcome: A sandboxed, repeatable environment for ethical testing

2. Passive and Active Reconnaissance

Objective: Perform reconnaissance using OSINT and scanning techniques.
- Tools: Shodan, Maltego, Nmap, Netcat, Whois, nslookup
- Tasks: Map target IPs, enumerate open ports and services, analyze metadata
- Outcome: Create a target profile using digital footprint analysis

3. Vulnerability Assessment and Exploitation of Web Applications

Objective: Discover and exploit vulnerabilities in web apps.
- Tools: Burp Suite, OWASP ZAP, Nikto, SQLMap
- Tasks: Perform SQL Injection, XSS, and CSRF attacks on DVWA or Juice Shop
- Outcome: Understand OWASP Top 10 vulnerabilities and practical exploitation

4. Password Cracking and Privilege Escalation

Objective: Conduct brute-force attacks and escalate privileges.
- Tools: Hydra, John the Ripper, rockyou.txt, Linux Exploit Suggester
- Tasks: Crack SSH login, enumerate users, exploit SUID/GTFObins
- Outcome: Gain root access from a low-privilege shell

5. Wireless Network Penetration Testing

Objective: Audit and exploit Wi-Fi security protocols.
- Tools: Aircrack-ng, Wifite, Reaver
- Tasks: Capture handshake, crack WPA password, set up Evil Twin access point
- Outcome: Demonstrate security flaws in wireless encryption and authentication

6. Social Engineering and Phishing Simulation

Objective: Simulate real-world phishing attacks.

- Tools: Social Engineering Toolkit (SET), Gophish
- Tasks: Create fake login pages, clone legitimate websites, craft spear-phishing emails
- Outcome: Measure success rate of phishing campaigns and user awareness

7. Cloud Penetration Testing Basics
Objective: Identify and exploit misconfigurations in cloud environments.

- Tools: AWS/Azure free-tier sandbox, ScoutSuite, Pacu, S3Scanner
- Tasks: Enumerate IAM policies, test S3 bucket access, privilege escalation
- Outcome: Understand cloud-specific security risks and red team opportunities

8. Full-Scope Red Team Simulation and Reporting
Objective: Execute end-to-end penetration test with formal reporting.

- Tools: All previously used tools + report templates
- Tasks: Recon, exploit, maintain access, exfiltrate data, document findings
- Outcome: Submit a professional pentest report with CVSS ratings and remediation steps

TOTAL PERIODS(Lab) 30

TOTAL PERIODS 75

Text Books:	
1.	Penetration Testing Demystified: A Hands-on Introduction and Guide by J. Smith, A. Ray, and M. Chen, CyberSec Lab Series. 1st Edition, published 2024 by Amazon Digital Publishing.
2.	Learn Penetration Testing by Rishalin Pillay and Philip Ingram, 1st Edition, published 2024 by Packt Publishing.
Reference Books:	
1.	Penetration Testing: A Complete Guide – 2024 Edition by Gerardus Blokdyk, CyberEdge Press. 1st Edition, published 2024 by 5STARCooks.
2.	The Hacker Playbook 3: Practical Guide to Penetration Testing by Peter Kim, Secure Planet. 3rd Edition, published 2024 by Secure Planet, LLC.
Web References:	
1.	https://it.wikipedia.org/wiki/Offensive_Security?utm
2.	https://en.wikipedia.org/wiki/OWASP?utm
3.	https://pentest-tools.com/
4	https://academy.tcm-sec.com/p/learn-penetration-testing-free?utm

23AD902	EXPLORATORY DATA ANALYSIS USING PYTHON	2/0/2/3
Nature of Course	F (Theory Programming)	
Prerequisites	-	

Course Objectives:

1	To utilize NumPy and Pandas for data manipulation and structuring.
2	To implement querying and transforming data using Data Frame operations.
3	To familiarize learners with descriptive and exploratory visualizations using Python libraries.
4	To teach statistical concepts like central tendency, dispersion, and correlation in the context of EDA.
5	To enable learners to apply best practices of univariate, bivariate, and multivariate analysis using Python and GenAI tools.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C902.1	Apply NumPy and Pandas to organize and manipulate structured data for analysis.	[U]
C902.2	Apply Query and transform Data Frames using filters, aggregations, and CRUD operations.	[AP]
C902.3	Create descriptive and exploratory visualizations using Matplotlib and Python libraries.	[AP]
C902.4	Apply descriptive statistics and explore central tendency, dispersion, and correlation.	[AP]
C902.5	Develop a comprehensive EDA project that demonstrates multivariate analysis, integrates SQL data sources, and uses GenAI tools for insights.	[AP]

Course content:

MODULE I DATA STRUCTURING WITH PYTHON LIBRARIES   **10**

Array Structures - 1D/2D NumPy Arrays, Indexing, Slicing, Broadcasting. Data Structures - Series, DataFrames, Data Types, Null Handling. Data Manipulation - Sort, Drop, Apply, Map, Merge, Join, groupby, concat. Data Types and Conversion – astype(), to_numeric(). Basic Data Cleaning – dropna(), fillna(), replace().

MODULE II QUERY TRANSFORMATION DATA AND DESCRIPTIVE ANALYSIS   **10**

Data Filtering - Conditional Filters, Logical Operators, Query Method. Aggregation - Mean, Sum, Count, Min, Max, Custom Aggregations. CRUD Operations - Insert, Update, Replace, Delete rows/columns. SQL Integration – Sqlite3, Connectors, Executing Queries from Python.Descriptive Analysis - Mean, Median, Mode, Range, Standard Deviation, Variance. Correlation Analysis - Pearson Coefficient, Covariance Matrix. Visualization: Matplotlib Charts, Seaborn Charts, Histograms, Boxplots, Scatterplots, Pairplots.

MODULE III EDA BEST PRACTICES AND MULTIVARIATE ANALYSIS   **10**

EDA Techniques - Univariate, Bivariate, Multivariate Analysis. GenAI Tools - AI-generated Summary, Code Assistance, Automated Charts. Project and Summative Assessment - Perform a complete exploratory data analysis using NumPy, Pandas, and Matplotlib. Integrate SQL datasets and use GenAI tools for generating summaries, visuals, and insights.

TOTAL PERIODS (Theory) 30

List of Experiments

1. Create and manipulate 1D and 2D NumPy arrays for basic numeric operations.
2. Construct Pandas Series and Data Frames from lists, dictionaries, and CSV files.
3. Apply filtering and aggregation techniques on Data Frames using groupby and pivot table.
4. Perform insert, update, and delete operations on Data Frames to simulate CRUD logic.
5. Connect Python with a SQLite database and retrieve data into a Data Frame.
6. Calculate mean, median, mode, standard deviation, and correlation on sample datasets.
7. Create visualizations like bar charts, histograms, scatter plots, and box plots using Matplotlib.
8. Perform univariate and bivariate analysis on a dataset using appropriate visuals and stats.
9. Demonstrate multivariate analysis using pair plots or heatmaps on complex datasets.
10. Complete a mini project that uses GenAI tools to generate exploratory insights and visual summaries.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text Books:

1	‾Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython‖ by Wes McKinney, Third Edition, O'Reilly Media, 2022.
2	Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python‖ by Peter Bruce, Andrew Bruce, and Peter Gedeck, Second Edition, O'Reilly Media, 2020.

Reference Books:

1	‾Data Science from Scratch: First Principles with Python‖ by Joel Grus, Second Edition, O'Reilly Media, 2019.
2	‾Python Data Science Handbook: Essential Tools for Working with Data‖ by Jake VanderPlas, O'Reilly Media, 2016.
3	‾Hands-On Exploratory Data Analysis with Python: Perform EDA Techniques to Understand, Summarize and Investigate your Data‖ by Suresh Kumar Mukhiya and Usman Qamar, Packt Publishing, 2020.

23AD905	STATISTICAL METHODS AND BASIC MACHINE LEARNING MODELS	2/0/2/3
Nature of Course	F (Theory Programming)	
Prerequisites	-	

Course Objectives:

1	To develop a foundational understanding of probability theory and sampling methods essential for statistical inference.
2	To apply and interpret hypothesis testing techniques to validate assumptions using real-world datasets.
3	To perform data preparation and preprocessing for effective use in machine learning applications.
4	To explore and analyze regression and classification models for identifying patterns and making predictions.
5	To gain practical experience in implementing clustering algorithms to discover hidden structures in data.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C905.1	Understand and apply probability concepts and sampling techniques for statistical inference.	[AN]
C905.2	Analyse data distributions and perform hypothesis testing using Z-test, T-test, and Chi-Square test	[AN]
C905.3	Prepare and transform data effectively for building machine learning models.	[AP]
C905.4	Apply linear regression techniques to analyse relationships between variables	[C]
C905.5	Implement classification models like logistic regression and K-Nearest Neighbors for predictive analytics and perform clustering using K-Means through a course-end project simulating real-world practices.	[AP]

MODULE I PROBABILITY, SAMPLING, AND STATISTICAL INFERENCE   10

Probability and Prediction- Basic probability- Joint and conditional probability- Real-world probability applications- Sampling and Normal Distributions- Sampling techniques- Sampling distribution- Properties of the normal distribution- Central Limit Theorem- Statistical Inference and Hypothesis Testing(Parametric) - Formulating hypotheses, Z-test and T-test for means, p- value interpretation, confidence intervals. Hypothesis Testing(Nonparametric) - Chi-Square goodness-of-fit test, test for independence in contingency tables.

MODULE II DATA PREPARATION AND SUPERVISED LEARNING MODELS   10

Data Preparation for Machine Learning- Handling missing values- Encoding categorical variables- Data normalization and scaling-Train-test split-Regression Models-Simple linear regression: line of best fit, correlation vs causation, residual analysis
-Multiple linear regression: multicollinearity, variable selection, coefficient interpretation, model assumptions- Classification Models- Logistic regression: binary classification, sigmoid function, threshold tuning- Confusion matrix, ROC-AUC.

MODULE III UNSUPERVISED LEARNING AND MODEL EVALUATION   10

K-Nearest Neighbor (KNN) - Distance metrics, choosing k, model training and prediction, performance evaluation. K-Means Clustering - Centroid initialization, distance calculation, elbow method, cluster interpretation and visualization. Model Evaluation -Accuracy, precision, recall, F1-score, cross-validation- Project / Summative Assessment- Implementation of regression, classification, and clustering models- Use of real-world datasets- Model analysis and reporting.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS

1. Probability Estimation: Simulate and compute simple, joint, and conditional probabilities using Python.
2. Sampling and Visualization: Apply simple random and stratified sampling on datasets and visualize distributions.
3. Normal Distribution Analysis: Plot and interpret normal distribution with Python and identify z-scores.
4. Hypothesis Testing - Z and T Test: Perform one-sample and two-sample z-test and t-test on numerical data.
5. Chi-Square Test: Conduct Chi-square goodness of fit and independence tests for categorical variables.
6. Data Cleaning and Scaling: Perform handling of missing values, outlier detection, and standardization.
7. Simple Linear Regression: Implement and evaluate a linear regression model using one independent variable.
8. Multiple Linear Regression: Build a model using multiple features and interpret coefficients and R^2.
9. Classification using Logistic Regression and KNN: Train and evaluate logistic regression and KNN models using classification metrics.
10. K-Means Clustering Project: Apply clustering on a real dataset, use elbow method to select k, and interpret results.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text Books:

1	Statistics for Data Science and Business Analysis‖ by Bhushan Patil, BPB Publications, 2020.
2	Introduction to Machine Learning with Python: A Guide for Data Scientists‖ by Andreas C. Müller and Sarah Guido, O'Reilly Media, 2016.

Reference Books:

1	Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python‖ by Peter Bruce, Andrew Bruce, and Peter Gedeck, Second Edition, O'Reilly Media, 2020.
2	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow‖ by Aurélien Géron, Third Edition, O'Reilly Media, 2022.
3	Python Machine Learning‖ by Sebastian Raschka and Vahid Mirjalili, Third Edition, Packt Publishing, 2019.

23IT901	ADVANCED MACHINE LEARNING TECHNIQUES	2/0/2/3
Nature of Course	D (Theory Application)	
Pre requisites	-	

Course Objectives:

1.	To equip learners with the knowledge of advanced supervised learning techniques for accurate classification tasks.
2.	To develop the ability to select optimal models using cross-validation and robust performance metrics.
3.	To introduce ensemble learning methods for improved generalization and predictive performance.
4.	To provide hands-on experience in unsupervised learning using hierarchical and density-based clustering methods.
5.	To enable learners to perform dimensionality reduction and explore smart tools like GenAI for automating ML workflows.

Course Outcomes

Upon completion of the course, students shall have ability to

C901.1	Illustrate advanced supervised learning techniques like Naive Bayes, SVM, and Decision Trees for data classification tasks.	[U]
C901.2	Apply unsupervised learning techniques using Hierarchical Clustering and DBSCAN to discover patterns in unlabelled data.	[AP]
C901.3	Identify ensemble learning techniques such as Random Forest, Boosting, and Stacking for improved predictive accuracy.	[AP]
C901.4	Examine dimensionality reduction techniques like PCA and LDA to enhance model performance and interpretability.	[AN]
C901.5	Develop automation of machine learning workflows using Generative AI and smart ML tools for streamlined development.	[AP]

MODULE I SUPERVISED AND UNSUPERVISED LEARNING TECHNIQUES   **10**

Naive Bayes Classification - Probabilistic modelling, prior and likelihood, Gaussian and Multinomial Naive Bayes, real-world applications. Support Vector Machines (SVM) - Hyperplane and margins, kernel tricks, soft vs hard margin, model tuning. Decision Trees for Classification - Tree construction, entropy, Gini index, overfitting and pruning. Hierarchical Clustering - Dendrograms, agglomerative vs divisive, linkage criteria, cluster interpretation. DBSCAN Clustering - Density-based clustering, core points, epsilon-neighbourhood, handling noise/outliers.

MODULE II MODEL EVALUATION AND ENSEMBLE LEARNING   **10**

Model Validation and Selection - K-Fold, hold-out, stratified K-Fold, LOO cross-validations, model performance comparison. Random Forest & Ensemble Learning - Bagging, feature importance, OOB error, Random Forest classifier. Boosting and Stacking Models - AdaBoost basics, model stacking architecture.

MODULE III DIMENSIONALITY REDUCTION TECHNIQUES, ML WORKFLOW AUTOMATION AND GENAI TOOLS   **10**

Dimensionality Reduction Techniques - PCA for variance preservation, LDA for class separation. ML Workflow Automation - GenAI-powered model recommendation tools, Auto ML pipelines, smart feature engineering.

                                TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS:

1. Naive Bayes Classifier: Apply Gaussian/Multinomial Naive Bayes for text or numeric classification.
2. SVM Implementation: Train and test an SVM model with different kernels (linear, RBF).
3. Decision Tree Classifier: Build a tree-based classifier and visualize decision rules.
4. Hierarchical Clustering: Use dendrograms to visualize clusters and interpret structure.
5. DBSCAN Clustering: Implement density-based clustering and tune epsilon and minPts.
6. Cross-Validation: Perform k-fold cross-validation to compare multiple models.
7. Random Forest Model: Train and evaluate a random forest classifier on a structured dataset.
8. Boosting Techniques: Apply AdaBoost or XGBoost to improve model performance.
9. PCA and LDA: Apply PCA and LDA to reduce dimensions and plot transformed data.
10. AutoML Tools/GenAI Integration: Use GenAI toolkits (e.g., Google Vertex AI, AutoML, or GenAI notebooks) for automated model selection and optimization.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text Books:	
1.	Christopher M. Bishop, ‾Pattern Recognition and Machine Learning‖, Springer, 2006
2.	Aurélien Géron, 2.Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow‖, Third Edition, O'Reilly Media, 2022

Reference Books:	
1.	Kevin P. Murphy, ‾Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012
2.	Andreas C. Müller, Sarah Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists‖, O'Reilly Media, 2016
3.	Sebastian Raschka, Vahid Mirjalili, Python Machine Learning‖, Third Edition, Packt Publishing, 2019

23IT902		**NATURAL LANGUAGE PROCESSING**	2/0/2/3
Nature of Course		D (Theory Application)	
Pre requisites		-	

Course Objectives:

1.	To introduce learners to statistical methods for analysing and interpreting time series data.
2.	To equip students to build and evaluate time series forecasting models using classical methods like AR, MA, ARIMA, SARIMA, and SARIMAX.
3.	To enable learners to integrate Generative AI tools to enhance forecasting accuracy and automate predictions.
4.	To provide knowledge of Natural Language Processing (NLP) techniques to clean, process, and analyze unstructured text data.
5.	To train learners to implement text vectorization, rule-based matching, and various text classification models including fastText.

Course Outcomes

Upon completion of the course, students shall have ability to

C902.1	Interpret statistical characteristics of time series data for effective modeling and forecasting.	[U]
C902.2	Build classical time series models such as AR, MA, ARMA, ARIMA, SARIMA, and SARIMAX.	[AP]
C902.3	Apply preprocessing and cleaning of unstructured textual data using NLP techniques	[AP]
C902.4	Examine rule-based matching, vectorization, and classification for text-based applications.	[AN]
C902.5	Analyse the impact of text classification models including binary, multi-class, and multi-label using fastText and other tools.	[AN]

MODULE I TIME SERIES FUNDAMENTALS & CLASSICAL FORECASTING MODELS   10

Time Series Statistics and Exploration - Time-dependent features, trend, seasonality, autocorrelation, stationarity, ACF and PACF. AR and MA Models - Autoregressive and Moving Average models, lag selection, parameter tuning. ARMA and ARIMA Models - Combining AR and MA, differencing for stationarity, model diagnostics, error metrics. Seasonal Models (SARIMA & SARIMAX) - Seasonal components, exogenous variables, parameter selection, forecasting.

MODULE II UNDERSTAND NLP FUNDAMENTALS AND TEXT PREPROCESSING   10

Text Processing Fundamentals - Tokenization, stop word removal, stemming, lemmatization, part-of-speech tagging. Text Cleaning and Annotation -Removing noise, entity recognition, labelling strategies. Rule-Based NLP - Pattern matching with spaCy, custom rules, phrase matching, entity ruler.

MODULE III TEXT CLASSIFICATION MODELS AND USE OF GENAI FOR NLP   10

Text Vectorization Techniques - Bag-of-Words, TF-IDF, word embeddings, feature selection for modeling. Text Classification – Basics: Binary, multi-class, and multi-label approaches, confusion matrix, evaluation metrics. Advanced Classification with fastText - Text preprocessing, training classifiers, model tuning. GenAI for NLP and Forecasting - Apply GenAI to automate text preprocessing and enhance the extraction of insights from unstructured data.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS:

1. Time Series Analysis: Plot and interpret components like trend, seasonality, and residuals.
2. Stationarity Testing: Apply ADF test and visualize rolling statistics.
3. AR/MA Modeling: Build and evaluate Autoregressive and Moving Average models.
4. ARIMA/SARIMA Modeling: Apply ARIMA and SARIMA models with proper order selection.
5. SARIMAX Implementation: Incorporate exogenous variables into SARIMA models.
6. GenAI for Forecasting: Use Generative AI tools to automate and improve time series predictions.
7. Text Cleaning and Tokenization: Preprocess raw textual data with annotation and normalization.
8. Rule-Based Matching: Implement phrase and pattern matching using rule-based NLP techniques.
9. Vectorization Techniques: Convert text to numerical format using CountVectorizer or TF-IDF.
10. Text Classification: Build and evaluate binary, multi-class, and multi-label classifiers using fastText, use GenAI for NLP.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text Books:	
1.	Galit Shmueli, Kenneth C. Lichtendahl Jr, ‖Practical Time Series Forecasting with R: A Hands-On Guide‖, 2nd Edition, 2016
2.	Daniel Jurafsky, James H. Martin, ‖Speech and Language Processing‖, International Edition, 2008.

References:	
1.	Wes McKinney, ‖Python for Data Analysis‖, 2nd Edition, O'Reilly Media, 2017
2.	Steven Bird, Ewan Klein, Edward Loper, ‖Natural Language Processing with Python‖, O'Reilly Media, 2009.
3.	Online GenAI documentation (OpenAI, Google Vertex AI) for workflow automation

23IT903	**COMPUTER VISION**	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites		

Course Objectives:

1.	To introduce learners to the foundational principles of deep learning and its application to real- world predictive problems.
2.	To build proficiency in developing deep learning architectures using TensorFlow or PyTorch.
3.	To enable learners to apply LSTM and BERT models for textual analysis such as recommendation systems and sentiment classification.
4.	To teach core computer vision techniques including image processing, classification, detection, and segmentation using CNNs.
5.	To encourage the use of Generative AI tools for critique, interpretation, and explainability in deep learning models.

Course Outcomes

Upon completion of the course, students shall have ability to

C903.1	Outline core concepts and architectures of deep learning for predictive modeling using TensorFlow or PyTorch.	[U]
C903.2	Apply LSTM and BERT models for building recommendation engines and performing sentiment analysis on text data.	[AP]
C903.3	Develop computer vision techniques including image processing, classification, and segmentation.	[AP]
C903.4	Utilize Convolutional Neural Networks (CNNs) to classify images and detect patterns in visual data.	[AP]
C903.5	Make use of Generative AI tools to improve model critique, interpretation, and explainability in computer vision tasks.	[AP]

MODULE I DEEP LEARNING FUNDAMENTALS AND TEXT MODELS   **5**

Deep Learning Foundations - Neurons, activation functions, forward and backward propagation. Core Building Blocks: Dense layers, dropout, batch normalization, loss functions, optimizers. Predictive Modeling with DL Model definition, training deep networks, evaluation techniques.
Text-Based DL Models - Sentiment analysis using BERT, tokenizer, transformer architecture, fine-tuning. Sequential Models - LSTM - Recurrent layers, building a recommendation system, sequence prediction.

MODULE II IMAGE PROCESSING & CNNs   **5**

Image Processing Fundamentals - OpenCV operations, grayscale conversion, edge detection, image transformation. Image Classification with CNN - Filters, feature maps, pooling layers, CNN architecture, model training.

MODULE III TRANSFER LEARNING & DETECTION   **5**

Transfer Learning for Images - Pretrained models, feature extraction, fine-tuning. Object Detection Techniques, Bounding boxes, real-time detection basics. Semantic Segmentation - Pixel-wise classification, U-Net architecture, real-time applications. Generative AI Integration - Utilize Generative AI to streamline neural network design and hyperparameter tuning, accelerating the development of deep learning models. DL Tools and Frameworks - TensorFlow/PyTorch, Keras usage; debugging, model saving.

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS:

1. Build a basic neural network using TensorFlow or PyTorch to predict numeric output.
2. Perform sentiment classification using pre-trained BERT on a Twitter dataset.
3. Build a recommendation engine using LSTM with sequential user-item data.
4. Load and preprocess images using OpenCV and apply edge detection filters.
5. Construct and train a CNN from scratch on a dataset like CIFAR-10 or Fashion-MNIST.
6. Implement transfer learning using a pretrained model like ResNet or VGG16 for image classification.
7. Detect objects in an image using bounding boxes and a YOLO or SSD approach.
8. Perform semantic segmentation using U-Net and visualize segmentation maps.
9. Use Grad-CAM or similar techniques to interpret CNN predictions visually.
10. Build a GenAI-powered notebook that critiques model performance and explains misclassifications.
11. Compare image classification accuracy using CNNs vs Transfer Learning techniques.
12. Present a course-end Project using a full pipeline from problem statement to deployment-ready model.

TOTAL PERIODS (LAB) 60

TOTAL PERIODS 75

Text Books:		
1.		François Chollet, ‾Deep Learning with Python‖,1st Edition, Manning Publisher, 2017.
2.		Aurélien Géron, ‾Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow‖, 3rd Edition, O'Reilly, 2022.

References:		
1.		Sebastian Raschka, Vahid Mirjalili, ‾Python Machine Learning‖, Packt Publishing, 2017.
2.		Online TensorFlow and PyTorch documentation
3.		Generative AI documentation for automated model tuning and interpretability

23AD906	GENAI ADVANCED PROMPT ENGINEERING & LLMS	1/0/4/3
Nature of Course	M (Practical Application)	
Prerequisites	Basic knowledge of Python programming and fundamentals of prompt engineering.	

Course Objectives:

1	To apply advanced prompt engineering techniques to craft effective prompts and optimize outputs from generative AI models.
2	To programmatically interact with large language models (LLMs) using Java libraries and APIs such as OpenAI and Hugging Face for AI-driven applications.
3	To design and implement API-driven workflows for tasks like content generation, summarization, and text analysis using GenAI services.
4	To address ethical considerations in generative AI, covering areas like bias mitigation, privacy protection, regulatory compliance, and fairness in AI-generated content.
5	To integrate generative AI functionalities into Java-based applications through foundational techniques, enabling the development of practical, AI-enhanced solutions.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C906.1	Analyze advanced prompt engineering techniques to optimize GenAI outputs.	[AN]
C906.2	Implement programmatic interactions with LLMs using Java libraries and APIs (e.g., OpenAI, Hugging Face).	[AP]
C906.3	Design API-driven workflows for specific AI tasks such as content generation, summarization, and text analysis.	[AP]
C906.4	Analyze ethical practices in GenAI, including bias mitigation, privacy safeguards, adherence to regulatory frameworks, and ensuring fairness.	[AN]
C906.5	Apply foundational skills to integrate GenAI into practical applications, preparing for more advanced AI application-building courses.	[AP]

MODULE I PROMPT ENGINEERING AND LLM INTEGRATION EXPLORING GENAI CAPABILITIES   5
Introduction to Prompt Engineering: Basics of Prompt Engineering, Prompt Structure, Optimization Techniques, Complex Prompts, Common Pitfalls, Troubleshooting. Interacting with LLMs Programmatically: Java Libraries, API Keys, Request Handling, Response Processing, Key Functions, Error Handling, Rate Limits. Exploring GenAI Capabilities: Text Generation, Summarization, Sentiment Analysis, Text Classification, Language Translation, Use Cases, Output Quality.

MODULE II API WORKFLOWS AND GENAI APPLICATIONS ETHICS, FAIRNESS, AND   5

RESPONSIBLE AI
API-Driven Workflows: API Workflows, Workflow Design, Automation Scripts, Workflow Efficiency, Model Integration, Security Considerations. Case Studies and Real-World Applications: GenAI Solutions, Customer Service, Education, Marketing, Domain-Specific Challenges, Effectiveness Evaluation. Ethics and Responsible AI: Biases in AI, Bias Mitigation, Privacy Safeguards, Regulatory Compliance, Fairness, Ethical Frameworks, Accountability Measures.

MODULE III CAPSTONE PROJECT AND ASSESSMENT   5
Project and Summative Assessment: Project Planning and Design, Solution Development, Testing and Debugging, Review and Refactoring, Project Documentation and Presentation, Summative Course-end Assessment.

LIST OF EXPERIMENTS

1. Design an optimized few-shot prompt that generates creative product descriptions while minimizing hallucinations and ensuring factual accuracy.
2. Develop a Java script that programmatically interacts with an LLM API to generate contextual customer support responses.
3. Create and evaluate different variations of a chain-of-thought prompt for summarizing long-form research papers, ensuring conciseness without losing key insights. Compare the performance with a direct summarization prompt.
4. Implement an interactive chatbot using OpenAI API that refines user-generated prompts. Use the ReAct prompting method to enable reasoning and error correction before responding to the user.
5. Build an API-driven workflow in Java that automates blog content generation and stores the output in a database.
6. Develop an automation pipeline that takes raw user feedback, processes it using sentiment analysis, and categorizes responses for actionable insights. Use chain-of-thought reasoning to improve the classification of nuanced responses.
7. Integrate multiple AI models (e.g., OpenAI + Hugging Face) in a workflow to generate content followed by toxicity detection.
8. Implement a Java-based few-shot language translation tool using an LLM API and evaluate its performance across different dialects.
9. Develop an AI-driven resume screening tool that extracts and classifies key information from job applications

TOTAL PERIODS (LAB) 60

TOTAL PERIODS 75

Text books:	
1.	"You Look Like a Thing and I Love You" by Janelle Shane (for ethical perspectives).
2.	OpenAI, Anthropic, or Cohere documentation for prompt engineering and API usage.
3.	"Hands-On GenAI with Python" (online resources / platforms like GitHub & Medium tutorials).

Reference books:	
1.	Hugging Face API and Inference Documentation.
2.	Ethical AI resources from Google, IBM, and Partnership on AI.
3.	Flask and Fast API documentation for real-world web integration.

23AD901	DATA STORYTELLING AND VISUALIZATION	2/0/2/3
Nature of Course	M (Practical Application)	
Prerequisites	-	

Course Objectives:

1	To introduce learners to the fundamentals of data types, Excel functions, and spreadsheet operations.
2	To train learners in data cleaning, transformation, and preparation techniques using Excel tools.
3	To analyze data summarization using PivotTables and apply basic statistical concepts.
4	To understand in creating effective data visualizations to represent patterns, trends, and outliers.
5	To express the ability to craft compelling data narratives using dashboards and visual summaries.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C901.1	Identify data categories and apply essential Excel functions to manipulate data efficiently	[U]
C901.2	Apply cleaning and transformation techniques to prepare datasets for analysis.	[AP]
C901.3	Generate summaries and insights using PivotTables and basic statistical techniques.	[AP]
C901.4	Evaluate meaningful visualizations for descriptive data analysis.	[AP]
C901.5	Design a real-world data storytelling project using dashboards and visual narratives based on industry-oriented practices.	[AP]

MODULE I EXCEL DATA HANDLING AND FUNCTIONS   10

Data Types and Functions - Data categories, structured vs. unstructured, XLOOKUP(), IF(), SUMIF(), SUMIFS, COUNTIF(), COUNTIFS, AVERAGEIF(), Logical Operators. Data Import and Cleanup – Import from text, remove blanks, trim, find and replace, remove duplicates.

MODULE II ANALYSIS WITH PIVOTTABLES AND VISUAL TECHNIQUES   10

PivotTables and Charts - Grouping, filtering, calculated fields, PivotCharts, Central Tendency Analysis - Mean, median, mode. Outlier Detection - Visual spotting, IQR, z-score basics - Bar and Column Charts - Categorical comparisons, stacked vs. clustered. Pie and Donut Charts - Composition representation. Histograms and Scatterplots - Distribution analysis, pattern recognition. Trend Lines and Custom Formatting - Forecasting, dynamic visuals.

MODULE III DATA STORYTELLING, CORRELATION AND ASSESSMENTS   10

Correlation and Spread – Variance, standard deviation, correlation coefficient. Storytelling with Data – Visual hierarchy, narrative building. Dashboard Design – Layout planning, dashboards, slicers, interactivity, interpretation - Apply storytelling techniques to a real-world dataset using Excel to design an interactive dashboard and narrative presentation.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS:

1. Classify different data types and apply functions like XLOOKUP, COUNTIF, and IF to perform logical operations for a given business scenario.
2. Import messy data from CSV/TEXT and clean it using trimming, find & replace, and removal of duplicates.
3. Create a PivotTable to summarize sales data by category, region, and time.
4. Generate a PivotChart to compare product performance across quarters.
5. Plot bar and pie charts using cleaned data to depict category-wise sales contribution.
6. Use histogram and scatter plot to analyze data spread and identify correlation.
7. Apply statistical formulas to calculate mean, median, mode, and detect outliers.
8. Design a multi-section Excel dashboard using slicers, conditional formatting, and charts.
9. Narrate a short data story integrating visuals and insights derived from an Excel analysis.
10. Apply data cleaning, pre-processing, visualization and storytelling techniques to a real-world dataset using Excel to design an interactive dashboard.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text books:

1.	"Data Visualization with Excel Dashboards and Reports" – Dick Kusleika.
2.	"Storytelling with Data: A Data Visualization Guide for Business Professionals" – Cole Nussbaumer Knaflic.

Reference books:

1.	Microsoft Excel Online Documentation.
2.	Blogs and Tutorials on Excel PivotTables, Charts, and Dashboards.
3.	Data storytelling case studies and online courses (LinkedIn Learning, Coursera).

23AD903	**PROBLEM SOLVING WITH ANALYTICAL & DESIGN THINKING**	**2/0/2/3**

Nature of Course	F (Theory Programming)
Prerequisites	Nil

Course Objectives:

1	To identify and deconstruct real-world problems through root cause analysis and user-centric research.
2	To generate innovative ideas using structured ideation techniques and frame actionable problem statements.
3	To organize, prioritize, and visualize ideas through the creation of rapid prototypes and user flow mockups.
4	To explore solutions with users and refine designs through iterative feedback and continuous improvement.
5	To design and present real-world solutions and plan further improvements through collaborative decision- making.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C903.1	Identify root causes of real-world problems and build user empathy through research tools and techniques.	[AN]
C903.2	Generate multiple creative solutions and translate user needs into actionable problem statements.	[AN]
C903.3	Organize and prioritise ideas using mapping tools and create low-fidelity prototypes.	[AN]
C903.4	Conduct usability testing and refine designs based on structured user feedback and observation.	[AN]
C903.5	Apply analytical and design thinking practices in an end-to-end industry-oriented problem-solving project.	[AP]

MODULE I PROBLEM DISCOVERY AND RESEARCH   10

Problem Identification & Understanding – Spot surface-level vs deeper issues – Apply 5 Whys and Fishbone tools – Break down complex challenges – Frame a clear problem statement. Understanding the User's World – Create Empathy Maps – Draft User Journey Maps – Identify pain points and behavior patterns – Use journey maps to define the real problem. Defining the Problem Statement – Synthesise key user insights – Frame a Point of View (POV) – Write focused ‾How Might We‖ questions – Align problem with user/business needs.

MODULE II IDEATION, PROTOTYPING AND VISUALISATION   10

Generating Potential Solutions – Run Crazy 8s sketch activity – Use SCAMPER technique Build on team ideas – Avoid early filtering or judging. Prioritising & Organising Ideas – Cluster ideas using Affinity Mapping – Build early process flows – Use Impact-Effort matrix – Select one idea to pursue. Translate ideas into quick draft – Sketch step-by-step user flows – Draw simple screen layouts – Build quick paper-based mockups – Walk others through the concept.

MODULE III TESTING, REFINEMENT AND FINAL PROJECT EXECUTION   10

Testing with Users – Conduct usability tests – Use Think-Aloud Protocol – Observe and take silent notes – Identify confusion or friction points. Refine designs using user feedback – Identify what to improve from feedback – Prioritise using Impact-Effort mapping – Document decisions in a changelog – Refine prototypes. **Final Project Execution** – Project and Summative Assessment involving real-world problem definition, user research, ideation, prototyping, testing, and final presentation.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS

1. Root Cause Analysis: Use 5 Whys and Fishbone diagram to identify the core of a given problem.
2. Empathy Mapping: Create empathy maps and journey maps based on user interviews or personas.
3. Problem Framing: Write Point of View (POV) statements and corresponding ‾How Might We‖ questions.
4. Idea Generation: Conduct a Crazy 8s activity to generate 8 creative solutions in 8 minutes.
5. SCAMPER Exercise: Apply SCAMPER technique to improve an existing product or service.
6. Idea Prioritisation: Use Affinity Mapping and Impact-Effort Matrix to select a feasible solution.
7. Prototyping: Build a low-fidelity paper prototype and prepare a walk-through of the concept.
8. User Testing: Conduct Think-Aloud usability testing with 2-3 users and document observations.
9. Iteration Log: Maintain a changelog to record design decisions and refinements based on feedback.
10. Mini Project: Execute a mini end-to-end design sprint (Empathize → Define → Ideate → Prototype → Test) on a campus or community problem.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text books:

1.	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business.
2.	Jeanne Liedtka, Design Thinking for the Greater Good: Innovation in the Social Sector, Columbia Business School Publishing.

Reference books:

1.	Microsoft Excel Online Documentation.
2.	Blogs and Tutorials on Excel PivotTables, Charts, and Dashboards.
3.	Data storytelling case studies and online courses (LinkedIn Learning, Coursera).

23AD904	POWER BI	2/0/2/3

Nature of Course	M (Practical Application)
Prerequisites	-

Course Objectives:

1	To identify the complete workflow of extracting, cleaning, and transforming data using Power Query.
2	To gain knowledge in preparing structured datasets and designing efficient data models for scalable analytics.
3	To understand the use of DAX expressions for aggregations, measures, and implementing business logic.
4	To be familiar with the process of designing interactive dashboards and applying effective data storytelling techniques.
5	To analyse AI-powered analytics features and the secure publishing and management of Power BI reports for collaboration.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C904.1	Extract, clean, and transform raw datasets using Power Query and ETL features in Power BI.	[AN]
C904.2	Structure data and implement robust data models for performance and scalability.	[AN]
C904.3	Use DAX to build dynamic metrics, perform business calculations, and derive insights.	[AP]
C904.4	Design compelling dashboards with interactive visuals for effective data storytelling.	[C]
C904.5	Apply advanced DAX and AI analytics to generate predictive insights and deliver a course-end project simulating real business reporting.	[AP]

MODULE I DATA PREPARATION AND TRANSFORMATION   **10**

Data Extraction and Transformation - Power Query Editor- ETL techniques - connecting to data sources - cleansing and shaping data. Data Preparation and Structuring - Handling missing data - data types - appending and merging queries - data formatting best practices. Data Modeling and Optimization - Creating Relationships - star and snowflakes schema design - calculated columns – role playing dimensions.

MODULE II MODELING AND DAX CALCULATIONS   **10**

Model Optimization - Relationship management - model size reduction - use of aggregations - performance tuning. Basic DAX Calculations – Syntax - calculated columns vs measures – aggregations- conditional – logical - time intelligence functions. Advanced DAX - Context transition, CALCULATE -FILTER, scenario-based analysis, KPIs.

MODULE III REPORTING, VISUALIZATION AND PROJECT EXECUTION   **10**

Data Visualization and Storytelling – Chart selection - visual formatting – narrative driven dashboards – drill through - bookmarks. Interactive Reports - Slicers - filters - tooltips - buttons - custom visuals - cross-filtering. AI-Powered Analytics - Q&A visuals - Smart Narrative - Decomposition Tree - Key Influencers. Project and Summative Assessment including DAX model building - interactive dashboard creation - AI insights - and secure report sharing.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS:

1. Data Cleaning in Power Query: Load a messy CSV and perform basic cleaning such as removing nulls, renaming columns, and filtering rows.
2. ETL Workflow: Connect multiple data sources (CSV, Excel), perform merge and append operations in Power Query.
3. Model Creation: Create fact and dimension tables from the dataset and establish relationships for a sales dashboard.
4. Calculated Columns and Measures: Use DAX to create calculated columns (e.g., Profit = Sales - Cost) and dynamic measures (e.g., Year-over-Year Growth).
5. Time Intelligence: Create Month-to-Date and Year-to-Date measures using DAX time intelligence functions.
6. Dashboard Design: Develop a sales performance dashboard using line charts, KPI cards, slicers, and bar charts.
7. Drill-through and Bookmarks: Add page navigation and drill-through capabilities to a dashboard with customized tooltips.
8. AI Insights Integration: Use decomposition tree and key influencers visuals for AI-assisted insights.
9. Secure Report Publishing: Publish a report to Power BI Service, set access controls, and schedule data refresh.
10. Mini Capstone Project: Execute a complete reporting cycle including data cleaning, modelling, DAX, visualization, and secure publishing for a retail business use case.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text books:

1.	Alberto Ferrari & Marco Russo, The Definitive Guide to DAX: Business intelligence with Microsoft Excel, SQL Server Analysis Services, and Power BI, Microsoft Press.
2.	Daniil Maslyuk, Mastering Microsoft Power BI, Packt Publishing.

Reference books:

1.	Reza Rad, Power BI from Rookie to Rock Star, RADACAD.
2.	Ruth Pozuelo Martinez, Learning Power BI, Curbal.
3.	Official Microsoft Power BI Documentation and Community resources.

23CS901	**IMPLEMENTING AND ADMINISTERING ENTERPRISE NETWORKS**	**2/0/2/3**
Nature of Course	D (Theory Application)	
Pre-requisite(s)	Nil	

Course Objectives:	
1	To introduce the fundamentals of network design using OSI and TCP/IP models for various networking scenarios.
2	To develop logical networking skills for small to large-scale networks including LAN, MAN, and WAN environments.
3	To train learners to configure routers and switches using Cisco's Internetworking Operating System (IOS).
4	To equip students with skills in network traffic monitoring, analysis, and troubleshooting using industry- grade tools.
5	To familiarize learners with the use of GenAI tools in detecting network anomalies and strengthening network security.

Course Outcomes:

Upon completion of the course, students shall have ability to

C901.1	Analyse communication protocols using OSI and TCP/IP models and apply them to design efficient networks.	[AN]
C901.2	Design and implement logical networks for LAN, MAN, and WAN using simulation and configuration tools.	[AP]
C901.3	Configure routers and switches using Cisco IOS to establish and secure reliable network connectivity.	[AP]
C901.4	Troubleshoot and optimize network performance using techniques like subnetting, partitioning, and IP planning.	[AN]
C901.5	Build an end-to-end network project integrating GenAI-based anomaly detection with tools like Wireshark and SNMP, adhering to industry practices.	[AP]

MODULE I NETWORK FOUNDATIONS AND LOGICAL NETWORK DESIGN   **10**

OSI and TCP/IP models, data encapsulation and de-encapsulation, Ethernet standards, types of cables and connectors, network interface devices, switching basics, collision and broadcast domains, LAN, MAN, WAN architectures, IP addressing and subnetting, VLSM and CIDR, network partitioning, logical topology planning, VLAN creation and configuration, trunking and inter-VLAN routing.

MODULE II ROUTING AND SWITCHING   **10**

Router and switch boot process, Cisco IOS command-line interface, static routing, RIP and OSPF configuration, routing table management, switch configuration, MAC address tables, port security settings,

MODULE III NETWORK ANALYSIS & ANOMALY DETECTION   **10**

Traffic sniffing using Wireshark, protocol and packet analysis, identifying latency and packet loss, SNMP-based monitoring with Zabbix, event correlation, GenAI-based anomaly detection, alert generation and reporting. End-to-end network design and simulation, router and switch configuration, traffic monitoring using Wireshark, integration of GenAI
tools for anomaly detection, documentation and reporting of findings.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENT:

1. Simulate OSI layer communication using Packet Tracer and analyze encapsulation and de-encapsulation at each layer.
2. Design a LAN topology in GNS3 and assign static IPs to configure connectivity among nodes.
3. Perform subnetting and configure appropriate addressing schemes for segmented networks.
4. Create and configure VLANs and enable inter-VLAN routing in a switch-based topology.
5. Configure and verify static routing and RIP protocol on multiple routers.
6. Use Wireshark to capture live packets, filter protocols like ICMP, HTTP, DNS, and analyze headers.
7. Diagnose network issues using tools like ping, traceroute, and show commands in Cisco IOS.
8. Monitor network performance using Zabbix with SNMP configurations to track CPU, memory, and interface traffic.
9. Detect and classify network anomalies using GenAI prompts applied to Wireshark data logs.
10. Complete an integrated project to design, configure, monitor, and report on a secure and efficient network using simulation and GenAI tools.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text books:		
1.	Behrouz A. Forouzan, Data Communications and Networking‖, 5th Edition, McGraw-Hill Education, 2017	
2.	William Stallings, Network Security Essentials: Applications and Standards‖, 6th Edition, Pearson, 2016	
Reference books:		
1.	Wayne Lewis, Cisco Certified Network Associate (CCNA) Routing and Switching 200-120 Official Cert Guide Library‖, Cisco Press, 2013	
2.	Richard Deal, CCNA Routing and Switching Portable Command Guide‖, 4th Edition, Cisco Press, 2016	
3.	Chris Sanders, Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems‖, 3rd Edition, No Starch Press, 2007	

23CS902	**LINUX SYSTEM ADMINISTRATION**	**2/0/2/3**
Nature of Course	D (Theory Application)	
Pre-requisite(s)	Nil	

Course Objectives:

1	To introduce learners to Linux system architecture, essential commands, and shell environment.
2	To equip students with skills to install Linux distributions, manage partitions, and configure file systems.
3	To enable management of users, groups, permissions, services, and disk operations.
4	To teach automation of administrative tasks using Bash scripting and GenAI tools.
5	To train learners to configure network services, implement security hardening, and centralized monitoring in a Linux environment.

Course Outcomes:

Upon completion of the course, students shall have ability to

C902.1	Install and configure Linux systems with manual disk partitioning and filesystem setup.	[AP]
C902.2	Manage users, groups, files, permissions, and services for secure system operations.	[AN]
C902.3	Troubleshoot Linux services and processes to maintain availability and performance.	[AN]
C902.4	Automate administrative tasks using Bash scripting and integrate GenAI tools effectively.	[AN]
C902.5	Complete a capstone project applying Linux administration concepts and industry practices in a simulated environment.	[AN]

MODULE I LINUX INSTALLATION AND USER MANAGEMENT　　　　　　　　　**10**

Linux installation using ISO files, manual disk partitioning, Linux boot process, file system structure and types, working with mount and unmount commands, terminal usage and basic Linux commands, package management in Debian and RedHat systems, User and group management, setting file and directory permissions using chmod and chown, managing access control lists (ACL), disk partitioning using fdisk and parted, managing Linux processes and services, service status monitoring using systemctl and journalctl.

MODULE II AUTOMATION AND SHELL SCRIPTING　　　　　　　　　　　**10**

Writing and debugging Bash scripts, automating routine tasks with cron and at, managing process priorities using nice and renice, multitasking in shell, system update and upgrade operations, using GenAI tools to generate Linux administrative scripts,

MODULE III NETWORKING AND MONITORING SERVICES　　　　　　　　　**10**

Configuring network interfaces and services, using nmtui and Network Manager, implementing DHCP and DNS services, enabling remote access with SSH and RDP, centralized logging with rsyslog and syslog-ng, log management using logrotate, SNMP-based monitoring using Zabbix.Capstone project integrating Linux installation, configuration, service management, scripting, and monitoring tasks, demonstrating real-world system administration and automation practices using VirtualBox, GenAI, and remote tools.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS:

1. Install Ubuntu or CentOS with manual partitioning using VirtualBox.
2. Create, modify, and delete users and groups, and enforce password aging policies.
3. Configure and test file and directory permissions using chmod, chown, and ACL
4. Partition disks and create file systems using fdisk, mkfs, and mount them manually.
5. Monitor and restart services using systemctl and diagnose logs using journalctl
6. Write a Bash script to automate the creation of users and configuration of a firewall
7. Schedule automated backup tasks using cron and implement basic recovery with rsync
8. Configure static IPs, test DHCP and DNS settings, and access systems remotely via SSH

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text books:

1.	Tommy Singleton, ‖Linux Administration Handbook‖, 2nd Edition, Pearson Education, 2006
2.	Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, ‖UNIX and Linux System Administration Handbook‖, 5th Edition, Pearson, 2017
3.	Nemeth, Hein, Snyder, Whaley, ‖Linux Administration: A Beginner's Guide‖, 8th Edition, McGraw-Hill Education, 2020

Reference books:

1.	William E. Shotts Jr., ‖The Linux Command Line: A Complete Introduction‖, No Starch Press, 2012.
2.	Mark G. Sobell, ‖A Practical Guide to Linux Commands, Editors, and Shell Programming‖, 4th Edition, Pearson, 2017

23CS903	INFORMATION SECURITY SYSTEMS	2/0/2/3
Nature of Course	D (Theory Application)	
Pre-requisite(s)	Nil	

Course Objectives:

1	To introduce learners to the foundational principles and core objectives of information security, including the CIA triad, asset protection, and risk assessment methodologies.
2	To train students to implement secure authentication and enforce access control mechanisms in enterprise systems.
3	To equip learners with knowledge and tools to build secure network perimeters using firewalls, IDS/IPS systems, and encrypted communication protocols.
4	To enable students to understand and apply cryptographic techniques for secure data exchange and identity verification.
5	To leverage GenAI tools to enhance threat detection, malware analysis, and develop real-world security responses.

Course Outcomes:

Upon completion of the course, students shall have ability to

C903.1	Explain the CIA triad, conduct risk assessments, and align security implementations with industry standards.	[U]
C903.2	Design and enforce authentication policies using passwords, hashing techniques, and multi-factor authentication.	[AP]
C903.3	Configure and manage network security defences such as firewalls, IDS/IPS, and VPNs to prevent external threats.	[AN]
C903.4	Apply symmetric and asymmetric cryptography, generate keys, and secure data using encryption, digital signatures, and PKI.	[AP]
C903.5	Use GenAI and open-source tools to analyse and mitigate malware threats and implement security controls in practical scenarios.	[AP]

MODULE I FUNDAMENTALS OF INFORMATION SECURITY   10

CIA triad concepts, assets and vulnerabilities, threats and attacks, security goals and objectives, risk analysis methods, information security frameworks and compliance standards (ISO 27001, NIST), security governance and security policiesm,Password policy enforcement, hashing and salting, multi-factor authentication methods, access control models (MAC, DAC, RBAC), implementation of IAM (Identity and Access Management), directory services, SSO integration.

MODULE II NETWORK PERIMETER PROTECTION   10

Firewall types and configuration (stateful, stateless), VPN setup and tunneling protocols, IDS/IPS concepts and implementation (Snort, Suricata), secure network protocol usage (SSH, HTTPS, SFTP), transport layer security, port scanning and hardening,

MODULE III CRYPTOGRAPHY AND DATA SECURITY   10

Symmetric and asymmetric encryption techniques (AES, RSA), hashing algorithms (SHA, MD5), Kerberos, LDAP, digital signature generation and verification, public key infrastructure (PKI), usage of OpenSSL for encryption and signing, certificate generation and validation. Capstone project on secure system design including cryptographic implementation, firewall and VPN setup, malware traffic detection using GenAI-based tools. Summative evaluation through documentation, testing, and practical defense strategy presentation.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS:

1. Analyse and document security gaps in a given system using the CIA triad model
2. Implement password hashing using SHA256 and validate salted hash results
3. Set up multi-factor authentication using tools like Google Authenticator or DUO
4. Simulate RBAC (Role-Based Access Control) in a Linux or web application environment
5. Configure iptables or pfSense to create firewall rules and log denied packets
6. Capture and analyse potentially malicious traffic using Wireshark filters
7. Encrypt and decrypt sensitive files using OpenSSL command-line utilities
8. Create and use public/private key pairs for signing and verification tasks
9. Use a GenAI-based tool to simulate malware detection and analyse log patterns
10. Final integrated project to demonstrate understanding of access control, cryptographic security, and perimeter defence mechanisms.

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text books:

1.	William Stallings, ¯Cryptography and Network Security: Principles and Practice‖, 8th Edition, Pearson Education, 2023
2.	Michael E. Whitman and Herbert J. Mattord, ¯Principles of Information Security‖, 7th Edition, Cengage Learning, 2023
3.	Shon Harris and Fernando Maymi, ¯CISSP All-in-One Exam Guide‖, 8th Edition, McGraw Hill Education, 2019

Reference books:

1.	Behrouz A. Forouzan, ¯Cryptography and Network Security‖, McGraw Hill Education, 2007
2.	Mark Rhodes-Ousley, ¯Information Security: The Complete Reference‖, 2nd Edition, McGraw Hill Education, 2012
3.	Nitesh Dhanjani, ¯Network Security Tools: Writing, Hacking, and Modifying Security Tools‖, O'Reilly Media, 2005

23CS904	LOW-CODE NO-CODE APPLICATION BUILDING	2/0/2/3
Nature of Course	D (Theory Application)	
Pre-requisite(s)	Nil	

Course Objectives:

1	To grasp foundational concepts such as programming logic techniques, databases, user interface elements, and basic application logic to create robust LCNC solutions.
2	To get familiar with LCNC tools, HTML5/CSS3, ChatGPT, and discover their applications in streamlining development.
3	To create form-based applications with customized user interfaces for data collection and analysis.
4	To build workflow-driven applications that optimize business processes using automation triggers and logic.
5	To design and customize reports within LCNC applications to effectively visualize and communicate data insights.

Course Outcomes:

Upon completion of the course, students shall have ability to

C904.1	Explain LCNC development principles, identify use cases, and select suitable tools and techniques.	[AN]
C904.2	Design user interfaces and develop applications using drag-and-drop components and responsive layout techniques.	[AP]
C904.3	Develop dynamic form-based applications with validation, conditional logic, and data collection.	[AN]
C904.4	Integrate APIs and configure workflow automation using triggers and business logic.	[AN]
C904.5	Visualize application data using built-in reporting tools and finalize a comprehensive project solution.	[AN]

MODULE I FOUNDATIONS OF LCNC AND UI DESIGN   10

Low-code no-code principles, citizen development and its role in business, benefits and limitations of LCNC, programming logic concepts, working with databases and user interface elements, overview of LCNC platforms, basic HTML5 and CSS3 for customization, ChatGPT for assistance in development, API integration basics, fundamentals of user-centered design, creating responsive interfaces, visual hierarchy and usability principles,

MODULE II WORKFLOW AUTOMATION AND DATA VISUALIZATION   10

Form design using LCNC platforms, dynamic fields and conditional logic, multi-step forms and layout optimization, input validation and error handling, designing application logic, process automation through workflows, creating and managing custom triggers, integrating external services into workflows, debugging and optimizing automated processes. Designing and embedding interactive dashboards, choosing effective visualization types, working with real-time data sources, report creation and layout customization, grouping and filtering data, using built-in connectors for cloud services, configuring custom APIs for data fetch and sync, troubleshooting integration issues, testing system interoperability and performance,

MODULE III ROLE-BASED ACCESS AND SECURITY PRACTICES   10

User authentication techniques, configuring user roles and access permissions, implementing secure data handling and validation, best practices in managing application sessions and credentials, audit logging and activity tracking, protecting APIs and third-party integrations, enforcing secure deployment

guidelines across LCNC applications. Final capstone project integrating UI design, form development, workflow automation, API integration, and reporting, project planning and scope definition, iterative development and testing, debugging and error resolution, final deployment and presentation, course-end summative assessment and individual reflection.

TOTAL PERIODS(Theory) 30

LIST OF EXPERIMENTS:

1. Create a simple LCNC-based application to collect user data using form components
2. Design a responsive user interface layout with text fields, dropdowns, and buttons.
3. Implement form validation rules and configure multi-step navigation between form sections.
4. Automate a workflow that sends notifications based on form submissions using triggers
5. Create dynamic dashboards with charts to visualize collected data in real-time
6. Integrate a third-party API into your application and display external data in a table
7. Build and export a custom report with filtered and grouped data insights
8. Use a GenAI tool like ChatGPT to generate field logic and UI text recommendations
9. Configure user roles, permissions, and access control for multi-level users.
10. Develop a capstone LCNC project integrating forms, workflows, API calls, and reporting features

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text books:	
1.	Lim Mei Ying, Sriram Krishnan, ̄Low-Code Application Development with Appian‖, 1st Edition, Packt Publishing, 2022.
2.	Mark Goodyear, ̄HTML5 and CSS3: Visual QuickStart Guide‖, Peachpit Press, 2011.
3.	Jan Vanthienen and Monique Snoeck, ̄Low-Code Development: A Practical Guide for Business Transformation‖, Springer, 2021
Reference books:	
1.	Matt Cavanagh, ̄Building Low-Code Applications with Mendix‖, 1st Edition, Packt Publishing, 2021.
2.	Jon Duckett, ̄HTML and CSS: Design and Build Websites‖, 1st Edition, Wiley, 2011.
3.	Vijay Kumar Velu, Robert Beggs, ̄Mastering Kali Linux for Advanced Penetration Testing‖, 3rd Edition, Packt Publishing, 2019

23CS905	VIRTUALIZATION, CLOUD COMPUTING & SYSOPS	1/0/4/3
Nature of the Course	F (Theory Programming)	
Pre-requisite(s)	Nil	

Course Objectives:

1	To understand core principles of IT virtualization, containerization, and cloud computing.
2	To learn to implement and manage virtualized infrastructure and storage systems.
3	To use Docker containers for efficient application deployment.
4	To explore AWS cloud services and architectures for scalable and resilient deployments.
5	To integrate GenAI tools for enhancing security and cloud operations.
6	To design and implement fault-tolerant cloud solutions with real-time use cases.

Course Outcomes:

Upon completion of the course, students shall have ability to

C905.1	Understand the foundational concepts of virtualization, containerization, and cloud deployment models.	[U]
C905.2	Implement and manage virtual machines, storage, and networking using hypervisors and cloud-based tools.	[AP]
C905.3	Explore containerization using Docker and distinguish it from traditional virtualization approaches.	[AN]
C905.4	Design secure and resilient cloud architectures using GenAI tools and AWS services.	[AP]
C905.5	Gain proficiency in AWS SysOps tasks including resource provisioning, automation, and infrastructure monitoring.	[AP]

MODULE I VIRTUALIZATION AND CLOUD FOUNDATIONS   **5**

Capital expenditure vs operational expenditure in IT, cloud deployment patterns and service models (IaaS, PaaS, SaaS), just-in-time provisioning concepts, hypervisor types and architecture, creating and managing virtual machines using VirtualBox, introduction to virtual storage and networking, types of virtual networks and configurations.

MODULE II CONTAINERIZATION AND INFRASTRUCTURE MANAGEMENT   **5**

Containerization fundamentals, how Docker differs from hypervisors, building Docker images with Dockerfile, running and managing Docker containers, creating and managing Docker networks, use cases for containerized workloads, integrating containers in cloud environments.

Utilizing GenAI tools for security analysis and compliance, introduction to AWS cloud infrastructure, regions and availability zones, AWS identity and access management (IAM), managing user accounts and billing with AWS Organizations, designing and implementing secure Virtual Private Clouds (VPC), configuring access control and network segmentation, introduction to CloudTrail for auditing.

MODULE III SYSOPS ON AWS AND SCALABLE DEPLOYMENTS   **5**

Provisioning applications on AWS using EC2, managing block storage with EBS, hosting static data using S3, working with RDS for relational databases, configuring auto-scaling and load balancing, monitoring services with AWS tools, deploying fault-tolerant architectures using AWS services, hands-on experience with real-time deployment and infrastructure automation. Final project focused on designing, implementing, and deploying a secure and scalable cloud-native application, infrastructure planning using VirtualBox and AWS, integration of Docker containers, applying GenAI tools for security

evaluation, monitoring and optimization, project documentation, presentation, and summative evaluation.

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS:

1. Install and configure VirtualBox to create and manage multiple virtual machines.
2. Design and deploy a virtual network using host-only and bridged network adapters in VirtualBox
3. Set up and test Docker containers by creating a Dockerfile and launching multi-container applications
4. Create custom Docker networks and connect multiple containers for inter-container communication
5. Provision and configure an EC2 instance on AWS and access it using SSH.
6. Create and attach Elastic Block Store (EBS) volumes to EC2 instances and perform mount operations
7. Design and deploy a Virtual Private Cloud (VPC) with public and private subnets using AWS.
8. Use AWS IAM to create users, groups, and policies, and test access control scenarios
9. Enable and analyze CloudTrail logs for auditing AWS account activities
10. Plan and execute a project to deploy a secure, fault-tolerant web application using EC2, S3, RDS, and Docker containers.

TOTAL PERIODS (LAB) 60

TOTAL PERIODS 75

Text books:		
1.	Tom Clark , ‾Designing and Implementing Linux Virtualization‖, Packt Publishing,
2.	Karl Matthias, Sean P. Kane ,‖Docker: Up & Running: Shipping Reliable Containers in Production‖, 3rd Edition O'Reilly Media, 2023.
3.	Michael Wittig, Andreas Wittig, ‾Amazon Web Services in Action‖, 3rd Edition Manning Publications, 2023.
Reference books:		
1.	James Turnbull, ‾The Docker Book: Containerization is the New Virtualization‖, Turnbull Press, 1st Edition, 2019.
2.	Eric Ligman, ‾AWS Certified SysOps Administrator Official Study Guide‖, Wiley, 2017.
3.	Stuart Scott, ‾AWS Certified Solutions Architect Study Guide: Associate (SAA-C03) Exam‖, 4th Edition, Wiley, 2022.

23CS906	**CONTINUOUS MONITORING AND OBSERVABILITY**	**1/0/4/3**
Nature of Course	F (Theory Programming)	
Pre-requisite(s)	Nil	

Course Objectives:

1	To understand the need for configuration management and infrastructure as code in cloud environments.
2	To learn to automate server configurations using Ansible and manage resources through AWS CloudFormation.
3	To apply observability principles to monitor AWS infrastructure using CloudWatch metrics, events, and alarms.
4	To configure monitoring dashboards and set up alerting mechanisms for proactive cloud operations.
5	To analyse AWS logs to troubleshoot, detect issues, and implement response strategies using GenAI tools.

Course Outcomes:

Upon completion of the course, students shall have ability to

C906.1	Understand the fundamentals of Configuration Management and Infrastructure as Code using Ansible and AWS CloudFormation.	[U]
C906.2	Apply Ansible to automate configuration tasks and manage cloud inventory using playbooks, variables, and modules.	[AP]
C906.3	Develop proficiency in designing and deploying AWS infrastructure using CloudFormation templates and stacks.	[AN]
C906.4	Monitor AWS infrastructure by setting up CloudWatch dashboards, custom metrics, events, and alarms.	[AN]
C906.5	Analyse AWS logs to detect patterns, optimize performance, and ensure system health.	[AN]

MODULE I CONFIGURATION MANAGEMENT WITH ANSIBLE   **5**

Introduction to Configuration Management, Introduction to Ansible, Defining Inventory Files, Ansible Playbooks, Group and Host Variables, Ansible Modules and Galaxy,

MODULE II INFRASTRUCTURE AUTOMATION AND MONITORING AWS INFRASTRUCTURE   **5**

AWS CloudFormation Overview, Writing YAML Templates, Defining Resources, Stack Management, Template Validation, Updating and Deleting Stacks, Linting Best Practices. Introduction to Observability, AWS CloudWatch Metrics, Creating Dashboards, Monitoring EC2, EBS, RDS, ELB, Creating Custom Metrics, Common Graphs and Visualizations.

MODULE III CLOUDWATCH EVENTS, LOGS, AND ALERTS   **5**

CloudWatch Events and Triggers, setting up Alarms, Using AWS Logs for Troubleshooting, Log Insights, Automating Alert Responses, Using GenAI for Alert Analysis. Real-world implementation of monitoring solution using Ansible and CloudFormation, with complete observability via CloudWatch. Includes alert configuration and log analysis using GenAI.

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS:

1. Install and configure Ansible on a Linux system and define a basic inventory file.
2. Write and execute an Ansible playbook to configure Apache web server on EC2 instances.
3. Use Ansible variables and handlers to customize service deployment and restart services on change
4. Create a CloudFormation template to deploy an EC2 instance and attach an EBS volume
5. Validate and deploy a CloudFormation stack and update it to reflect infrastructure changes
6. Set up CloudWatch to monitor EC2 instance metrics and create a custom dashboard
7. Configure CloudWatch to collect and display metrics for EBS, RDS, and ELB services
8. Create a CloudWatch alarm to notify when CPU utilization exceeds a defined threshold
9. Analyse AWS CloudTrail logs to track API activities and detect unauthorized changes
10. Simulate and respond to an infrastructure alert using automation and observability best practices

TOTAL PERIODS (LAB) 60

TOTAL PERIODS 75

Text books:	
1	Jeff Geerling, ¯Ansible for DevOps: Server and Configuration Management for Humans‖, 1st Edition, Midwestern Mac, 2015.
2	Michael Wittig, Andreas Wittig, ¯Amazon Web Services in Action‖, 3rd Edition, Manning Publications, 2023.
3	Lorin Hochstein, ¯Ansible: Up and Running – Automating Configuration Management and Deployment the Easy Way‖,3rd Edition, O'Reilly Media, 2022.
Reference books:	
1	Kief Morris, ¯Infrastructure as Code: Dynamic Systems for the Cloud Age‖, 2nd Edition, O'Reilly Media, 2020.
2	Eric Ligman, ¯AWS Certified SysOps Administrator Official Study Guide‖, 3rd Edition, Wiley, 2024.
3	Mike Julian, ¯Practical Monitoring: Effective Strategies for the Real World‖, 1st Edition, O'Reilly Media, 2017.

23CY901	CLOUD COMPUTING AND CONTAINERIZED VIRTUAL INFRASTRUCTURE	2/0/2/3
Nature of Course	D (Theory Application)	
Pre-requisite(s)	Nil	

Course Objectives:

1	To understand the fundamental concepts of cloud computing, virtualization, and containerization.
2	To learn to deploy and manage virtual machines using hypervisor technologies.
3	To explore virtual networking and storage concepts in a cloud-based environment.
4	To implement containerization using Docker for lightweight and scalable workload management.
5	To apply GenAI tools to enhance cloud infrastructure security and risk analysis

Course Outcomes:

Upon completion of the course, students shall have ability to

C901.1	Explain cloud computing models, virtualization techniques, and infrastructure provisioning.	[U]
C901.2	Deploy and manage virtual machines using tools like VirtualBox.	[AP]
C901.3	Configure and manage virtual storage and networking systems.	[AP]
C901.4	Build and manage containerized applications using Docker.	[AP]
C901.5	Secure containerized and virtualized environments using GenAI-powered tools.	[AP]

MODULE I CLOUD COMPUTING AND VIRTUALIZATION CONCEPTS **10**

Capital Expenditure vs. Operational Expenditure, Cloud Deployment Patterns, Service Models (IaaS, PaaS, SaaS), Just- in-Time Provisioning, Auto-scaling and Elasticity, Types of Hypervisors and their use cases

MODULE II VIRTUAL MACHINE, STORAGE MANAGEMENT AND DOCKER CONTAINERIZATION 10

Creating Virtual Machines using Oracle VirtualBox, Snapshot and Cloning, Resource Allocation and Optimization, Virtual Storage Concepts (Local and Remote), Creating and Managing Virtual Disks in Linux. Types of Virtual Networking (NAT, Bridged, Host-Only), IP Configuration and Access, Containerization with Docker, Docker vs. Hypervisors, Creating Docker Images with Dockerfile, Running and Networking Docker Containers,

MODULE III GENAI-DRIVEN CLOUD SECURITY **10**

Security Risks in Virtualized Infrastructure, Cloud Security Principles, Role-Based Access Control, Introduction to GenAI Tools for Threat Detection, GenAI-based Cloud Security Automation and Best Practices. Plan and implement a secure virtual and containerized cloud infrastructure; include hypervisors, Docker, and GenAI security components. Activities include architecture design, deployment, testing, documentation, and presentation.

TOTAL PERIODS (Theory) 30

LIST OF EXPERIMENTS:

1. Set up a virtual machine in Oracle VirtualBox and install a Linux OS

2. Simulate just-in-time provisioning and auto-scaling using cloud deployment tools

3. Configure virtual networks (NAT and bridged) and verify VM-to-VM connectivity

4. Attach and partition virtual storage in a Linux-based virtual machine.

5. Create a Dockerfile and build a custom container image

6. Deploy multiple Docker containers and link them via Docker networks

7. Set up port forwarding in Docker and expose containerized services

8. Compare and analyze resource usage between VMs and Docker containers

9. Use a GenAI tool to identify vulnerabilities in a containerized setup

10. Design and present a project on secure cloud infrastructure using virtualization and containers

TOTAL PERIODS (LAB) 30

TOTAL PERIODS 60

Text book:	
1	Virtualization Essentials – Matthew Portnoy, Wiley, 2nd Edition.
2	Docker: Up & Running – Shipping Reliable Containers in Production – Karl Matthias, Sean P. Kane, O'Reilly Media, 3rd Edition
3	Mastering Virtual Machine Manager 2019 – Sarmad Ali, Packt Publishing, Latest Edition.
Reference book:	
1	The Docker Book: Containerization is the New Virtualization – James Turnbull, Turnbull Press, Latest Edition.
2	AWS Certified SysOps Administrator Official Study Guide – Eric Ligman, Wiley, Latest Edition.
3	Practical Cloud Security: A Guide for Secure Design and Deployment – Chris Dotson, O'Reilly Media, Latest Edition.

23CY902	PENETRATION TESTING	1/0/4/3

Nature of Course	F (Theory Programming)
Prerequisite	Nil

Course Objectives:

1	To introduce students to ethical hacking principles, attack methodologies, and threat modeling.
2	To enable learners to identify and exploit operating system, network, and web application vulnerabilities.
3	To train students in using penetration testing tools and techniques to simulate real-world cyberattacks.
4	To empower learners to evaluate and bypass security controls like firewalls, IDS/IPS, and authentication mechanisms.
5	To enable learners to develop GenAI-based scripts for automated penetration testing and real-time vulnerability detection

Course Outcomes:

Upon completion of the course, students shall have ability to

C902.1	Understand core ethical hacking concepts, vulnerabilities, and enumeration techniques	[U]
C902.2	Perform targeted exploitation of operating systems, networks, applications, and web services.	[AP]
C902.3	Evaluate and optimize tools for penetration testing, privilege escalation, and post-exploitation.	[AN]
C902.4	Evaluate and enhance security control effectiveness using standard frameworks and GenAI tools.	[AN]
C902.5	Design and implement a comprehensive penetration testing project simulating real-world threat scenarios.	[AP]

MODULE I FUNDAMENTALS OF EXPLOITATION   **5**

Vulnerability Types and Exploits, System Enumeration Techniques, Operating System Attacks, Malware Threats and Payloads, Privilege Escalation Methods,

MODULE II WIRELESS EXPLOITS AND APPLICATION EXPLOITATION TECHNIQUES   **5**

Network Scanning and Mapping, Exploiting Network Vulnerabilities, Wireless Network Attacks, Bluetooth and Mobile Exploits, Sniffing, Spoofing, and Hijacking. Web Application Vulnerabilities, SQL Injection and XSS, API and Webhook Exploits, Web Shells and Backdoors, Bypassing Security Controls

MODULE III AUTOMATION AND GAP ANALYSIS   **5**

GenAI for Target Enumeration, Automated Exploit Scripting, Honeypots and Detection Evasion, Security Controls Mapping, NIST, CIS Benchmark Evaluation. Project and Summative Assessment – Learners will execute a full-scale penetration test project that includes reconnaissance, exploitation, automation using GenAI, and security control evaluation.

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS:

1. Perform enumeration and vulnerability scanning using Nmap and Nikto
2. Exploit an operating system vulnerability using Metasploit on Kali Linux
3. Bypass user authentication using password-cracking tools like Hydra or John the Ripper
4. Exploit a web application vulnerability such as SQL Injection or Cross-Site Scripting (XSS)
5. Simulate privilege escalation in a Linux or Windows environment
6. Capture and analyze network traffic using Wireshark for session hijacking
7. Exploit a vulnerable wireless network using tools like Aircrack-ng.
8. Develop a basic GenAI-assisted Python script for automated reconnaissance and scanning
9. Map enterprise security controls and analyze configuration gaps using OWASP and CIS benchmarks
10. Conduct a full-cycle penetration testing simulation including reporting and recommendations

TOTAL PERIODS (LAB) 60

TOTAL PERIODS 75

Text books:

1	The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws — Dafydd Stuttard, Marcus Pinto, Wiley, 2nd Edition.
2	Penetration Testing: A Hands-On Introduction to Hacking — Georgia Weidman, No Starch Press, Latest Edition.
3	Kali Linux Revealed: Mastering the Penetration Testing Distribution – Raphael Hertzog, Jim O'Gorman, Mati Aharoni, Offensive Security Press, Latest Edition.

Reference books:

1	The Hacker Playbook 3: Practical Guide To Penetration Testing — Peter Kim, Secure Planet LLC, Latest Edition.
2	Hacking: The Art of Exploitation – Jon Erickson, No Starch Press, 2nd Edition.
3	Metasploit: The Penetration Tester's Guide – David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni, No Starch Press, Latest Edition.

23CY903	SECURITY OPERATIONS OF INFORMATION SYSTEMS	1/0/4/3

Nature of Course	F (Theory Programming)
Prerequisite	Nil

Course Objectives:

1	To introduce foundational principles of incident response and security operations in modern information systems.
2	To train students to detect, respond to, and recover from various cybersecurity threats using real-time monitoring tools.
3	To equip learners with forensic investigation methods for effective threat identification and evidence preservation.
4	To enable students to apply and assess cybersecurity controls using industry frameworks like NIST and MITRE ATT&CK.
5	To guide learners in generating and automating incident response playbooks using GenAI and other modern tools.

Course Outcomes:

Upon completion of the course, students shall have ability to

C903.1	Describe the core concepts of incident response, policies, and operational security procedures	[U]
C903.2	Apply containment, eradication, and recovery strategies to manage cybersecurity incidents.	[AP]
C903.3	Investigate and analyze digital threats using forensic techniques and open-source tools.	[AN]
C903.4	Evaluate and improve GenAI-driven incident response playbooks based on threat scenarios.	[AN]
C903.5	Develop and present a functional SOC dashboard or case study applying threat detection and mitigation frameworks.	[AP]

MODULE I FOUNDATIONS OF INCIDENT RESPONSE   5

Incident types and lifecycle, Policy creation and compliance, Roles and responsibilities in IR, Stakeholder communication plan

MODULE II CONTAINMENT RECOVERY TACTICS AND FORENSICS INVESTIGATION SECURITY CONTROLS   5

Initial response procedures, Containment strategies, Eradication methods, Recovery and post-incident activities. Log collection and preservation, Host and network forensics, Chain of custody, Timeline analysis and documentation.

MODULE III GENAI INTEGRATION   5

Threat intelligence mapping, SIEM dashboards and alerts, Security control implementation, Playbook generation using GenAI. Develop and present an end-to-end SOC use-case scenario integrating SIEM, forensic investigation, and automated GenAI-based playbook.

TOTAL PERIODS (Theory) 15

LIST OF EXPERIMENTS:

1. Configure and deploy Wazuh SIEM and perform basic log ingestion
2. Create an incident response policy document tailored to a small enterprise.
3. Simulate a containment and eradication scenario using Linux or Windows systems
4. Collect and preserve forensic evidence from a compromised virtual machine
5. Use Wazuh to generate alerts for brute-force attacks and unauthorized access.
6. Integrate MITRE ATT&CK mappings into a SIEM dashboard for threat tracking
7. Develop a basic time-series chart from logs using Wazuh or ELK stack.
8. Generate a GenAI-assisted incident response playbook for ransomware.
9. Conduct a network traffic investigation and produce a report.
10. Design a custom SOC dashboard displaying security control effectiveness

TOTAL PERIODS (LAB) 60

TOTAL PERIODS 75

Text books:	
1	Incident Response & Computer Forensics — Jason Luttgens, Matthew Pepe, Kevin Mandia; McGraw-Hill Education; 3rd Edition.
2	The Practice of Network Security Monitoring: Understanding Incident Detection and Response — Richard Bejtlich; No Starch Press; Latest Edition.
3	Cybersecurity Incident Response: How to Contain, Eradicate, and Recover from Incidents — Eric C. Thompson; Packt Publishing; Latest Edition.
Reference books:	
1	Blue Team Handbook: Incident Response Edition — Don Murdoch; CreateSpace Independent Publishing; Latest Edition.
2	Digital Forensics and Incident Response: Incident response techniques and procedures to respond to modern cyber threats — Gerard Johansen; Packt Publishing; 3rd Edition.
3	NIST Computer Security Incident Handling Guide (SP 800-61 Rev. 2) — National Institute of Standards and Technology; Free Public Document; Latest Revision.