Curriculum & Syllabi

Regulation 2022

2024-28 Batch

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

(Batch 2024-2028)

👁 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

II.	PROGRAMME OUTCOMES (POs)
PO 1	**Engineering Knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	**Problem Analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO 5	**Engineering Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO 7	**Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	**Individual and Collaborative Team work**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO 9	**Communication**: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO 10	**Project Management and Finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one"s own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	**Life-Long Learning**: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

III.	PROGRAMME SPECIFIC OUTCOMES (PSOs)

The Graduates of B.E — COMPUTER SCINCE 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.

IV.	MAPPING OF PEOs WITH POs and PSOs													
PEO	POs											PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	3	3	3	3	2	2	—	1	2	1	1	2	2	3
2	3	3	3	3	3	2	—	—	2	—	—	2	3	2
	1- low, 2 - medium, 3 - high, „-' - no correlation													

V.	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 (24-28 Batch)

SEMESTER I						
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits	SDG Mapping
Theory (Internal 40 Marks & External 60 Marks)						
1	23MA101	Mathematics I	3 / 1 / 0	4	4	4,8,9
2	23SB101	Engineering Biology	3 / 0 / 0	3	3	4, 8, 9, 17
3	23AS101	Applied Science	4 / 0 / 0	4	4	4, 8, 9, 12
4	23CY102	Network Communication and Protocols	3 / 0 / 0	3	3	4,8,9
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
5	23CS101	Problem Solving using C++	1 / 0 / 4	5	3	3, 4, 7, 9, 11, 12, 13, 16
6	23IT101	Application Development Practices	1 / 0 / 4	5	3	4,8,9
Practicals(Internal 60 Marks & External 40 Marks)						
7	23AS102	Applied Science Laboratory	0 / 0 / 4	4	2	4,8,9
Indian Knowledge System - Blended Learning (Internal 100 Marks)						
8	23TA101	Heritage of Tamils	1 / 0 / 0	1	1	2, 7, 9, 12, 15, 16
Mandatory Course (Internal 100 Marks)						
9	23MC101	Induction Programme	Three Weeks			3,4,5,10,16
			TOTAL	**29**	**23**	

SEMESTER II						
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits	SDG Mapping
Theory (Internal 40 Marks & External 60 Marks)						
1	23MA201	Mathematics II	3 / 1 / 0	4	4	4,8,9
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
2	23EN101	Oral and Written Communication Skills	2 / 0 / 2	4	3	4,5,8,10
3	23CY202	Operating Systems	3 / 0 / 2	5	4	4,8,9

4	23CS201	Data Structures and Algorithms	1 / 0 / 4	5	3	4,9
5	23CD201	Database Management Systems	1 / 0 / 4	5	3	4,8,9
6	23CY203	Programming in Java	1 / 0 / 4	5	3	3,4,7,9
Indian Knowledge System - Blended Learning **(Internal 100 Marks)**						
7	23TA201	Tamils and Technology	1 / 0 / 0	1	1	2, 7, 9, 11, 12, 15, 17
Mandatory Course-Blended Learning **(Internal 100 Marks)**						
8	23MC102	Environmental Sciences	1 / 0 / 0	1	0	4,5,10,16
			TOTAL	**30**	**21**	

SEMESTER III						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory-Blended Learning(Internal 100 Marks)						
1	23GE301	Universal Human Values	3 / 0 / 0	3	3	3,4,5,8, 16
Theory (Internal 40 Marks & External 60 Marks)						
2	23CYC01	Cybersecurity Essentials	3 / 0 / 0	3	3	4,8,9
Theory with Practicals **(Internal 50 Marks & External 50 Marks)**						
3	23CY305	Applied Statistics Using Python	3 / 0 / 2	5	4	4, 9
4	23ADC01	Artificial Intelligence and Its Application	2 / 0 / 2	4	3	4,9,11
5	23CS303	Algorithm Design Techniques	3 / 0 / 2	5	4	4, 9
Practicals(Internal 60 Marks & External 40 Marks)						
6	23CS304	Frontend Frameworks	0 / 0 / 4	4	2	4,8,9
Spoken Language (Internal 100 Marks)						
7	23SLC01	Multilingual Practices	0 / 0 / 2	2	1	4,11,16
			TOTAL	**26**	**20**	
Certification/Online Course						
Certification/Spoken Tutorial/Coursera/NPTEL Courses- Minimum one Course						

SEMESTER IV

S. No.	Course Code	Courses	L/T/P	Total Hours	Credits	SDG Mapping
Theory-Blended Learning (Internal 100 Marks)						
1	23GEC01	Entrepreneurship and Startups	3 / 0 / 0	3	3	3,4,5,8,9,17
Theory (Internal 40 Marks & External 60 Marks)						
2	23CY403	Auditing IT Infrastructure for Compliance	3 / 1 / 0	4	4	4,9,16
3	23CY406	Cyber Law and Digital Forensics	3 / 0 / 0	3	3	4,5,16
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
4	23CSC02	Machine Learning Techniques	2 / 0 / 2	4	3	4,9
5	23CY401	Ethical Hacking	3 / 0 / 2	5	4	9,16
6	23CY405	Classical Cryptography	2 / 0 / 2	4	3	4,9,16
Practicals (Internal 60 Marks & External 40 Marks)						
7	23MEC04	Design Thinking and Idea Lab	0 / 0 / 2	2	1	4,9,11,12
8	23CS404	Backend Frameworks	0 / 0 / 4	4	2	4,9
Mandatory Course - Blended Learning (Internal 100 Marks)						
9	23MCC11	Disaster Management and Preparedness	2 / 0 / 0	2	0	4,9,13
			TOTAL	**31**	**23**	
Certification/Online Course						
Certification/Spoken Tutorial/Coursera/NPTEL Courses- Minimum one Course						

SEMESTER V

S. No.	Course Code	Courses	L/T/P	Total Hours	Credits	SDG Mapping
Theory (Internal 40 Marks & External 60 Marks)						
1	23CY501	Security Assessment and Risk Analysis	3 / 0 / 0	3	3	9,11,16
2	23CY502	Computational Number Theory for Cryptography	3 / 1 / 0	4	4	4,9,16
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
3	23CY504	Cloud Security	2 / 0 / 2	4	4	9,11,16
4	23XXXX	Professional Elective - I	2 / 0 / 2	4	3	

5	23XXXX	Professional Elective - II	2 / 0 / 2	4	3	
Practicals(Internal 60 Marks & External 40 Marks)						
6	23CS505	Cloud Infrastructure and Services Management	0 / 0 / 4	4	2	4,9
Mini Project(Internal 100 Marks)						
7	23CS503	Application Development	0 / 0 / 6	6	3	3,4,8,9
Mandatory Course-Blended Learning **(Internal 100 Marks)**						
8	23MCC03	Indian Constitution	1 / 0 / 0	1	0	1,2,3,5,6, 8,11
			TOTAL	**30**	**22**	

SEMESTER VI						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23CY601	Blockchain Technologies	3 / 0 / 0	3	3	8,9,16
Theory with Practicals **(Internal 50 Marks & External 50 Marks)**						
2	23CY603	Hacker Technique Tools and Incident Handling	3 / 0 / 2	5	4	9,16
3	23CY604	Cyber Attack Simulation and Security Testing	3 / 0 / 2	5	4	9,16
4	23CY606	Embedded Systems and IoT	2 / 0 / 2	4	3	7,9,11,13
5	23XXXXX	Professional Elective - III	2 / 0 / 2	4	3	
6	23XXXXX	Professional Elective - IV	2 / 0 / 2	4	3	
Mini Project						
7	23CY605	Capstone Project	0 / 0 / 4	4	2	4,8,9,12
			TOTAL	**29**	**22**	

SEMESTER VII						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23XXXXX	Open / Emerging/ Industrial Elective - I	3 / 0 / 0	3	3	
2	23XXXXX	Open / Emerging/ Industrial Elective - II	3 / 0 / 0	3	3	
3	23XXXXX	Open / Emerging/ Industrial Elective- III	3 / 0 / 0	3	3	

S. No.	Course Code	Courses	L/T/P	Total Hours	Credits	SDG Mapping
4	23XXXXX	Professional Elective - V	3 / 0 / 0	3	3	
5	23XXXXX	Professional Elective - VI	3 / 0 / 0	3	3	
Project(Internal 60 Marks & External 40 Marks)						
6	23CY701	Project Phase I	0 / 0 / 6	6	3	4,9,17
Internship(Internal 100 Marks)						
7	23EES01	Internship		28 Days	2	8,12,17
			TOTAL	**21**	**20**	

SEMESTER VIII						
S. No.	Course Code	Courses	L/T/P	Total Hours	Credits	SDG Mapping
Project(Internal 60 Marks & External 40 Marks)						
1	23CY801	Project Phase II	0 / 0 / 24	24	12	4,9,17
			TOTAL		**167**	

SUMMARY											
Sl. No.	Stream	Credits/Semester								C	%
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences Including Management (HSMC)	1	4	3	3					11	7.40
2	Basic Sciences (BSC)	9								9	5.5
3	Engineering Sciences (ESC)	4	4							8	4.9
4	Professional Core (PCC)	9	13	16	20	15	15			88	54.0
5	Professional Electives (PEC)					6	6	6		18	11
6	Open/Emerging/Industry (OEC)							9		9	5.5
7	Project Work (PROJ)						2	5	12	19	11.7
8.	Mandatory Course (MC) / Spoken Hindi			1						1	0.6
	Total	23	21	23	23	22	22	20	12	163	

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM			
S. No.	Course Work - Subject Area	AICTE Suggested Credits	SKCET Credits (162)
1.	Humanities and Social Sciences (HS), including Management;	16	11
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology;	23	9
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	29	8
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	88
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	19
8.	Mandatory Courses (MC)	Non-credit	1
	Total		163

Minor Variations is allowed as per need of the respective disciplines

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (12 Credits)						
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./ Wk.	C	SDG Mapping
1.	23TA101	Heritage of Tamils	1 / 0 / 0	1	1	2, 7, 9, 12, 15, 16
2.	23EN101	Oral and Written Communication Skills	2 / 0 / 2	4	3	4,5,8,10
3.	23TA201	Tamils and Technology	1 / 0 / 0	1	1	2, 7, 9, 11, 12, 15, 17
4.	23GE301	Universal Human Values	3 / 0 / 0	3	3	3,4,5,8,16
5.	23GEC01	Entrepreneurship and Startups	3 / 0 / 0	3	3	3,4,5,8,9,17
6.	23SLC01	Multilingual Practices	1 / 0 / 0	1	1	4,11,16

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
		BASIC SCIENCE COURSES (09 Credits)				
1.	23SB101	Engineering Biology	3 / 0 / 0	3	3	4, 8, 9, 12
2.	23AS101	Applied Science	4 / 0 / 0	4	4	4, 8, 9, 17
3.	23AS102	Applied Science Laboratory	0 / 0 / 4	4	2	4,8,9

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
		ENGINEERING SCIENCE COURSES (08 Credits)				
1.	23MA101	Mathematics I	3 / 1 / 0	4	4	4,8,9
2.	23MA201	Mathematics II	3 / 1 / 0	4	4	4,8,9

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
		PROFESSIONAL CORE COURSES (90 Credits)				
1.	23CY102	Network Communication and Protocols	3 / 0 / 0	3	3	4,8,9
2.	23CS101	Problem Solving using C++	1 / 0 / 4	5	3	3, 4, 7, 9, 11, 12, 13, 16
3.	23IT101	Application Development Practices	1 / 0 / 4	5	3	4,8,9
4.	23CY202	Operating Systems	3 / 0 / 2	5	4	4,8,9
5.	23CS201	Data Structures and Algorithms	1 / 0 / 4	5	3	4,9
6.	23CD201	Database Management Systems	1 / 0 / 4	5	3	4,8,9
7.	23CY203	Programming in Java	1 / 0 / 4	5	3	3,4,7,9
8.	23CYC01	Cybersecurity Essentials	3 / 0 / 0	3	3	4,8,9
9.	23CY305	Applied Statistics Using Python	3 / 0 / 2	5	4	4, 9
10.	23ADC01	Artificial Intelligence and Its Application	2 / 0 / 2	4	3	4,9,11
11.	23CS303	Algorithm Design Techniques	3 / 0 / 2	5	4	4, 9
12.	23CS304	Frontend Frameworks	0 / 0 / 4	4	2	4,8,9
13.	23CY403	Auditing IT Infrastructure for Compliance	3 / 1 / 0	4	4	4,9,16
14.	23CY406	Cyber Law and Digital Forensics	3 / 0 / 0	3	3	4,5,16
15.	23CSC02	Machine Learning Techniques	2 / 0 / 2	4	3	4,9
16.	23CY401	Ethical Hacking	3 / 0 / 2	5	4	9,16
17.	23CY405	Classical Cryptography	2 / 0 / 2	4	3	4,9,16
18.	23MEC04	Design Thinking and Idea Lab	0 / 0 / 2	2	1	4,9,11,12
19.	23CS404	Backend Frameworks	0 / 0 / 4	4	2	4,9
20.	23CY501	Security Assessment and Risk	3 / 0 / 0	3	3	9,11,16

		Analysis				
21.	23CY502	Computational Number Theory for Cryptography	3 / 1 / 0	4	4	4,9,16
22.	23CY504	Cloud Security	2 / 0 / 2	4	4	9,11,16
23.	23CS505	Cloud Infrastructure and Services Management	0 / 0 / 4	4	2	4,9
24.	23CS503	Application Development	0 / 0 / 6	6	3	3,4,8,9
25.	23CY601	Blockchain Technologies	3 / 0 / 0	3	3	8,9,16
26.	23CY603	Hacker Technique Tools and Incident Handling	3 / 0 / 2	5	4	9,16
27.	23CY604	Cyber Attack Simulation and Security Testing	2 / 0 / 2	4	3	9,16
28.	23CY606	Embedded Systems and IoT	2 / 0 / 2	4	3	7,9,11,13

PROFESSIONAL ELECTIVE COURSES (18 Credits)							
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Ext/ Int	Cat.
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 (01 Credits)				
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23MCC02	Spoken Hindi	1 / 0 / 0	1	1	4,11,16
2.	23MCC03	Indian Constitution	1 / 0 / 0	1	0	1,2,3,5,6,8,11

		OPEN/ EMERGING/ INDUSTRY (09 Credits)				
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23CY001	Cyber Security Fundamentals	3 / 0 / 0	3	3	4,9,16
2.	23CY002	Cryptography – Tools and Techniques	3 / 0 / 0	3	3	9,16
3.	23CY003	Cyber security Auditing and Assurance	3 / 0 / 0	3	3	9,16
4.	23CY004	Web Security	3 / 0 / 0	3	3	9,11
5.	23CY005	Operating System Security	3 / 0 / 0	3	3	9,16
6.	23CY006	Security Governance, Risk, and compliance	3 / 0 / 0	3	3	16,17

		PROJECT WORK (19 Credits)				
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23CY605	Cap stone project	0 / 0 / 4	4	2	4,8,9,17
2.	23CY701	Project Phase - I	0 / 0 / 6	6	3	4,9,17
3.	23EES01	Internship	28 Days		2	8,12,17
4.	23CY801	Project Phase - II	0 / 0 / 24	24	12	4,9,17

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)						
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23EESO1	Internship		28 Days	2	8,12,17

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		-	4, 9,12	III
2.	23VA102	Amazon Web Service (AWS)	1 / 0 / 0		-	4, 9,12	IV
3.	23VA103	Google Certified Cloud Professional (GCCP)	1 / 0 / 0		-	4, 9,12	V
4.	23VA104	CISCO Certification	1 / 0 / 0		-	4, 9,12	VI
5.	23VA105	Wipro PRP Certification	1 / 0 / 0		-	4, 9,12	VI

MANDATORY COURSES (Non-Credits) (Courses conducted either by internal faculty or through MOOCs)						
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23MC101	Induction Programme		0		
2.	23MC102	Environmental Sciences	1 / 0 / 0	1	0	4,5,10,16
3.	25MCC11	Disaster Management and Preparedness	2/0/0	2	0	6,12,13, 15

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

23MA101	MATHEMATICS I	L	T	P	C
	(Common to all branches)	3	1	0	4

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 inpractical 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.

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: Types of relations and their properties-Relational matrix and graph of a relation-Equivalence relations Partial ordering relation-Graphical representation of relations-Binary 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-Directed acyclic graphs and scheduling–Isomorphism-Bipartite graphs and Matchings-The Stable marriage problem Connectivity-Forests and trees-Spanning trees-Minimum weight spanning trees-Prims algorithm Kruskal algorithm.

MODULE III : COUNTING & PROBABILITY **20**

Sums and Asymptotics-Sums of Powers-Harmonic Numbers-Asymptotic Notation-The Division Rule Counting Subsets-Sequences with Repetitions-The Pigeonhole Principle-Events and Probability Spaces-The Four Step Method-Set Theory and Probability-Conditional Probability-The Four-Step Method for Conditional Probability-The Law of Total Probability-Baye's theorem–Independence-Mutual Independence-Pairwise Independence-Random Variables-Distribution Functions-Bernoulli Distributions-Uniform Distributions-Binomial Distributions-Great Expectations-Conditional Expectation-Linearity of Expectation-Infinite Sums-Expectations of Products.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall the basic concepts of logical laws, structures andprobability.	[R]
CO2	Understand the concepts of proof techniques, structures and random variables.	[U]
CO3	Apply the logical and foundational structures of mathematics with an emphasis on writing proofs.	[AP]
CO4	Apply the concepts of graph and number theory in cryptography.	[AP]
CO5	Apply the probability concepts in transition from real problem to a probabilistic model.	[AP]

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, 30thReprint, 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   Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2004.

4   P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, New Delhi, Fifth Edition, 2019.

Web References:

1   https://www.cs.ucdavis.edu/~rogaway/classes/20/fall21/mit-book.pdf

2   https://mathworld.wolfram.com/topics/DiscreteMathematics.html

3   https://mathworld.wolfram.com/topics/NumberTheory.html

23SB101	ENGINEERING BIOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To grasp and apply biological engineering principles, procedures needed to solve real-world problems.
2	To give a basic knowledge of the applications of biological systems in relevant Industries.
3	To understand the mutual dependence of modern biology and engineering.
4	To give a basic knowledge of artificial organs and physiological assist devices.
5	To understand about the use of various nanomaterials towards biological applications.

MODULE I: HUMAN PHYSIOLOGY ANDARTIFICIAL ORGANS: 15

Cell and their structure-Transport of ions through cell-Different systems of human body-Biological neural networks-Artificial neural networks-applications of neural networks-Artificial Kidney-Artificial Pancreas

MODULE II: BCI: 15

Hours Fundamentals of BCI–Working of BCI–Classification of BCI–measuring of surgical and non-surgical BCI–Neurofeedback Training for BCI Control-signal processing and application.

MODULE III: NANOBIOLOGY: 15

Introduction to Nanobiology, Nanomaterials for antimicrobial coatings-medical implants–medical and defence textiles. Biosensors-biodevices and implantable devices. Nanomaterials for diagnosis and therapy-Implications of Drug delivery-various forms of nanocarriers-Polymeric Nanoparticles as drug carriers-Drug release mechanism-Targeted drug delivery.

                                                          TOTAL :45 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Explain the structure of human physiology.	[R]
CO2	Compare biological and artificial neural networks.	[AN]
CO3	Understand the compatibility and functioning of artificial organs inside the human being.	[U]
CO4	Understand the basic concepts of brain computer interface.	[U]
CO5	Understand the concepts of Nanomaterials for biotechnology.	[U]

Text Books:
1 Leslie Cromwell, "Bomedical Instrumentation and measurements", Prentice Hall,2011

2 Bernhard Graimann, Brenden Allison, Gert Pfurtscheller, "Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer 2010

3 M Arumugam, "Bio medical instrumentation", Anuradha Publications,2002

4 B. Bhushan, "Springer Handbook of Nanotechnology", Springer-Verlag, 2004

Reference Books:

1 Malcom Carpenter, "Textbook of Neuroanatomyǁ", McGraw Hill Edition, 1996.

2 Arthur T. Johnson, "Biology for Engineers",CRC Press, Taylor and Francis, 2011

3 Matews G.G, "Neurobiology", 2ndEdition, Blackwell Science, UK, 2000

Web References:
1 https://ocw.mit.edu/courses/biological-engineering/20-010j-introduction-to-bioengineering-be-010j spring-2006/videos/Lecture-1-bioengineering/

2 https://www.technicalsymposium.com/alllecturenotes_biomed.html

3 https://ocw.mit.edu/courses/biology/7-28-molecular-biology-spring-2005/

23AS101	APPLIED SCIENCE	L	T	P	C
		4	0	0	4

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 ofelectrochemistry 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.

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: 45 PERIODS

COURSE OUTCOMES

Upon completion of thecourse, students shall have ability to

CO1	Understand the principles of electrostatics and problems relating to electric field and electric potential.	[U]
CO2	Realize the nature of magnets, properties and the magnetic effect of electriccurrent.	[U]
CO3	Describe the nature of electromagnetic wave and its propagation through different media and interfaces involved in different situations.	[AP]
CO4	Understand the principle and working of reference electrodes, energy storage devices and polymer products in engineering fields.	[U]
CO5	Interpret the principle and working of analytical techniques.	[AP]

Text Books:

1   Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, NewDelhi, 2017.

2   Gaur, R.K. and Gupta, S.L., "Engineering Physics", DhanpatRai Publishers, 2017.

3   David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11thedition, Wiley, 2018.

4   Jain P. C. & Monica Jain., "Engineering Chemistry",17 th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, Reprint-2020.

Reference Books:

1   AvadhanuluM.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics"S.Chand& Co Ltd, 2018.

2   Sadiku M H, "Principles of Electromagnetics", Oxford University Press Inc.,New Delhi,2015

3   R. Wolfson, "Essential University Physics",Volume 1 & 2. Pearson, 2020.

4   David Griffiths 'Introduction to Electrodynamics' 4th Edition, Cambridge University Press 2017.

Web References:

1   https://ocw.mit.edu/courses/8-02t-electricity-and-magnetism-spring-2005/

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

23CY102	**NETWORK COMMUNICATION AND PROTOCOLS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES

1   To study the different layers of the OSI andTCP/IP reference models

2   To understand the difference between various network topologies and networking devices.

3   To study the concepts of data link layer and network layer protocols, including encoding, error detection, reliabletransmission, MAC protocols, and routing techniques.

4   To analyze the types of protocols in the transport layer, specifically focusing on TCP and UDP, their header formats, functionalities, and congestion control mechanisms.

5   To study advancedapplication layer protocols such as DNS, SMTP, MIME, IMAP, FTP, and HTTP, along with emerging technologies like 5G and edge computing.

Module I: Fundamentals of Networking and Protocols   15

Data Communication, The OSI Model, TCP/IP Protocol Suite, Addressing, Transmission Media, Networking Devices: Hubs, Bridges, Switches, Routers, Gateways, Network Topologies, Bluetooth, Zigbee, and RFID in Networking, VLANs, Introduction to Network Simulation Tools (e.g., Cisco Packet Tracer, GNS3),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 and Error Detection, Reliable Transmission Protocols, MAC Protocols: CSMA/CD, CSMA/CA, Link Aggregation and Load Balancing (EtherChannel, LACP),Circuit Switching and Packet Switching, Bridges and LAN Switches, Spanning Tree Algorithm, Internetworking: IPv4, Subnetting, IPv6 Transition Mechanisms (Dual Stack, Tunnelling, NAT64), Routing Techniques: Distance Vector (RIP), Link State (OSPF), Interdomain Routing (BGP), Network Virtualization, Case Study: IP address planning and subnetting for a geographically dispersed organization.

Module III: Transport layer and Application Layer: 15

Transport Layer Protocols: UDP, TCP, Congestion Control and Resource Allocation: TCP Congestion Control, Congestion Avoidance Mechanisms, Quality of Service: Integrated Services, Differentiated Services, Network Traffic Analysis, Application Layer Protocols: Domain Name System (DNS), Electronic Mail (SMTP, MIME, IMAP), File Transfer (FTP), WWW (HTTP), HTTP/3 (QUIC), IoT Communication Protocols (MQTT, CoAP), Content Delivery Networks (CDN), Zero Trust Network Architecture (ZTNA), Case Study: Evaluating the impact of 5G and edge computing on the future of network communication.

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the protocols operating in each layer of the OSI and TCP/IP models.	[U]
CO2	Recall different network topologies, devices, and transmission media.	[U]
CO3	Interpret and apply error control, flow control, and routing protocols in networking.	[AP]
CO4	Analyzethe structure and functionality of IP, TCP, and UDP headers.	[A]
CO5	Analyze congestion control mechanisms andCompare HTTP/3 (QUIC), MQTT, CoAP, and advanced security models like ZTNA	[A]

Text Books:

1 A S Tanenbaum, DJ Wetherall, "Computer Networks", 6th Edition, Prentice-Hall, 2021.

2 Behrouz A. Forouzan, "Data communication and Networking", 5th Edition, Tata McGraw- Hill, 2013.

3 Andrei Gurtov, Madhusanka Liyanage, Mika Ylianttila, "Software Defined Mobile Networks (SDMN) Beyond LTE Network Architecture", 5th Edition, Wiley, 2021.

Reference Books:

1 Peterson & Davie, "Computer Networks, A Systems Approach", 6th Edition, Elsevier, 2021.

2 William Stallings, "Data and Computer Communications", 10th Edition, PHI, 2013.

3 . Xingqin Lin, Namyoon Lee "5G and Beyond Fundamentals and Standards", Springer, 2021 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**

23CS101	PROBLEM SOLVING USING C++	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1   To master fundamental programming concepts and methodologies essential for developing robust C++ programs.

2   To acquire a deep understanding of control structures and functions in C++

3   To explore basic object-oriented programming principles and apply them effectively in problem solving.

4   To introduce file streams and operations for persistent data storage.

5   To gain familiarity with the generic programming paradigm

Module I: C++ Programming Fundamentals 5

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, whileloop, 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 5

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 5

Abstract Classes as Interfaces-Abstract Methods, Exception Handling Methodologies-try catch block, Multiple catch block, Nested try-catch, Inbuilt Exception-Custom Exception, File Handling-Files Operations, Streams and I/O, Buffering and Serialization,STL-Vector, List, Set, Pair, Lambda Functions Generic Programming, Lambda Expression.

TOTAL (Theory) 15 PERIODS

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

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 (Lab): 15 PERIODS

TOTAL: 30 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Demonstrate fundamental concepts and methodologies to design and develop programs for specific problem scenarios.	[U]
CO2	Create programs to address real-timechallenges using pointers and objects in C++	[AP]
CO3	Utilize constructors, destructors, and overloading techniques to solve real-world problems effectively.	[AP]
CO4	Develop C++ programs incorporating interfaces, exception handling, and file processing	[AP]
CO5	Apply file streams, I/Ooperations, and lambda expressions in C++ programming.	[AP]

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

Text Books:

1	E Balagurusamy," Object Oriented Programming With C++", 4th Edition, Tata McGraw-Hill Education, 2008.

2	Yashavant P. 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, 2017.

2	John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.

3	Walter J. Savitch "Problem Solving with C++", 6th edition, the University of California, Pearson/Addison-Wesley, 2007.

Web References:

1	https://www.geeksforgeeks.org/c-plus-plus/

2	https://www.hackerrank.com/domains/cpp

3	https://www.hackerearth.com/practice/notes/tricky-and-fun-programming-in-c/

23IT101	APPLICATION DEVELOPMENT PRACTICES	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1　To discuss the essence of agile development methods.

2　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.

Module-I: Software Development and Basic Linux Programming　　　　5

History of traditional software development model, SDLC, Waterfall Model, Agile Software Development-Agile Manifesto and Principles, Agile Valus, Characteristics, Agile methods and practices, Agile Vs Waterfall Model, Introduction to Scrum, Roles and Responsibilities, Practices and Artifacts, User Story, Review Meetings, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint Scrum Team, Extreme Programming (XP)–Principles, Lean Software Development–Principles, 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 first script, Conditional statements, Loops, Command line arguments, Functions & file manipulations, Background processes, Scheduling processes-At, batch & Cron-Networking.

Module-II: HTML　　　　5

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 as date, number, range, email, search and data list, Understand audio, video, article tags.

Module-III: Front End Development   5

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 (Theory):15 PERIODS

LIST OF EXPERIMENTS

1   Study of Basic Linux Commands.

2   Implementation of Shell Programming.

3   Design a web page using HTML basic tags.

4   Develop web site with suitable contents and links.

5   Design web pages using lists and tables.

6   Build a web client-side Login, Registration form and Dashboard with drop down menus.

7   Develop a HTML form and validation using HTML5 features.

     Create a website using HTML:

     To embed an image map in a webpage.

8   To fix the hot spots.

     Show all the related information when the hot spots are clicked.

9   Apply style specification in HTML page using CSS.

10   Develop dynamic web application using HTML, CSS and JavaScript.

TOTAL (Lab):15 PERIODS

TOTAL:30 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1   Relate the concepts of agile software engineering and its advantages in   [R]
       software development.

CO2   Demonstrate the roles and responsibilities of Scrum, Lean Software   [U]
       Development and how to setup the GitHub repository.

CO3   Analyze the working model and develop static, dynamic websites.   [A]

CO4   Utilize the knowledge of HTML, CSS and Bootstrap using forms to build   [AP]
       modern interactive web applications.

CO5   Develop dynamic web pages using HTML5 with validation using Java Script   [AP]
       objects and by applying different event handling mechanisms.

TEXT BOOKS

1.   Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1stEdition, 2010.

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.

4.   . Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley India Pvt. Limited, 2020.

REFERENCE BOOKS

1.   Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2nd Edition, 2014.
2.   Mike Cohn, "User Stories Applied: For Agile Software", Addison Wesley,2nd Edition, 2016.
3.   Thomas a Powell, "HTML & CSS: The Complete Reference", 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
4.   Russ Ferguson, "Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development", Apress Publishers, 3rd Edition, 2019.

WEB RESOURCES

1. https://www.atlassian.com/agile/scrum

2. https://developer.mozilla.org/en-US/docs/Web/HTML

3. https://developer.mozilla.org/en-US/docs/Web/CSS

4. https://developer.mozilla.org/en-US/docs/Web/JavaScrip

23AS102	**APPLIED SCIENCE LABORATORY**	L	T	P	C
		0	0	4	2

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.

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: 30 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1   To determine the magnetic field around a current carrying conductor.   [E]

CO2   To determine the rate of growth or decay in a resistor-capacitor circuit and to estimate the resonant frequency and Q-factor.   [E]

CO3   To determine the relationship between the magnetic flux density and the magnetizing field strength and to find the specific resistance of the wire.   [E]

CO4   To determine the pH, single electrode potential using reference electrodes and Electroplating process based on electrolytic cell.   [E]

CO5   Interpret the principle and working of Spectroscopic technique.   [E]

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 ofEngineering practical physics", Laxmi Publications Pvt. Ltd., 2016.

4.   S.L.Gupta and V Kumar "Practical Physics Volume-II", Pragati Prakashan ., 2023.

REFERENCE BOOKS

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

2. S. L. Gupta and Dr. V. Kumar, "Practical physics with viva voice", Pragati Prakashan Publishers, Revised Edition, 2009.

3. M. N. Avadhanulu, A. A. Dani and Pokely P.M, "Experiments in Engineering Physics", S. Chand&Co,2008.

WEB RESOURCES

1. https://bop-iitk.vlabs.ac.in/basics-of-physics/

2. https://vlab.amrita.edu/

3. https://ee1-nitk.vlabs.ac.in/exp/determination-of-biological-oxygen/simulation.html

23TA101	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

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.

Module I: Language and Literature:

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

Module II: Heritage-Rock Art Paintings to Modern Art–Sculpture:

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:

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 Conquestof 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: 15 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1   Know about the language families in India, impact of religions and the contribution of Bharathiyar and Bharathidhasan.   [U]

CO2   Observe the growth of sculpture, making of musical instruments and the role of temples in socio and economic lives.   [U]

CO3   Understand the significance of folklore and martial arts.   [U]

CO4   Learn the sangam literature, sangam age and overseas conquest of Cholas.   [U]

CO5   Understand the contribution of Tamils to Indian Freedom Struggle, role of Siddha medicine and print history of Tamil Books.   [U]

TEXT and REFERENCE BOOK

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL– (in print)

2. Social Life of the Tamils-The Classical Period (Dr.S.Singaravelu) (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).

4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

23MC101	INDUCTION PROGRAMME	L	T	P	C
		1	0	0	0

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.

PHYSICAL ACTIVITY:

Research over the past years has shownYogato have stress-relieving powers onstudents, paving the wayfor improvedacademicperformance 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 choice):

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 workeffectively 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 seelectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as ameansof 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:

Travelingis 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 betaken 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	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. To study the basic probability concepts and inequalities.

2. To apply 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 a variety of engineering fields.

5. To introduce the concepts of Group theory.

MODULE I BOUNDS ON PROBABILITY 20

Mean Deviation : Markov's theorem – Chebyshev's inequality – Random walk and Gambler's ruin : Probability of winning – Chernoff's bounds – Above the mean and under the mean of Chernoff Bound - Deviation on sum of independent random variables - Weak law of large numbers – Van der Waerden's theorem (Statement only).

MODULE II MODELLING WITH LINEAR PROGRAMMING, TRANSPORTATION AND GAME THEORY 20

Linear Programming Problem : Introduction – Formulations of Linear Programming Problems – Graphical method - Simplex Algorithm – Two phase method – Duality – Transportation Problem : Initial Basic Feasible solutions – Optimal solution by MODI method – Game theory: Introduction – Classification of Games – Solving payoff matrix – The Minimax and Maximin principle – Games with mixed strategies – Graphical method.

MODULE III FOURIER ANALYSIS AND GROUP CODES 20

Fourier series: Dirichlet's conditions – Half range sine and cosine series – Fourier transform: Discrete Fourier transform – Inverse Discrete Fourier transforms – Fast Fourier transform – Modulo p and fast integer multiplication – Groups: Definition and basic properties – Subgroups – Cosets – Linear codes – Error correcting codes – Hamming codes – Perfect codes.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall the concepts of basic probability.	[R]
CO2	Formulate and analyze the existence of solutions to Optimization problems.	[U]
CO3	Formulation of modern Probability theory and think of random variables as an intrinsic need for the analysis of random phenomena.	[AP]
CO4	To apply Game theory in searching, auctioning and trading.	[AP]
CO5	Apply Fourier transform to discrete time sequence and use of Group theory and Coding theory in communication.	[AP]

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", 12th 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 RESOURCES

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/

23EN101	ORAL AND WRITTEN COMMUNICATION SKILLS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1. To empower students to comprehend different aspects of communication using LSRW skills.

2. To equip students with the skills to create impactful job search and perform confidently in group discussions and interviews.

3. To enrich students to carry out day-to-day communication at the workplace and facilitate efficient interpersonal communication.

MODULE I: READING   15

Reading: 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   15

Writing: 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 AND SPEAKING   15

Listening: Situational listening - Listening about an experience - Listening about short extracts - Listening an interview: Conversational speaking - Speaking: Engaging in interactive conversations - Decipher the picture given and answer the question posed along with it - Decipher the mind map given and speak about it - Listen to the questions posed and answer them appropriately.

TOTAL(Theory): 45 PERIODS

LIST OF EXPERIMENTS

1. Conversational listening
2. Speaking – Pictography
3. Listening about an experience
4. Listening to short extracts
5. Writing - Resume Writing, Job application letter
6. Mock interview

TOTAL(Lab):15 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Remember and develop LSRW skills through guided activities.	[R]
CO2	Understand and collaborate better with colleagues, building stronger professional and personal relationships.	[U]
CO3	Apply communication skills in a corporate environment.	[AP]
CO4	Apply technical writing skills to write letters, emails and prepare technical documents.	[AP]
CO5	Analyze and communicate effectively in personal and professional situations.	[AN]

TEXTBOOKS

1. Jay Sullivan, "Simply Said: Communicating Better at Work and Beyond", Wiley Publication, 2018.

2. Alred J Gerald, Brusaw T Charles,.Oliu E Walter, "Handbook of Technical Writing", Bedford/St. Martin's Boston publication,New York, 2012.

3. Liz Hamp-Lyons and Ben Heasly, "Study Writing :A Course in Written English for Academic Purposes", Updated Edition, Cambridge University Press, 2006.

REFERENCE BOOKS

1. Dr.Praveen Sam and K N Shoba - A Course in Technical English by Cambridge University press, 2020.

2. Rutherfoord J Andrea, " Basic Communication Skills for Technology", Upper Saddle River, N.J. : Prentice Hall, 2001.

3. SinghHardeep (Author), Kothari (Author), "Written & Oral Technical Communication Skills For Engineers/Scientists" - LAMBERT Publications, 2019.

WEB RESOURCES

1. http://www.academiccourses.com/Courses/English/Business-English.

2. https://www.liveworksheets.com/worksheets/en/English_as_a_Second_Language_(ESL)/Technical_English.

3. https://www.coursera.org/specializations/business-english

23CY202	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

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.

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 (Theory): 45 PERIODS**

LIST OF EXPERIMENTS

1. Study of basic Linux commands, proc file system of Linux, disk I/O, buffer caches, and disk monitoring tools.

2. Implementation of shell programming.

3. Implementation of Unix system calls.

4. Implementation of non-preemptive and preemptive CPU scheduling algorithms.

5. Implementation of the 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 a study on modern file systems like ZFS, btrfs, and ext4.

10. Implementation of disk scheduling algorithms and comparison of CPU and disk scheduling algorithms in terms of the number of voluntary and involuntary context switches.

TOTAL (Lab): 30 PERIODS
TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1 Review the basic concepts and functions of operating systems. [U]

CO2 Interpret the processes and threads in operating systems for real world problems. [U]

CO3 Examine CPU scheduling algorithms, process synchronization mechanisms and deadlock handling methods. [AP]

CO4 Practice memory management techniques including virtual memory and page replacement algorithms. [AP]

CO5 Illustrate the concepts related to mass storage, I/O and file system. [AP]

TEXTBOOKS

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.

3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016

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.

3. Operating Systems – Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, 2014.

WEB RESOURCES

1. https://www.studocu.com/sg/course/nanyang-technological-university/operating systems/1390534

2. https://nptel.ac.in/courses/106108101

3. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

23CS201	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		1	0	4	3

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.

MODULE I LINKED LIST AND STACK   5

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   5

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   5

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 (Theory): 15 PERIODS

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 (Lab): 60 PERIODS
TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Implement the basic data structures like array and Linked List.	[AP]
CO2	Solve real world problems efficiently by applying stack and queue data structures.	[AP]
CO3	Enumerate the applications with tree data structures.	[AP]
CO4	Discuss the importance of hashing techniques in information storage.	[U]
CO5	Employ graph algorithms for solving real time computing problems and analyze them.	[AN]

TEXTBOOKS

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",2nd Edition, 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, 2nd Edition,2014.

WEB RESOURCES
1. https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms.

2. https://www.edx.org/course/data-structures-algorithms-using-c

3. https://www.udacity.com/course/data-structures-and-algorithms-in-python--ud513

23CD201	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		1	0	4	3

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.

MODULE I: INTRODUCTION   5

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, Keys - primary Key, Foreign Key.

MODULE II: CONSTRAINTS AND SQL COMMANDS   5

DDL Commands - Create, Drop, Alter, Truncate, Rename, Normalization - 1NF, 2NF, 3NF, BCNF, 4NF- 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

MODULE IIIQUERIES AND TRANSACTIONS   5

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, Transactions as SQL statements.

Total (Theory): 15 PERIODES

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 (Lab): 60 PERIODES
Total: 75 PERIODES

Text Books
1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Data base System Concepts", 7th Edition, McGraw hill, 2020.
2. Vijay Krishna Pallaw, "Database Management Systems", 2nd Edition Asian Books Private Limited, 2010.
3. Mark L. Gillenson, "Fundamentals of Database Systems", 7th Edition, 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.

3. Shio Kumar Singh, *Database Systems Concepts, Designs and Application*, Pearson Education, Second Edition, 2011.

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

23CY203	PROGRAMMING IN JAVA	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1. To understand the JavaBeans Concepts and basic of Core Java.
2. To understand Conditional and Control Statements
3. To provide Insight Knowledge of OOP Concepts and Collection Framework
4. To demonstrate threads, JDBC & exception handling with real world examples

MODULE I   5

Overview of Java– Defining Classes in Java– Methods– Access Specifiers– Static Members– Java Doc Comments–JavaBean Standards- DataTypes-Wrapper Classes- Variables– Operators– Conditional Statements- Control Statements– Arrays- String– StringBuilder– StringBuffer. Streams– Instance Control Flow & Regular Expressions- Instance Block and Instance Flow Of Execution. Regular Expressions (RegEx), Pattern Matching.

MODULE II   5

Class and Object, Encapsulation, Keywords, Constructors: Introduction & Constructor Overloading, Inheritance Types of Inheritance, Up Casting, Down Casting, IS-A Relationship & HAS-A Relationship, Composition Vs Aggregation. Polymorphism: Method Overloading & Method Overriding. Abstraction & Interface: Abstract Methods and Abstract classes, Interfaces. Exception Handling- Exception Hierarchy, Multiple Exceptions In a Catch Block, Overriding Methods And Exception, User defined Exception.

MODULE III   5

The Assert Keyword, The Generics Framework, Collections: Set, List, Map & Tree, The Iterator Interface. Working with Hashtable Collection Threads: Threads, Basic Thread Control Methods, Multithreading. JDBC: Drivers, CURD operations, Database Connectivity. Servlets : Servlet Life Cycle, Servlet Request and Response, web.xml and its need, Servlet Configuration, Session Tracking.

TOTAL (Theory): 15 PERIODS

LIST OF EXPERIMENTS

1. Basic Java programs using loops (Pattern Problems).
2. Implement a Java program to perform array and string operations.
3. Implementation of a student application using class and objects.
4. Implementation of date, numbers, currency, and tokenizing.
5. Implementation of encapsulation and inheritance.
6. Implementation of method overloading and overriding.
7. Implement a Java program using abstract classes and interfaces.
8. Programs using the collection interface.
9. Implementation of multi-threading for generation of prime numbers and Fibonacci series.

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

10.   Program to handle multiple exceptions using try, catch, and finally blocks.
11.   Implement a simple application using servlets.
12.   Implement CRUD operations using JDBC.
13.   Project:Console-based project with OOPS concepts.

TOTAL (Lab):60 PERIODS
TOTAL:75 PERIODS

COURSE OUTCOMES
Upon completion of the course, students shall have ability to

CO1   Develop the features of Core Java Paradigm.   [AP]
CO2   Apply Looping Statements, Arrays, Strings in Real Time Environment.   [AP]
CO3   Apply OOPS Concepts in the Real Time Applications.   [AP]
CO4   Apply the concepts of Exception Handling in real world applications and   [AP]
       usage of collection frameworks.
CO5   Develop Multithreaded Applications.   [AP]

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.   Head First Java by Kathy Sierra and Bert Bates Third Edition Publication, O'Reilly Media 2022.

REFERENCE BOOKS
1.   Paul Deitel, 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.   "Thinking in Java" by Bruce Eckel (4th edition, 2018)

WEB RESOURCES

1.   http://www.nptel.ac.in
2.   https://www.codecademy.com/learn/learn-java
3.   https://www.learnjavaonline.org/

23TA201	TAMILS AND TECHNOLOGY / தமிழரும் தெதொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

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.

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

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

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: 15 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Describe about the weaving industry in sangam age and ceramic technology.	[U]
CO2	Observe the design of houses, sculptures and construction of temples.	[U]
CO3	Relate the various manufacturing materials and stone types in Silappathikaram.	[U]
CO4	Understand the significance of agriculture and irrigation technology in ancient period.	[U]
CO5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.	[U]

TEXTBOOKS

1. "தமிழக வரலாறு – மக்களும் பண்பாடும்" – கே. கே. பிள்ளள (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனனெர் இல. சுந்தரம் . (விகடன் பிரசுரம்).
3. கீழடி – னெனக நதிக்கனரயில் சங்ககால நகர நாகரிகம் (வதால்லியல் துனற வெளியீடு)

REFERENCE BOOKS
1. "Social Life of Tamils" (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. "Social Life of the Tamils - The Classical Period" (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. "Tamils and Technology" by G. Jayanthi Ravikrishnan,Published by Sri Krishna HiTech Publishing Company Private Limited

WEB RESOURCES
1. https://archive.org/details/keeladibookenglish18092019/page/n13/mode/2up

2. https://www.tamildigitallibrary.in/admin/assets/book/TVA_BOK_0005812_Language_and_Literature.pdf

3. https://archive.org/details/ILXZ_historical-heritage-of-the-tamils-edited-by-s-v subrahmanian-and-k-d-thirunavukk

		L	T	P	C
23MC102	**ENVIRONMENTAL SCIENCES**	2	0	0	0

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.

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 - Green house effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedy b. Water pollution c. 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. HIV AIDS.

TOTAL: 30 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
CO2	Understand the importance of natural resources and conservation of biodiversity.	[U]
CO3	Understand and analyze the impact of engineering solutions in a global and societal context.	[U]
CO4	Apply the gained knowledge to overcome pollution problems.	[AP]
CO5	Apply the gained knowledge in various environmental issues and sustainable development.	[AP]

TEXT BOOKS
1. Anubha Kaushik and C P Kaushik "Perspectives in Environmental Studies"4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi.

2. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2015.

3. Tyler Miller, Jr., "Environmental Science", Brooks/Cole a part of Cengage Learning, 2014.

REFERENCE BOOKS
1. William Cunningham and Mary Cunningham, "Environmental Science", 13th Edition, McGraw Hill, 2015.
2. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Third Edition, Pearson Education, 2014.

3. 1. Anji Reddy .M (2007), Textbook of Environmental Sciences and Technology, Hyderabad, BS. Publications.

WEB RESOURCES
1. www.edx.org/course/subject/environmental-studies
2. www.environmentalscience.org
3. http://nptel.ac.in/courses/104103020/20

23GE301	UNIVERSAL HUMAN VALUES	L	T	P	C
	(Common to all branches)	3	0	0	3

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 complementarities 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.

Module I: COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION, UNDERSTANDING HARMONY IN THE HUMAN BEING- HARMONY IN MYSELF! 10

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 10

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 HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS   **10**

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 an 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.

<div align="right">

TOTAL : 30 PERIODS

</div>

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
CO2	Apply responsibilities towards their commitments (human values, human relationship and human society).	[AP]
CO3	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]
CO4	Analyze ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[AN]
CO5	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in nature.	[U]

TEXT BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G Bagaria, Excel Books, New Delhi, 2010

2. Universal Human Values by Dr. Kuldeep S. Sharma, Dr. Sarveen Kaur Sachdeva, Booksclinic Publishing, New Delhi, 2023

3. Universal Human Values by Dr. Narayan R. Chandak, Adv. Jyotsna N. Chandak, Notion Press, Chennai, 2021

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 India Wins Freedom-Maulana Abdul Kalam Azad.

3. Values and Ethics in Business and Profession by Samita Manna, Suparna Chakraborti, PHI Learning Pvt. Ltd., New Delhi, **2010**

WEB RESOURCES

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.basic%20human%20values.pdf

23CYC01	CYBER SECURITY ESSENTIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To obtain comprehensive knowledge in the field of Cyber security and understanding Threats, Vulnerabilities and Attacks.
2. To analyse the principles and techniques used in intrusion detection and also analyse the technical challenges and fundamental limitations.
3. To identify and investigate in-depth both early and contemporary threats in mobile and wireless security.
4. To understandand analyse the challenging Internet cyber attacks and its counter measures.
5.
6. To associate the Compliance standards and Computer Ethics with cyber security.

Module I: INTRODUCTION TO SECURITY   15

Computer Security Concepts – Cybersecurity Threats, Vulnerabilities and Attacks, The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security. Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography — Foundations of modern cryptography: Perfect security — Information Theory — Product Cryptosystem — Cryptanalysis - Zero trust Security.

Module II: SECURITY IN OPERATING SYSTEMS AND DEFENCES   15

Security in Operating Systems: Security in the Design of Operating Systems – Rootkit – Network security attack – Threats to Network Communications – Wireless Network Security — Denial of Service — Distributed Denial-of-Service. Security Countermeasures: Cryptography in Network Security – Firewalls – Intrusion Detection and Prevention Systems – Network Management – Databases – Security Requirements of Databases – Reliability and Integrity – Database Disclosure.

Module III: CYBER SECURITY MANAGEMENT   15

Security Planning – Business Continuity Planning – Handling Incidents – Risk Analysis – Dealing with Disaster – Incident response and management. Cyber security in industrial contexts Information Governance in Industry – Securing Industrial Internet of Things (IIoT) Intrusion detection and prevention - Compliance standards, Computer Ethics.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the fundamentals of Cybersecurity Threats, Vulnerabilities and Attacks.	[U]
CO2	Analyse the technical challenges and fundamental limitations of intrusion detection	[A]

CO3   Analyse the risks involved in a complex real time systems with [A] countermeasures.

CO4   Analyze cyber-attacks and learn data privacy issues and preventive measures [A] in the scalable network domain

CO5   Associate the Compliance standards and Computer Ethics with cyber security   [A]

TEXTBOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.

2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short, "Cybersecurity essentials", John Wiley & Sons, 2018.

3. Amit Garg, Krishna Kumar Goyal, "Cyber Security", Laxmi Publications, 2022.

REFERENCE BOOKS

1. George K. Kostopoulous, "Cyber Space and Cyber Security", CRC Press, 2013.

2. Graham, J. Howard, R., Olson, R., "Cyber Security Essentials", CRC Press, 2011.

3. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations ‖", Cengage Learning, New Delhi,2009.

WEB RESOURCES

1. https://skillsforall.com/course/cybersecurity-essentials

2. https://www.ncsc.gov.uk/cyberessentials/overview

3. https://in.coursera.org/learn/introduction-to-cybersecurity-essentials#syllabus

4. https://www.netacad.com/courses/cybersecurity/cybersecurity-essentials

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

23CY305	APPLIED STATISTICS USING PYTHON	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To understand and gain the knowledge of linear regression models
2. To learn the concept of testing hypotheses using statistical analysis
3. To develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
4. To understand the key technologies in data science and business analytics.
5. To effectively visualize the data using tools Matplotlib and Seaborn to communicate statistical findings.

Module I: DESCRIPTIVE AND PREDICTIVE STATISTICS   15

Central tendency - Mean, Median and Mode, Dispersion- Range, Quartile deviation, Standard deviation. Bivariate data. Summarization, marginal and conditional frequency distribution - Linear Regression Model - Standard multiple regression models. Test of hypothesis: Concept and formulation — Neyman Pearson lemma– Procedures of testing: Small samples: Student"s t test — F test — Chi square test — Large samples: Difference of Means and proportions. Multivariate Analysis of Variance.

Module II: PRINCIPAL COMPONENT ANALYSIS AND CLUSTERING   15

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot. Cluster Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

Module III: PYTHON DATA STRUCTURES, CLASSES, TIME SERIES AND VISUALIZATION   15

Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files - Reading and Writing. Data Wrangling: Combining and Merging Datasets, Reshaping and Pivoting, Data Transformation, String Manipulation, Regular Expressions. Group by Mechanics, Data Aggregation, Groupwise Operations and Transformations, Pivot Tables and Cross Tabulations, Time Series Basics, Data Ranges, Frequencies and Shifting Visualization in Python: Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches.

TOTAL (Theory): 45 PERIODS

LIST OF EXPERIMENTS

1. Generation of prime numbers and computation of GCD for foundational cryptographic operations.
2. Analysis of student scores to determine statistical measures and grade classification.

3. Execution of matrix operations using NumPy to simulate basic image processing functions.
4. Solving linear equations for engineering and business use cases using matrix algebra in Python.
5. Conducting hypothesis testing using t-test and chi-square test on small and large samples.
6. Building a logistic regression model to predict student performance outcomes.
7. Performing sales data analysis through data wrangling techniques using the pandas library.
8. Analyzing and visualizing time-series trends from datasets such as COVID-19 case statistics.
9. Application of K-Means clustering for customer segmentation using Scikit-learn.
10. Generating and interpreting statistical visualizations using the Seaborn package.

TOTAL(Lab):30 PERIODS
TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1   Interpret the coefficients in linear and multiple linear regression model and understand their relevance in modelling complex datasets.
             [U]

CO2   Use testing hypotheses in statistical analysis, estimators and time series analysis.
             [AP]

CO3   Categorize datasets using modern computational statistical approaches.
             [U]

CO4   Demonstrate original, non-trivial Python programs.
 [AP]

CO5   Apply algorithms to build machine intelligence.
             [AP]

TEXTBOOKS

1. Anderson. T.W, "An Introduction to Multivariate Statistical Analysis", Wiley, 3rd Edition, 2003.
2. Jobson. J.D, "Applied Multivariate Data Analysis", Vol I & II, Springer, 2012.
3. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", A press, 2ndEdition, 2008.

REFERENCE BOOKS
1. Stanley A Mulaik, "Foundations of Factor Analysis", 2nd Edition, CRC Press, 2009
2. Douglas C. Montogomery,Elizabeth A.Peck, G.Geoffrey Vining, "Introduction to Linear Regression Analysis", 5th Edition, Wiley,2012

3. Wes Mc Kinney, "Python for Data Analysis", O"Reilly, 2018

WEB RESOURCES

1. https://www.edx.org/course/statistical-modeling-and-regression-analysis

2. https://www.cin.ufpe.br/~embat/Python%20for%20Data%20Analysis.pdf

3. https://www.kdnuggets.com/2016/07/statistical-data-analysis-python.html

23ADC01	ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1. To explore AI's history, definitions, and ethical dimension of AI and differentiate it from Machine Learning and Deep Learning.
2. To study search algorithms, logic-based reasoning, and knowledge representation methods for problem-solving in AI.
3. To gain insights into knowledge representation, logic-based reasoning and expert systems.
4. To implement AI algorithms in domains such as Natural Language Processing (NLP), Computer Vision, and Decision-Making systems.
5. To investigate bias, fairness, accountability, and ethical considerations in designing and implementing AI technologies.

Module I: FOUNDATIONS OF ARTIFICIAL INTELLIGENCE   10

Definition and History of AI - AI vs Machine Learning vs Deep Learning - Applications of AI in Healthcare, Finance, and Robotics - AI Ethics and Challenges - Turing Test and AI Approaches (Symbolic AI vs Subsymbolic AI). PROBLEM SOLVING in AI **-** Problem Formulation - Uninformed Search (BFS, DFS) - Informed Search (A*, Greedy Search) - Constraint Satisfaction Problems (CSPs) - Adversarial Search and Game Theory (Minimax Algorithm, Alpha-Beta Pruning)

Module II: KNOWLEDGE, REASONING AND LEARNING   10

Logic in AI: Propositional and First-Order Logic - Knowledge Representation: Semantic Networks, Frames, Ontologies - Inference Mechanisms: Forward Chaining, Backward Chaining - Introduction to Expert Systems - Fundamentals of Language -Probabilistic Language Processing -NLP Basics - Reinforcement Learning and AI Agents

Module III: AI IN ACTION – PERCEPTION, COMMUNICATION & APPLICATIONS   10

Information Retrieval & Extraction – Perception: Image Formation, Object Recognition – AI in Computer Vision (Image Recognition) — AI in Edge Computing and IoT- Case Study - AI Applications in Smart Cities, Healthcare, and Business

TOTAL (THEORY): 30 PERIODS

LIST OF EXPERIMENTS

1. Implement a simple AI-based Python script
2. Exploring AI applications in real-world case studies.
3. Implementing BFS and DFS in Python.
4. Implement A* and Greedy Best-First Search to find the shortest path in a grid.
5. Implement an AI agent to play Tic-Tac-Toe using the Minimax algorithm.
6. Implement a basic propositional logic reasoning system.
7. Build a simple knowledge base using First-Order Logic.
8. Create a semantic network to represent relationships between objects.

9. Design a basic expert system for medical diagnosis
10. Perform tokenization, stemming, and stop-word removal on sample text.
11. Implement a speech-to-text system using Python's speech recognition library.
12. Implementing AI for a real-world problem (e.g., predicting student performance).

TOTAL (LAB): 15 PERIODS
TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Assess various Artificial Intelligence (AI) techniques and identify their fundamental concepts.	[U]
CO2	Apply problem-solving techniques such as search algorithms and game theory in AI systems.	[AP]
CO3	Implement knowledge representation and reasoning techniques for intelligent decision-making.	[AP]
CO4	Demonstrate Machine Learning algorithms and AI frameworks to solve real-world problems	[AP]
CO5	Design AI-based applications for NLP, Computer Vision, and Robotics. Evaluate the ethical considerations and social impacts of AI in various domains	[AP]

TEXTBOOKS

1. Stuart Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2021.
2. K. R. Chowdhary, Fundamentals of Artificial Intelligence, Springer, 2020.
3. Elaine Rich & Kevin Knight, "Artificial Intelligence", 3rd Edition, McGraw-Hill, 2017.

REFERENCE BOOKS

1. Wolfgang Ertel, Introduction to Artificial Intelligence, 2nd Edition, Springer, 2018.
2. Mariusz Flasiński, Introduction to Artificial Intelligence, Springer, 2016.
3. Stephen Lucci & Danny Kopec, Artificial Intelligence in the 21st Century: A Living Introduction, 2nd Edition, Mercury Learning and Information, 2016

WEB RESOURCES

1. https://www.coursera.org/learn/introduction-to-ai
2. https://www.coursera.org/learn/ai-for-everyone
3. https://ai.google/get-started/for-developers/
4. https://nptel.ac.in/courses/106102220
5. https://nptel.ac.in/courses/106106140

23CS303	ALGORITHM DESIGN TECHNIQUES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To enable students to analyze the performance of algorithms mathematically and apply problem-solving techniques effectively.
2. To guide students in utilizing greedy techniques for solving optimization problems, including applications in pattern matching and palindrome identification.
3. To train students in designing solutions for constraint satisfaction problems using backtracking algorithms.
4. To equip students with an in-depth understanding of advanced dynamic programming algorithms and their practical applications.
5. To facilitate learning of graph algorithms and range query optimizations, helping students implement these techniques in real-world problem-solving scenarios.

Module I: ALGORITHM COMPLEXITY ANALYSIS & GREEDY APPROACH   15

Time Complexity Analysis: Mathematical analysis of recursive and non-recursive algorithms, Master"s Theorem, Sieve of Sundaram. Recursion: Concept of recursion, base cases, and recursive problem-solving strategies. Greedy Algorithms: Activity Selection Problem, Fractional Knapsack. Industry Focus: Demonstration of built-in functions and optimization practices in C++.

Module II: STRING ALGORITHMS AND BACKTRACKING   15

String Algorithms: Naïve Pattern Matching, Rabin-Karp Algorithm, Z Algorithm, Knuth-Morris-Pratt (KMP) Algorithm, Manacher"s Algorithm for longest palindromic substring. Backtracking: Rat in a Maze, Permutation and Combination, N-Queen Problem. Knight's Tour Problem, Subset Sum, M-Coloring Problem, Hamiltonian Cycle Problem. Sudoku Solver, Prime Numbers after Prime P with Sum S.

Module III: DYNAMIC PROGRAMMING, GRAPH & RANGE QUERY ALGORITHMS   15

Dynamic Programming: Top-down and Bottom-up Approach, 0-1 Knapsack, Coin Change Problem, Subset Sum Problem, Minimum Cost Path. Longest Common Subsequence (LCS), Longest Increasing Subsequence (LIS), Longest Palindromic Subsequence. Graph Algorithms: Single Source Shortest Path Algorithm (Dijkstra"s Algorithm). All-Pairs Shortest Path (Floyd Warshall Algorithm). Minimum Spanning Tree (Prim"s and Kruskal"s Algorithm). Range Query Algorithms: Range Minimum Query (RMQ) - Brute Force Approach, RMQ Using Segment Tree, RMQ using Sparse Table.

TOTAL (Theory): 45 PERIODS

LIST OF EXPERIMENTS

1. Implement time complexity analysis for recursive and non-recursive algorithms.
2. Solve the Activity Selection Problem and Fractional Knapsack using the greedy approach.
3. Implement Rabin-Karp and Knuth-Morris-Pratt (KMP) string matching algorithms.

4. Solve backtracking problems: N-Queen, Knight"s Tour, Subset Sum, and Sudoku Solver.
5. Implement dynamic programming algorithms: Longest Common Subsequence (LCS), 0-1 Knapsack, and Minimum Cost Path.
6. Implement graph algorithms: Dijkstra"s Algorithm, Floyd-Warshall Algorithm, and Minimum Spanning Tree (MST).
7. Solve Range Minimum Query problems using Segment Tree and Sparse Table.

TOTAL (Lab): 30
PERIODS
PERIODS TOTAL: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Analyze the computational complexity of algorithms applied to real-world problem-solving	[AN]
CO2	Implement greedy algorithms for solving optimization problems and string-matching algorithms for pattern searching.	[AP]
CO3	Solve constraint satisfaction problems using backtracking techniques.	[AP]
CO4	Apply dynamic programming algorithms to real-world optimization and sequence-related challenges.	[AP]
CO5	Assess the efficiency and applicability of graph algorithms and range query techniques for solving optimization problems	[AN]

TEXTBOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", 4th Edition, The MIT Press, April 5, 2022.
2. Jon Kleinberg and Éva Tardos, "Algorithm Design", 2nd Edition, Pearson, 2022.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2019.

REFERENCE BOOKS

1. Steven S. Skiena, "The Algorithm Design Manual", 3rd Edition, Springer, 2020.
2. Robert Sedgewick, Kevin Wayne, "Algorithms", 4th Edition, Addison-Wesley, 2021.
3. Aditya Bhargava, "Grokking Algorithms", 2nd Edition, Manning Publications, 2024.

WEB RESOURCES

1. https://www.coursera.org/learn/cpsc-8400-design-and-analysis-of-algorithm
2. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring- 2015/pages/syllabus/
3. https://onlinecourses.nptel.ac.in/noc25_cs23/preview
4. https://www.codechef.com/learn/course/college-design-analysis-algorithms

23CS304	FRONTEND FRAMEWORKS	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

1. Provide a quick refresher on core JavaScript concepts essential for React.
2. Explore the fundamental and advanced concepts of React, including component- based architecture and state management.
3. Implement dynamic and responsive web applications using React's best practices.
4. Introduce practical techniques like HTTP requests, form handling, routing, and lazy loading.
5. Enable learners to build scalable, real-world projects with React and backend integration.

Module I: CORE JAVASCRIPT & REACT FUNDAMENTALS

JavaScript refresher covering Variables (var, let, const), Operators, and Control Flow. Functions including Callback Functions, Arrow Functions, Promises, and Async/Await. JavaScript Objects and Arrays with ES6+ Features such as Destructuring, Spread/Rest Operators, and Template Literals. Error Handling using Try-Catch and Debugging with Developer Tools. Modern JavaScript Features including Modules (import/export), Classes, and Closures. Introduction to React covering Core Concepts, Virtual DOM, and React Ecosystem. Setting up a React Development Environment using npm and create-react-app. JSX and React Components including Functional and Class-based Components, along with Props and Dynamic Rendering.

Module II: STATE MANAGEMENT, EVENT HANDLING & ROUTING

Understanding React State and State Manipulation using the useState Hook and Class-based State. Event Handling in React including User Inputs, Events, and Form Handling. React Forms covering Controlled and Uncontrolled Components with Form Validation. Component Lifecycle Methods including Mounting, Updating, and Unmounting Phases. Advanced Hooks such as useEffect, useContext, and Custom Hooks. React Router for Navigation including Setting Up Routing, Nested Routes, and Navigation Strategies in SPAs.

Module III: ADVANCED REACT CONCEPTS, API INTEGRATION & OPTIMIZATION

State Management with Redux for handling complex state efficiently. Fetching and Posting Data using Fetch API or Axios for REST API integration, including API Response Handling and Error Management. Performance Optimization using Lazy Loading and Code Splitting. Working with Environment Variables using .env Files and Configuration Management. End-to-End Integration of React with Backend APIs. Unit Testing in React and Implementing Continuous Integration and Deployment (CI/CD) strategies

LIST OF EXPERIMENTS

1. Create basic JavaScript functions, objects, and arrays with ES6+ features.
2. Build a simple SPA with React functional components and props.
3. Implement dynamic list rendering and conditional rendering in React.
4. Handle user input and form validation in a React app.
5. Manage component state using the useState hook and class-based state.
6. Work with React lifecycle methods and implement useEffect for side effects.
7. Implement routing and navigation using React Router.
8. Configure lazy loading and optimize app performance.
9. Fetch and display data from a REST API using Axios/Fetch API in React.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply key JavaScript concepts (objects, functions, and asynchronous operations) in React development.	[U]
CO2	Develop React applications with component-based architecture, props, and state management.	[AP]
CO3	Implement advanced React concepts, including lifecycle methods, forms, event handling, and hooks.	[AP]
CO4	Integrate React with REST APIs and optimize app performance with lazy loading.	[AN]
CO5	Build Single Page Applications (SPAs) using React Router and implement navigation and routing strategies	[AP]

TEXTBOOKS

1. Ethan Brown, *Learning JavaScript: JavaScript Essentials for Modern Application Development*, 2nd Edition, O'Reilly Media, 2020.

2. Robin Wieruch, *The Road to React: Your Journey to Master React.js in JavaScript*, Leanpub, 2023.

3. Alex Banks & Eve Porcello, *Learning React: Modern Patterns for Developing React Apps*, 3rd Edition, O'Reilly Media, 2023.

REFERENCE BOOKS

1. David Flanagan, *JavaScript: The Definitive Guide*, 7th Edition, O'Reilly Media, 2020.
2. Axel Rauschmayer, *JavaScript for Impatient Programmers*, 2nd Edition, O"Reilly Media, 2020.
3. Kent C. Dodds, *Testing JavaScript Applications*, Pragmatic Programmers, 2021.

WEB REFERENCE

1.   https://reactjs.org/docs/getting-started.html

2.   https://javascript.info/

3.   https://developer.mozilla.org/en-US/docs/Web/JavaScript

SEMESTER – IV

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

23GEC01	ENTREPRENEURSHIP AND STARTUP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To provide a comprehensive understanding of the entrepreneurial process, from idea generation to startup growth
2. To familiarize students with different startup funding mechanisms and legal frameworks
3. To equip students with problem-solving, innovation, and business decision-making skills
4. To enhance students' ability to use technology, market research, and financial planning in their entrepreneurial journey
5. To develop practical entrepreneurial skills through blended learning, real-world case studies, and project-based learning

Module I: ENTREPRENEURSHIP & STARTUP ECOSYSTEM 15

Overview of Entrepreneurship & Startups - Characteristics of Successful Entrepreneurs - Identifying Business Opportunities and Idea Generation - Types of Startups: Lifestyle, Scalable, Small Business, Social, etc. — Incubation - support - The Role of Incubators - , Accelerators, and Startup Ecosystems - Government Initiatives & Policies for Startups in India and Globally.

Module II: STARTUP FINANCE, LEGAL FRAMEWORK & BUSINESS STRATEGY 15

Startup Financial Planning: Start-up financing metrics- Bootstrapping, Angel Investors, Venture Capital, Crowdfunding - Developing a Financial Model & Revenue Strategy - Legal Aspects of Startups: Business Registration, IP & Patent Protection, Taxation & Compliance Risk Analysis and Mitigation Strategies - Go-to-Market Strategy and Product-Market Fit - Digital Marketing & Branding Strategies for Startups - Growth Hacking & Scaling Strategies.

Module III: STARTUP SUSTAINABILITY, SCALING, AND EXIT STRATEGIES 15

Startup Growth Stages: Expansion, Scaling, Diversification - Sustainable Business Models and Social Entrepreneurship - Leadership and Team Building in Startups - Fail Fast, Learn Faster: Case Studies on Startup Failures - Mergers, Acquisitions, and IPOs - Ethical & Social Responsibilities of Entrepreneurs.

TOTAL: 45 PERIODS

Blended Learning Activities:

• Case Study and Discussion: Analyze Airbnb"s startup journey,

• Draft a business contract or IP filing procedure.

• Startup Exit Strategy Simulation

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Apply the knowledge of entrepreneurship and startup ecosystem concepts to identify potential business opportunities and suitable startup types	[AP]
CO2	Apply lean startup methodology and create a Business Model Canvas for a selected startup idea using brainstorming tools like Miro or Google Jamboard	[AP]
CO3	Analyze various startup financing options, legal compliance requirements, and value chain positioning to construct a feasible financial and go-to-market strategy	[A]
CO4	Analyze real-world startup failures and crisis scenarios to identify root causes and recommend corrective strategies for future ventures	[A]
CO5	Apply the principles of sustainable business practices and strategic scaling to design a socially impactful startup model and simulate a realistic exit strategy	[AP]

TEXTBOOKS

1. Steven Fisher, Ja-nae‟ Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd, (2016)

2. Donald F Kuratko, Jeffrey S. Hornsby, New Venture Management: The Entrepreneur‟s Road Map, 2e, Routledge (2017)

3. David H. Hott, "Entrepreneurship New Venture Creation", PHI (2018)

REFERENCE BOOKS

1. Greco, F. (2023). Startup Ecosystems: Components for an Interpretative Model and International Benchmarks. Germany: Springer Nature Switzerland.

2. Aulet, B. (2013). Disciplined Entrepreneurship: 24 Steps to a Successful Startup. Germany: Wiley.

3. Harris, T. (2018). Start-up: A Practical Guide to Starting and Running a New Business. Germany: Springer International Publishing.

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc20_mg35/preview
2. https://cloud.google.com/startup
3. https://startup.google.com/
4. https://www.startupindia.gov.in/

23CY403	AUDITING IT INFRASTRUCTURE FOR COMPLIANCE	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. To understand the foundational concepts and significance of Identity and Access Management (IAM) in securing enterprise IT infrastructure.
2. To evaluate key U.S. compliance laws and frameworks, and analyze their role in shaping modern IT infrastructure audit standards.
3. To develop the ability to plan, execute, and document an IT infrastructure compliance audit across user, workstation, LAN, and WAN domains.
4. To implement and assess security controls in remote access and application systems through practical compliance audit exercises.
5. To explore ethical considerations and pursue professional certification pathways relevant to IT auditing and security compliance roles.

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, SSDLC and its importance.

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-Compliance Within the LAN-to-WAN Domain-Compliance Within the WAN Domain.

Module III: PRACTICAL APPLICATION AND COMPLIANCE REPORTING   15

Compliance Within the Remote Access and System/ Application Domains Compliance Within the Remote Access Domain - Compliance Within the System/Application Domain- Ethics, Education, and Certification for IT Auditors.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1	Understand the role of information systems security compliance.	[U]
CO2	Analyze the IT audit for compliance and, standards and frameworks.	[A]
CO3	Apply the parameters required to conduct and report on an IT infrastructure audit for organizational compliance.	[AP]
CO4	Describe information security systems compliance requirements within the seven domains of an IT infrastructure.	[U]
CO5	Understand the qualifications, ethics, and certification organizations for IT auditors al-time scenarios	[AP]

TEXTBOOKS

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. Information Technology Control and Audit by Sandra Senft, Frederick Gallegos, Taylor & Francis/CRC Press, Boca Raton, 2013
3. IT Auditing: Using Controls to Protect Information Assets by Chris Davis, Mike Schiller, Kevin Wheeler, McGraw-Hill Education, New York, 2011

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. IT Governance: An International Guide to Data Security and ISO27001/ISO27002 by Alan Calder, Steve Watkins, Kogan Page, London, 2015

WEB RESOURCES

1. https://www.nri-secure.com/blog/us-cybersecurity-laws-compliance
2. https://www.techtarget.com/searchsecurity/tip/IT-security-frameworks-and- standards-Choosing-the-right-one
3. https://samples.jblearning.com/9781284236606/9781284248814_FM_MKT_Secu_red.pdf

23CY406	CYBER LAW AND DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

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.

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

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Identify the fundamentals of Cybercrime.	[U]
CO2	Discover the causes of crime the Information Technology Law.	[U]
CO3	Interpret the benefits and principles of using open-source tools in digital forensics	[AP]
CO4	Analyze the learning tools such as TestDisk & PhotoRec, R-Linux, and SystemRescue.	[A]
CO5	Analyze Bulk Extractor and CAINE for advanced data extraction and integrated forensic analysis	[A]

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

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

3. Cyber Law and Ethics by Mark Grabowski, Routledge, London, **2021**

WEB RESOURCES

1. https://www.geeksforgeeks.org/last-minute-notes-Cybercrime/

2. https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_tutorial.pdf

3. https://www.coursera.org/learn/ethical-hacking-essentials-ehe?action=enroll

4. https://onlinecourses.swayam2.ac.in/cec22_lw07/preview

23CSC02	MACHINE LEARNING TECHNIQUES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

1. To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
2. To explore the different supervised learning techniques including ensemble methods
3. To learn different aspects of unsupervised learning
4. To learn the role of probabilistic methods for machine learning
5. To understand the basic concepts of neural networks and deep learning

Module I: INTRODUCTION AND MATHEMATICAL FOUNDATIONS   10

What is Machine Learning? Need — History — Definitions — Applications - Advantages, Disadvantages & Challenges - Types of Machine Learning Problems — Mathematical Foundations - Linear Algebra & Analytical Geometry - Probability and Statistics - Bayesian Conditional Probability - Vector Calculus & Optimization - Decision Theory - Information theory

Module II: SUPERVISED AND UNSUPERVISED LEARNING   10

Introduction- Discriminative and Generative Models - Linear Regression - Least Squares - Under-fitting / Overfitting - Cross-Validation — Lasso Regression - Classification - Logistic Regression - Gradient Linear Models - Support Vector Machines — Kernel Methods - Instance based Methods - K-Nearest Neighbours - Tree based Methods – Decision Trees — ID3 – CART - Ensemble Methods – Random Forest - Evaluation of Classification Algorithms- Introduction - Clustering Algorithms - K — Means — Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm.

Module III: PROBABILISTIC METHODS, NEURAL NETWORKS AND DEEP LEARNING
                                                                          10

Introduction - Naïve Bayes Algorithm - Maximum Likelihood - Maximum Apriori - Bayesian Belief Networks - Probabilistic Modelling of Problems - Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models - Neural Networks — Biological Motivation - Perceptron — Multi-layer Perceptron – Feed Forward Network – Back Propagation - Activation and Loss Functions- Limitations of Machine Learning — Deep Learning– Convolution Neural Networks — Recurrent Neural Networks.

TOTAL (Theory): 30 PERIODS

List of Experiments:

1. Implementation of Regression Models — Linear, Polynomial, Ridge & Lasso Regression on real-world data (House Price Prediction)

2. Decision Tree and Ensemble Learning — Implement Decision Tree, Random Forest, and XGBoost for classification tasks (Iris/Titanic dataset)
3. Support Vector Machines (SVM) and K-Nearest Neighbors (KNN) — Train and evaluate classifiers on Handwritten Digit Recognition (MNIST)
4. Artificial Neural Networks (ANN) — Build a feedforward neural network for classification using Backpropagation (MNIST dataset)
5. Convolutional Neural Networks (CNN) — Train a CNN model for image classification using CIFAR-10/Fashion-MNIST dataset
6. Unsupervised Learning – Implement K-Means, Hierarchical Clustering, and DBSCAN for customer segmentation
7. Dimensionality Reduction & Anomaly Detection — Apply PCA & t-SNE for feature reduction, Autoencoders for fraud detection
8. Model Deployment & Explainable AI — Deploy a trained ML model using Flask/FastAPI and analyze model predictions using SHAP/LIME

TOTAL (Lab): 30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES (COs):

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

CO1	Apply mathematical concepts like linear algebra, probability, and vector calculus to solve machine learning problems.	[AP]
CO2	Evaluate different machine learning problems, including supervised and unsupervised learning, along with their applications and challenges.	[AP]
CO3	Design supervised learning models and analyze their performance using techniques like cross-validation and ensemble methods.	[AN]
CO4	Construct probabilistic models, including Naïve Bayes and Hidden Markov Models, for sequence modeling and classification tasks.	[AP]
CO5	Assess deep learning architectures like CNNs and RNNs and compare them to traditional machine learning techniques	[AN]

TEXTBOOKS:

1. Christoph Molnar, "Interpretable Machine Learning: A Guide for Making Black Box Models Explainable", 3rd Edition, Creative Common License, 2025.
2. Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals", 2nd Edition, Wiley, 2020.
3. Francois Chollet, "Deep Learning with Python", 2nd Edition, Manning Publications, 2020.

REFERENCE BOOKS:

1. Josh Starmer, PhD, "The StatQuest Illustrated Guide to Machine Learning!!!: Master the Concepts, One Full-Color Picture at a Time, from the Basics All the Way to Neural Networks. BAM!", Qurate Books Pvt. Ltd., 2022.
2. Sebastian Raschka, Vahid Mirjalili, "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2", 3rd Edition, Packt Publishing Ltd, 2019.
3. Taylor Arnold, Michael Kane, Bryan W. Lewis, "Computational Approach to

Statistical Learning", CRC Press, 2019.

WEB REFERENCES:

1. Stat Quest - https://www.youtube.com/channel/UCtYLUTtgS3k1Fg4y5tAhLbw
2. https://onlinecourses.nptel.ac.in/noc16_cs18/preview 2.
3. https://freevideolectures.com/course/2257/machine-learning 3.
4. https://www.coursera.org/learn/machine-learning
5. https://www.analytixlabs.co.in/machine-learning-course-certification-training 2.
6. https://in.udacity.com/course/intro-to-machine-learning--ud120-india

23CY401	ETHICAL HACKING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To understand and learn a complete introduction to Linux and Windows operating system fundamentals, including file systems, boot processes, and advanced command-line usage.
2. To explore and apply the fundamental methodology and phases of ethical hacking, including reconnaissance, vulnerability assessment, and penetration testing techniques.
3. To gain practical knowledge in scanning, enumerating, and exploiting system vulnerabilities across web applications, wireless networks, and mobile devices.
4. To study and perform Linux privilege escalation, authentication bypass, and advanced malware analysis techniques in real-world scenarios.
5. To understand and learn key concepts in cryptographic attacks and countermeasures, network sniffing/spoofing, and secure client and infrastructure management.

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**

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 (Theory): 45 PERIOD

List Of Experiments

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP

2. Practice the basic commands in Kali.

3. Practice the tool burpsuite.

4. Practice the tools like nmap, ghidra.

5. Using FOCA / SearchDiggity 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 (Lab): 30 PERIODS
TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Remember basic Linux Commands and their usages.	[R]
CO2	Understand ethical hacking methodologies and techniques to identify security vulnerabilities.	[U]
CO3	Classify advanced ethical hacking techniques to secure systems and prevent attacks.	[U]
CO4	Analyze the knowledge of wireless network hacking, cryptographic attacks, and social engineering for effective threat mitigation.	[A]
CO5	Apply the digital forensics techniques to investigate and respond to security incidents.	[AP]

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,
3. Microsoft Press, 2017,ISBN: 978-0-7356-8418-8.

WEB RESOURCES

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/
4. FOCA : http://www.informatica64.com/foca.aspx.
5. Nessus : http://www.tenable.com/products/nessus.

23CY405	CLASSICAL CRYPTOGRAPHY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1. To Learn the foundations of Cyber security and threat landscape.
2. To equip students with the technical knowledge and skills needed to protect and defend against cyber threats.
3. To develop skills in students that can help them plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets.
4. To expose students to governance, regulatory, legal, economic, environmental, social and ethical contexts of cyber security.
5. To expose students to responsible use of online social media networks.

Module I: INTRODUCTION TO CYBER SPACE   10

Cyberspace Fundamentals - The Fall of Algorithms: Brute-force, mathematical, side- channel, and quantum threats-Internet Evolution and Infrastructure - Regulating Cyberspace
- Fermat"s Theorem, Euler"s Theorem, Chinese Remainder Theorem, and Extended Euclidean Algorithm. Primality & Factorization Tests : Solovay–Strassen Test, Jacobi Symbol, Pollard"s Rho, p-1, and Kangaroo methods.

Module II: CLASSICAL CRYPTOGRAPHY   10

Cryptosystems: Affine Cipher, Vigenere Cipher, Hill Cipher, Linear Feedback Shift Register (LFSR)– Cryptanalysis on Affine Cipher. Classification of cybercrimes, Common cybercrimes
- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, Social engineering attacks-malware and ransomware attacks, zero day and zero click attacks, Cybercriminals Modus operandi, Reporting of cybercrimes, Remedial and mitigation measures.

Module III: CRYPTOANALYSIS   10

Transposition Ciphers, Columnar Transposition, Keyword Columnar Transposition, Double Transposition Ciphers, Substitution Ciphers, Simple Substitution Ciphers, Poly-alphabetic Ciphers, Affine Ciphers, Simple Substitution Cryptanalysis. Cyber Laws: Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organisations dealing with Cybercrime and Cyber security in India, Case studies.

TOTAL (Theory): 30 PERIODS

LIST OF EXPERIMENTS

1. Checklist for reporting cyber crime at Cyber crime Police Station.
2. Checklist for reporting cyber crime online.
3. Reporting phishing emails.
4. Demonstration of email phishing attack and preventive measures
5. Setting, configuring and managing three password policy in the computer (BIOS,Administrator and Standard User).
6. Setting and configuring two factor authentication in the Mobile phone.
7. Security patch management and updates in Computer and Mobiles.
8. Managing Application permissions in Mobile phone.
9. Installation and configuration of computer Anti-virus.

10. Installation and configuration of Computer Host Firewall.
11. Wi-Fi security management in computer and mobile.

ATTACKING MODELS

1. Dictionary Attacks

2. Encryption Tools and Cryptanalysis Tools

3. Email/Phishing Attacks and Countermeasures

4. File Metadata Analysis Tools

5. Disk Imaging and Validation Tools

6. Registry Analysis

7. File system Analysis using Autopsy

8. RAM Analysis using Volatility

9. Network Analysis using Wireshark

10. Email and Browser Analysis.

11. Write a program to implement the following cipher techniques to perform encryption and decryption

i. Caesar Cipher

ii. Playfair Cipher

iii. Hill Cipher

12. Write a program to implement the following transposition techniques

(i) Rail fence technique –Row major transformation

(ii) Rail fence technique - Column major transformation

TOTAL (Lab): 30 PERIODS

TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the concept of Cyber security and issues and challenges associated with it. Understand the fundamental of Cryptosystems requirements.	[U]
CO2	Perform cryptanalysis of classical cryptography	[A]
CO3	Analyze and explore the use of authentication and hashing.	[A]
CO4	Inquire a deep insight into attacks and emerging security algorithms.	[A]
CO5	Explore and analyze of signature and key exchange algorithms	[A]

TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice by William Stallings, Pearson Education Limited, London, 2022 (8th Edition, Global Edition)

2. Cryptography, Network Security, and Cyber Laws by Bernard L. Menezes & Ravinder Kumar, Cengage Learning India Pvt. Ltd., New Delhi, 2018 (1st Edition)

3. Introduction to Information Security and Cyber Laws by Ritendra Goel, Surya Prakash Tripathi & Praveen Kumar Shukla, Dreamtech Press India Pvt. Ltd., New Delhi, 2014 (1st Edition)

REFERENCE BOOKS

1. The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography by Simon Singh, Fourth Estate (UK) / Doubleday (US), London/New York, 1999 (1st Edition)

2. Computers, Internet & New Technology Laws (with focus on India) by Karnika Seth, LexisNexis, New Delhi, 2022 (3rd Edition)

3. Law Relating to Information Technology, E-Commerce, E-Governance & Cyber Crimes by D.P. Mittal, Commercial Law Publishers (India), New Delhi, 2011

WEB RESOURCES

1. https://www.geeksforgeeks.org//
2. http://web.stanford.edu/class/cs306l/

23MEC04	DESIGN THINKING AND IDEA LAB	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To accelerate development of indigenous products in line with the "Make in India" campaign.
2. To encourage aspiring engineers to actualize their ideas under one roof.
3. To impart multidisciplinary education to all students to promote innovation and product development
4. To initiate new ways of creative thinking and enable the students to learn the cycle of Design Thinking process for developing innovative products.
5. To promote experiential learning and entrepreneurial skills among the students.

DESIGN THINKING
Design Thinking: Definition, Need and Objective, Concepts and Brainstorming, Stages – Empathize, Define, Ideate, Prototype, Test. Practical Examples of Customer Challenges, Alignment of Customer Expectations with Product Design - Feedback, Re-Design and Re-Create.

INTRODUCTION TO TOOLS AND EQUIPMENT
Introduction to Hand Tools and Power Tools - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc.

Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace and OpenBSP - 2D and 3D structures for prototype building using CNC machine - Basic welding and other joining techniques for assembly - Basics of 3D scanning, Point cloud data generation for reverse engineering.

Exposure to PCB prototype fabrication - Familiarity and use of soldering and de-soldering equipment - Usage of Arduino, Raspberry Pi and BeagleBone.

EXPERIMENTAL LEARNING
1. 2D profile cutting of press fit box / casing in acrylic (3 or 6 mm thickness) / polymer / cardboard / MDF (2 mm thickness) board using laser cutter and engraver.
2. Machine 3D geometry on soft material such as soft wood using CNC router.
3. Fabricate products like trusses using cutting and welding tools.
4. 3D printing of scanned geometry using FDM or SLA printer.
5. Designing a suitable PCB layout, fabrication and testing of the circuit.
6. Assemble and disassemble electronic components on a PCB using soldering and de-soldering equipment.
7. Embedded programming using Arduino, Raspberry Pi and BeagleBone.

DESIGN THINKING PROJECT
1. Design and implementation of a capstone project.

TOTAL: 30 PERIODS

TEXT BOOKS
1. Veeranna D.K, "Workshop / Manufacturing Practices (with Lab Manual)", AICTE"s Prescribed Textbook, Khanna Book Publishing, 1st edition, 2022.
2. E. Balaguruswamy, "Design Thinking: A Beginner's Perspective", McGraw-Hill Education, 1st edition, 2024.
3. Anuja Agarwal, "Design Thinking: A Framework for Applying Design Thinking in Problem Solving", Cengage India, 1st edition, 2024.

REFERENCE BOOKS

1. Lal, D. M., "Design Thinking- Beyond the Sticky Notes", Sage Publications India Pvt. Ltd., 1st edition, 2021.
2. Kaushik Kumar and Muralidhar Kurni, "Design Thinking: A Forefront Insight", CRC Press, 1st edition, 2023.
3. Shalini Rahul Tiwari, "Design Thinking: A Comprehensive Textbook", Wiley India, 1st edition, 2024.

WEB RESOURCES

1. https://fab-coep.vlabs.ac.in/List%20of%20experiments.html
2. https://www.innovationtraining.org/how-to-use-design-thinking-to-design-an-innovation-lab/
3. https://www.erdster.co.in/design-thinking-lab.html
4. https://www.coursera.org/learn/uva-darden-design-thinking-innovation

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23CS404	**BACKEND FRAMEWORKS**	0	0	4	2

COURSE OBJECTIVES

1. Introduce core web service concepts, including server communication and JSON/XML handling.
2. Understand Spring Framework basics, IoC, DI, and REST API layers using Spring Boot.
3. Explore ORM concepts with Hibernate, including Architecture, JPA, Generator class, Dialects, Mapping, and Transaction Management.
4. Analyze database normalization concepts, referential integrity, and advanced JPA mapping.
5. Develop expertise in HQL, HCQL, and CRUD operations using Hibernate and JPA.

Module I: WEB SERVICES, TOMCAT SERVER, AND SPRING BOOT BASICS

Introduction to Web Services: Client-Server Communication, HTTP Protocol, JSON, and XML. Overview of Tomcat Server: Setup, Configuration, and Deployment of Web Applications. Introduction to Servlets: Servlet API, Lifecycle, and Handling HTTP Requests. Spring Framework Basics: Understanding IoC (Inversion of Control), Dependency Injection (DI), and Autowiring. Spring Boot Architecture: Setting up a Spring Boot Project, Layers in REST APIs, and Handling HTTP Responses. Exception Handling and Validation: Implementing Custom Exceptions, Validation Techniques, and HTTP Status Codes. Performing CRUD Operations: Working with Collections and Managing Data in Spring Boot.

Module II: HIBERNATE ORM, JPA, AND DATABASE MANAGEMENT

Introduction to Hibernate ORM: Understanding Object-Relational Mapping, Hibernate Architecture, and JPA Overview. Hibernate Setup and Configuration: Generator Classes, Dialects, and Entity Relationships. Hibernate Mapping: Implementing One-to-One, One-to- Many, and Many-to-Many Relationships with Annotations. Transaction Management: Handling Database Transactions, Hibernate Query Language (HQL), and Hibernate Criteria Query Language (HCQL). Database Normalization: RDBMS Concepts, Referential Integrity Constraints, and Normalization up to 3NF. JPA Mapping in Spring Boot: Establishing Entity Relationships, Query Optimization, and Data Persistence with CRUD Operations.

Module III: ADVANCED JPA MAPPING, SPRING SECURITY, AND AUTHENTICATION

Advanced JPA Mapping: Handling Complex Entity Relationships, Many-to-Many Mapping, and Debugging Spring Boot Applications. Introduction to Spring Security: Implementing Basic Authentication, Role-based Access Control, and Authorization. Securing APIs with JWT Authentication: Token Generation, User Authentication, and Protecting Endpoints. Enhancing Security in Spring Boot Applications: Managing Authentication Tokens, Enforcing Secure Data Access, and Securing REST Endpoints.

LIST OF EXPERIMENTS

1. Develop and deploy a simple servlet using Tomcat Server.
2. Implement CRUD operations using Spring Boot and REST APIs.
3. Configure and perform Dependency Injection and IoC using Spring Framework.
4. Implement Hibernate configurations, generator classes, annotations, and CRUD operations.
5. Perform JPA mapping with normalization (1NF, 2NF, and 3NF).
6. Create Many-to-Many relationships and test associations in Spring Boot.
7. Implement basic security controls and JWT token-based authentication in Spring Boot.
8. Use HQL and HCQL to perform advanced data querying with Hibernate.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand client-server communication and deploy web services using Tomcat	[U]
CO2	Implement REST APIs with Spring Boot, handle exceptions, and validate requests.	[AP]
CO3	Utilize ORM tools like Hibernate for database interaction, including JPA, Dialects, HQL, and HCQL	[AP]
CO4	Develop relational databases and implement various mappings in Spring Boot JPA.	[AP]
CO5	Apply Spring Boot applications for authentication, authorization, and JWT tokens.	[AP]

TEXTBOOKS

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, McGraw-Hill Education, 2019.
2. Craig Walls, Spring in Action, 5th Edition, Manning Publications, 2018
3. Effective Java by Joshua Bloch (3rd Edition, 2018)

REFERENCE BOOKS

1. Rod Johnson, Expert One-on-One J2EE Design and Development, Wrox Press, 2004.
2. Gavin King, Hibernate in Action, Manning Publications, 2005.
3. Subrahmanyam Allamaraju, RESTful Java Web Services, 2nd Edition, O'Reilly Media,2010.

WEB RESOURCES

1. https://fab-coep.vlabs.ac.in/List%20of%20experiments.html
2. https://www.innovationtraining.org/how-to-use-design-thinking-to-design-an- innovation-lab/
3. https://www.erdster.co.in/design-thinking-lab.html
4. https://www.coursera.org/learn/uva-darden-design-thinking-innovation

23MCC11	DISASTER MANAGEMENT AND PREPAREDNESS	2/0/0/0

COURSE OBJECTIVES

1. To learn the basic concepts, types, and features of disasters and hazards.

2. To know the effects of disasters on the environment and society.

3. To become familiar with disaster preparedness, early warning systems, and stakeholder roles.

4. To follow measures for disaster risk reduction and safety.

Module I: Introduction and Types of Disasters   10

Concepts and definitions: Disaster, hazard, vulnerability, resilience, capacity, risk – Types and characteristics of disasters – Natural disasters: floods, droughts, cyclones, earthquakes, tsunamis, volcanoes, landslides, coastal hazards, wildfires etc. – Human-induced disasters: industrial accidents, chemical/nuclear hazards, transportation accidents, urban flooding, terrorist attacks etc. – Disaster profiles in India.

Module II: Disaster Impacts and Preparedness Planning   10

Impacts of disasters: environmental, social, economic, physical, psychological and political – Special focus groups: children, women, elderly, differently-abled – Hazard zoning and risk mapping – Concepts of preparedness planning – Community-based disaster preparedness – Public awareness and education – Disaster drills, mock exercises, emergency communication and first-aid practices.

Module III: Disaster Risk Reduction and Management Systems   10

Disaster Management Cycle: prevention, mitigation, preparedness, response, rehabilitation and reconstruction – Risk and vulnerability assessment – Early warning systems – Emergency operation centers – Incident command system – Roles and responsibilities of Government agencies, local bodies, NGOs, armed forces, community groups and international organisations – Policy frameworks: Sendai Framework for DRR, National Disaster Management Act and institutional mechanisms in India.

Total: 30PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Comprehend the key concepts, causes, and categories of disasters.	[U]
CO2	Discuss the environmental, social, and economic impacts of various disasters.	[U]
CO3	Interpret hazard, vulnerability, and risk assessment approaches in disaster contexts.	[U]
CO4	Describe the elements of preparedness, early warning, and stakeholder roles in disaster management.	[U]
CO5	Adopt preparedness and mitigation strategies to achieve effective disaster risk reduction.	[AP]

Text Books:

1. Sharma, S. C. Disaster Management, Khanna Publishing House, 2025.

2. Palanivel, K. Disaster Management, Allied Publishers, 2015.

3. Sulphey, M. M. Disaster Management, PHI Learning Publications, 2017.

Reference Books:

1. Shrivastava, A.K., Text book of Disaster Management, Scientific Publications, 2021.

2. Rajendra Kumar Pandey., Disaster Management in India, SAGE Publications Pvt. Ltd., 2020.

3. Arulsamy S., and Jeyadevi J., Disaster Management, Neelkamal Publications, 2016.

IS Code of Practice:

1. IS 15498: 2023 – Guidelines for Improving the Cyclonic Resistance of Low-Rise Houses and Other Buildings, BIS, New Delhi.

2. IS 17163: 2020 – Site-Specific Investigation and Stability Analysis of Landslides — Guidelines, BIS, New Delhi.

3. IS 1893 (Part 1): 2016 – Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi.

Web References:

1. https://ndma.gov.in/

2. https://www.ndrf.gov.in/

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

2. https://www.coursera.org/learn/disaster-preparedness