SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution | Approved by AICTE | Affiliated to Anna University | Accredited by NAAC with A++ Grade
Kuniamuthur, Coimbatore – 641008
Phone : (0422)-2678001 (7 Lines) | Email : info@skcet.ac.in | Website : www.skcet.ac.in

Curriculum & Syllabi

Regulation 2022

2024-2028 Batch

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

(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

VISION OF THE DEPARTMENT

- To prepare professionals with high technical, research and entrepreneurial skills as well as ethical values who will contribute to the computational world.

MISSION OF THE DEPARTMENT

- To develop human resources with the ability and attitude to adapt to emergingtechnological changes through academic and research-oriented events
- To identify current socio, economic problems of national and international significance and provide solutions through competency centers
- To impart ethics, social responsibilities and necessary professional, entrepreneurialand leadership skills through student lead activities

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
To enable graduates to	
PEO 1	Be successful in their career in industries associated with Computer Science and Engineering
PEO 2	Comprehend, analyze, design, and create novel products and solutions for the real-life problems
PEO 3	Possess professional and ethical attitude, effective communication skills, team working skills, multi-disciplinary approach, and an ability to relate engineering issues to broader social context
PEO 4	Exhibit leadership qualities and progress through life-long learning

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, 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 – CSE programme will be able to:	
PSO 1	Apply the fundamental knowledge for problem solving and analysis as well as conduct investigations in computer science and engineering for sustainable development
PSO 2	Design and develop the solutions for real time problems and implement them by using modern software tools in lieu of deploying them in the society for its growth
PSO 3	Communicate effectively, adopt ethics and engage in life-long learning

IV. MAPPING OF PEOs WITH Pos

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

V. MAPPING OF PEOs WITH PSOs

	PSO 1	PSO 2	PSO 3
PEO 1	2	2	2
PEO 2	3	1	-
PEO 3	1	3	2
PEO 4	-	-	3

AUTONOMOUS CURRICULUM AND SYLLABI

Regulation 2022 (2024-2028 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	3,6,7,13
3	23AS101	Applied Science	4 / 0 / 0	4	4	3, 4, 7, 9, 11, 12, 13, 16
4	23EC111	Digital Logic Design and Computer Architecture	3 / 1 / 0	4	4	4, 8, 9, 12
Theory with Practical (Internal 50 Marks & External 50 Marks)						
5	23CS101	Problem Solving using C++	1 / 0 / 4	5	3	4,8,9
6	23IT101	Application Development Practices	1 / 0 / 4	5	3	4,8,9
Practical (Internal 60 Marks & External 40 Marks)						
7	23AS102	Applied Science Laboratory	0 / 0 / 4	4	2	3, 4, 7, 9, 11, 12, 13, 16
Indian Knowledge System						
7	23TA101	Heritage of Tamils	1 / 0 / 0	1	1	2, 7, 9, 12, 15, 16
Mandatory Course (Internal 100 Marks)						
8	23MC101	Induction Programme	3 weeks		0	3,4,5,10,16
Total				**30**	**24**	

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 Practical (Internal 50 Marks & External 50 Marks)						
2	23EN101	Oral and Written Communication Skills	2 / 0 / 2	4	3	4,5,8,10
3	23CD202	Object Oriented Analysis and Design	3 / 0 / 2	5	4	4,9
4	23CS201	Data Structures and Algorithms	1 / 0 / 4	5	3	4,8,9
5	23CD201	Database Management Systems	1 / 0 / 4	5	3	4,8,9
6	23CY203	Programming in Java	1 / 0 / 4	5	3	4,8,9
Indian Knowledge System						
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	3,4,5,6,7,8, 11,13,15,16
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	4,5,10,16
Theory with Practical (Internal 50 Marks & External 50 Marks)						
2	23CY202	Operating Systems	3 / 0 / 2	5	4	4,8,9
3	23ADC01	Artificial Intelligence and Its Application	2 / 0 / 2	4	3	4,9,11
4	23ITC02	Data Communication and Networks	2 / 0 / 2	4	3	4,9,17
5	23CS303	Algorithm Design Techniques	3 / 0 / 2	5	4	4,8,9
6	23CY305	Applied Statistics Using Python	3 / 0 / 2	5	4	4,8,9
Practical (Internal 60 Marks & External 40 Marks)						
7	23CS304	Frontend Frameworks	0 / 0 / 4	4	2	4,8,9
Total				**30**	**23**	

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	23IT401	Formal Languages and Automata Theory	3 / 1 / 0	4	4	4,8,9

3	23CYC01	Cybersecurity Essentials	3 / 0 / 0	3	3	4,9,16,17
Theory with Practical (Internal 50 Marks & External 50 Marks)						
4	23CSC02	Machine Learning Techniques	2 / 0 / 2	4	3	4,9
5	23ITC01	Internet of Things	2 / 0 / 2	4	3	4,9
Practical (Internal 60 Marks & External 40 Marks)						
6	23MEC04	Design Thinking and Idea Lab	0 / 0 / 2	2	1	4, 9, 11, 12
7	23CS404	Backend Frameworks	0 / 0 / 4	4	2	4,9
Spoken Language (Internal 100 Marks)						
8	23SLC01	Multilingual Practices	0 / 0 /2	2	1	4,11,16
Mandatory Course-Blended Learning						
9	23MCC11	Disaster Management and Preparedness	2 / 0 /0	2	0	1,3,9,11
Total				**28**	**20**	

SEMESTER - V						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23CS501	Mobile and Edge Computing	3 / 0 / 0	3	3	4,9
2	23CSC03	Quantum Computing	3 / 0 / 0	3	3	3,7,9
Theory with Practical (Internal 50 Marks & External 50 Marks)						
3	23CS504	Signal Processing	2 / 0 / 2	4	3	4,9
4	23XXXX	Professional Elective – I	2 / 0 / 2	4	3	
5	23XXXX	Professional Elective - II	2 / 0 / 2	4	3	

Practical (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	4,9
Mandatory Course-Blended Learning (Internal 100 Marks)						
8	23MCC03	Indian Constitution	1 / 0 / 0	1	0	1,2,3,5,6,8,11
Total				**29**	**20**	

SEMESTER - VI						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23CS602	Advanced Graph Theory	3 / 0 / 0	3	3	7,9,10,11
2	23CS603	Parallel and Distributed Computing	3 / 0 / 0	3	3	4,7,9
3	23CS604	Real-time Operating Systems	3 / 0 / 0	3	3	3,4,7,9
Theory with Practical (Internal 50 Marks & External 50 Marks)						
4	23IT604	Mobile Application Development	3 / 0 / 2	5	4	9,17
5	23CSC04	Principles of Compiler Design	3/0/2	5	4	4,7,9
6	23XXXX	Professional Elective – III	2 / 0 / 2	4	3	
7	23XXXX	Professional Elective - IV	2 / 0 / 2	4	3	
Mini Project (Internal 100 Marks)						
8	23CS605	Prototype Lab	0 / 0 / 2	2	1	4,8,9,17
Total				**29**	**24**	

SEMESTER - VII						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23XXXX	Open / Emerging/ Industrial Elective- I	3/0/0	3	3	
2	23XXXX	Open / Emerging/ Industrial Elective- II	3/0/0	3	3	
3	23XXXX	Open / Emerging/ Industrial Elective- III	3/0/0	3	3	
Theory with Practical (Internal 50 Marks & External 50 Marks)						
4	23XXXX	Professional Elective - V	2/0/2	4	3	
5	23XXXX	Professional Elective - VI	2/0/2	4	3	
Project (Internal 60 Marks & External 40 Marks)						
6	23CS701	Project - I	0 / 0 / 6	6	3	4,9,17
Internship (Internal 100 Marks)						
7	23CS702	Employability Enhancement Skills (Internship)	28 Days		2	8,12,17
Total				**23**	**20**	

SEMESTER - VIII						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Project (Internal 60 Marks & External 40 Marks)						
1	23CS801	Project - II	0 / 0 / 24	24	12	4,9,17
Total				**24**	**12**	

SCHEME OF CREDIT DISTRIBUTION – SUMMARY											
S. 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	6.7
2	Basic Sciences (BSC)	13	4							17	10.4
3	Engineering Sciences (ESC)	10			1					11	6.7
4	Professional Core (PCC)		13	20	15	11	17			76	46.0
5	Professional Electives (PEC)					6	6	6		18	11.0
6	Open/Emerging/ Industry (OEC)							9		9	5.5
7	Project Work (PROJ)					3	1	5	12	21	12.8
8	Mandatory Course (MC) / Multilingual Practices				1					1	0.6
Total		24	21	23	20	20	24	20	12	164	100

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM			
S. No.	**Course Work - Subject Area**	**AICTE Suggested Credits**	**SKCET Credits (164)**
1	Humanities and Social Sciences (HS), including Management;	**16**	**11**
2	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology;	**23**	**17**
3	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	**29**	**11**
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**	**75**
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**	**21**
8	Mandatory Courses (MC)	**Non-credit**	**1**
Total		**163**	**163**
**Minor Variations is allowed as per need of the respective disciplines*			

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (11 Credits)					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23EN101	Oral & Written Communication Skills	2/0/2	4	3
2	23TA101	Heritage of Tamils	1/0/0	1	1
3	23TA201	Tamils and Technology	1/0/0	1	1
4	23GE301	Universal Human Values	3/0/0	3	3
5	23GEC01	Entrepreneurship and Startups	3/0/0	3	3

BASIC SCIENCE COURSES (17 Credits)					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23MA101	Mathematics I	3/1/0	4	4
2	23MA201	Mathematics II	3/1/0	4	4
3	23AS101	Applied Science	4/0/0	4	4
4	23AS102	Applied Science Laboratory	0/0/4	4	2
5	23SB101	Engineering Biology	3/0/0	3	3

ENGINEERING SCIENCE COURSES (11 Credits)					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23EC111	Digital Logic Design and Computer Architecture	3/1/0	4	4
2	23IT101	Application Development Practices	1/0/4	5	3
3	23CS101	Problem Solving using C++	1/0/4	5	3
4	23MEC04	Design Thinking and Idea Lab	0 / 0 / 2	2	1

PROFESSIONAL CORE COURSES (79 Credits)					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23CS201	Data Structures and Algorithms	1 / 0 /4	5	3
2	23CD201	Database Management Systems	1 / 0 /4	5	3
3	23CY203	Programming in Java	1 / 0 /4	5	3
4	23CD202	Object Oriented Analysis and Design	3 / 0 / 2	5	4
5	23CY202	Operating Systems	3 / 0 / 2	5	4
6	23ADC01	Artificial Intelligence and Its Application	2 / 0 / 2	4	3
7	23ITC02	Data Communication and Networks	2 / 0 / 2	4	3
8	23CS303	Algorithm Design Techniques	3 / 0 / 2	5	4
9	23CY305	Applied Statistics Using Python	3 / 0 / 2	5	4
10	23CS304	Frontend Frameworks	0 / 0 / 4	4	2
11	23IT401	Formal Languages and Automata Theory	3 / 1 / 0	4	4

12	23CYC01	Cybersecurity Essentials	3 / 0 / 0	3	3
13	23CSC02	Machine Learning Techniques	2 / 0 / 2	4	3
14	23ITC01	Internet of Things	2 / 0 / 2	4	3
15	23CS404	Backend Frameworks	0 / 0 / 4	4	2
16	23CSC03	Quantum Computing	3 / 0 / 0	3	3
17	23CSC04	Principles of Compiler Design	3 / 0 / 2	5	4
18	23CS501	Mobile and Edge Computing	3 / 0 / 0	3	3
19	23CS504	Signal Processing	2 / 0 / 2	4	3
20	23CS505	Cloud Infrastructure and Services Management	0 / 0 / 4	4	2
21	23CS602	Advanced Graph Theory	3 / 0 / 0	3	3
22	23CS603	Parallel and Distributed Computing	3 / 0 / 0	3	3
23	23CS604	Real-time Operating Systems	2 / 0 / 2	4	3
24	23IT604	Mobile Application Development	3 / 0 / 2	5	4

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

OPEN/ EMERGING/ INDUSTRY					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23CS001	Programming with Data Structures	2/ 0/ 2	4	3
2.	23CS002	Networks and Security	2/ 0/ 2	4	3
3	23CS003	Analysis of Algorithms	2/ 0/ 2	4	3

PROJECT WORK (21 Credits)					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23CS503	Application Development	0 / 0 / 6	6	3
2	23CS603	Prototype Lab	0 / 0 / 2	2	1
3	23CS701	Project - I	0 / 0 / 6	6	3
4	23CS702	Employability Enhancement Skills (Internship)	28 Days		2
5	23CS801	Project - II	0 / 0 / 24	24	12

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

INTERN (02 Credits)					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23CS702	Employability Enhancement Skills (Internship)	28 Days		2

VALUE ADDED COURSES (Based on student's interest)						
S. No	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Sem**
1	23VA200	Cassandra	1 / 0 / 0	1	1	III
2	23VA201	MongoDB	1 / 0 / 0	1	1	IV
3	23VA202	Edge Computing	1 / 0 / 0	1	1	V
4	23VA203	PyCharm	1 / 0 / 0	1	1	VI
5	23VA204	Generative AI	1 / 0 / 0	1	1	VI

MANDATORY COURSES (01) (Courses conducted either by internal faculty or through MOOCs)					
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**
1	23MC101	Induction Programme			0
2	23MC102	Environmental Sciences	1 / 0 / 0	1	0
3	23SLC01	Multilingual Practices	0 / 0 /2	2	1
4	23MCC01	Indian Constitution	1 / 0 / 0	1	0
5	23MCC11	Disaster Management and Preparedness	2 / 0 / 0	2	0

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

HSMC : Humanities and Social Sciences including Management

BSC : Basic Science Courses

ESC : Engineering Science Courses

PCC : Professional Core Courses

PEC : Professional Elective Courses

OEC : Open and Emerging Elective Courses

PRJ : Project Work

INT : Internship

MC : Mandatory Course

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

22TA101	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: 5

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in 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 5

Hero stone to modern sculpture - bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils. Folk And Martial Arts: Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

MODULE III THINAI CONCEPT OF TAMILS 5

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas. Contribution of Tamils to Indian national movement and indianculture: Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL PERIODS: 15

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-CUM-REFERENCE BOOKS:

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

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Articulation Matrix														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	1	-	-	1		
CO2	-	-	-	-	-	-	-	1	1	-	-	1		
CO3	-	-	-	-	-	-	-	1	1	-	-	1		
CO4	-	-	-	-	-	-	-	-	1	-	-	-		
CO5	-	-	-	-	-	-	-	1	1	-	-	-		
CO								**1**	**1**			**1**		

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 principles and applications of electrochemistry and Polymer science, and explore the knowledge of various energy sources and storage devices.
4. To understand the concepts of photo-physical and photochemical processes in spectroscopy.

MODULE I ELECTROSTATICS & MAGNETISM 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 Graff generator.

MODULE II ELECTROMAGNETIC INDUCTION & ALTERNATING CURRENT 15

Magnetism: 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 - 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 (H2-O2). Polymers-Classifications-addition and condensation polymerization-free radical mechanism.
Atomic and molecular Spectroscopy: Beer Lambert's law, principle, instrumentation, and applications of electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and atomic spectrum-Flame emission spectroscopy (FES).

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, 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 Electric current.	[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]

TEXTBOOKS

1. David Halliday, Robert Resnick, Jearl Walker “Fundamentals of Physics”, 11th edition, Wiley, 2018.
2. Bhattacharya, D.K. and Poonam, T., “Engineering Physics”, Oxford University Press, 2017.
3. Dara S.S, Umare S.S, “Engineering Chemistry”, First revised Edition by S. Chand & Company Ltd., New Delhi 2015.
4. Jain P. C. & Monica Jain., “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2020.

REFERENCE BOOKS

1. Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS “A Text Book of Engineering Physics” S.Chand& Co Ltd, 2018.
2. S.O. Kasap, “Principles of Electronic Materials and Devices”, McGraw Hill Education, 2017.
3. Perez, Nestor,” Electrochemistry and Corrosion Science”, Springer, 2016.
4. Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 2017.

WEB RESOURCES

1. https://nptel.ac.in/courses/115101005.
2. https://onlinecourses.nptel.ac.in/noc22_ph31/preview.
3. https://archive.nptel.ac.in/courses/108/106/108106073/.
4. https://www.sciencedirect.com/book/9780750646253/battery.
5. http://www.rnlkwc.ac.in/pdf/study-material/chemistry/Spectroscopy.

6. https://ocw.mit.edu/courses/chemistry.

Course Articulation Matrix														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2		1							1		
CO2	3	2	2		1							1		
CO3	3	2	2	1	1							1		
CO4	3	2	2		1							1		
CO5	3	2	2	1	1							1		
CO	**3**	**2**	**2**	**1**	**1**							**1**		

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

COURSE OBJECTIVES

1. To recall the structure and functions of cell in organ development
2. To understand the neural activity and use it for various applications.
3. To understand the mutual dependence of modern biology and engineering
4. To apply brain concepts in brain computer interface.
5. To analyze nanomaterial's and nanotechnology applications in drug delivery, textiles and healthcare.

MODULE I HUMAN PHYSIOLOGY AND ARTIFICIAL 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

Fundamentals of BCI – Working of BCI – Classification of BCI – measuring of surgical and non-surgical BCI – Neuro feedback 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 PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Outline the structure, and functions of cell and related organs	[R]
CO2	Understand the difference between biological neuron and artificial neurons.	[U]
CO3	Understand the compatibility and functioning of artificial organs.	[U]
CO4	Interpret the fundamental concepts, design, and major components of Brain-Computer Interfaces (BCI).	[AP]
CO5	Explain the concepts of Nanomaterial's for development of sensors in healthcare and drug delivery	[AN]

TEXTBOOKS

1. Andrew G.Webb, Principles of Biomedical Instrumentation, Cambridge: Cambridge University Press, 2018.
2. Maureen Clerc, Laurent Bougrain, Fabien Lotte, Brain–Computer Interfaces: Foundations and Methods, Wiley Publishers, 2016.

REFERENCE BOOKS

1. Ajit D. Kelkar, Daniel J.C. Herr, James G. Ryan, Nanoscience and Nanoengineering : Advances and applications , CRC Press, 2014.
2. Ross and Wilson Anatomy and Physiology in Health and Illness, International Edition, Elsevier, 2022.
3. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc16_ge03
2. https://ocw.mit.edu/courses/biological-engineering/20-010j-introduction-to-bioengineering-be-010j-spring-2006/videos/Lecture-1-bioengineering/
3. https://ocw.mit.edu/courses/biology/7-28-molecular-biology-spring-2005/
4. https://onlinecourses.nptel.ac.in/noc17_ge04
5. https://onlinecourses.nptel.ac.in/nanobiotechnology

Course Articulation Matrix															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	-	-	-	-	-	-	-	-	-	2	-	-	1
CO2	2	2	2	2	1	1	1	1	-	1	-	2	2	-	1
CO3	3	3	2	2	2	1	1	1	-	-	-	2	2	1	1
CO4	3	3	2	2	2	1	1	1	-	-	-	2	2	1	1
CO5	2	1	1	1	2	1	1	1	-	-	-	2	2	1	1
CO	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**		**1**		**2**	**2**	**1**	**1**

23MA101	MATHEMATICS I	L	T	P	C
		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 in practical situations.
3. To acquire thorough knowledge of fundamental notions of proof's and its application in Cryptography.
4. To analyse data pertaining to discrete and continuous random variables to interpret the results.
5. To impart the knowledge of counting principles, to think critically and apply it in real world problems.

MODULE I LOGICAL PROOFS & 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 - Multiplicative inverses and cancelling - Relatively prime - Euler's theorem. **Graph Theory:** Vertices and Degrees - Types of graphs - Handshaking theorem - Adjacency matrices - Walks and paths - Directed acyclic graphs and scheduling – Isomorphism - Connectivity - 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 - Set Theory and 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 PERIODS: 60

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

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

TEXTBOOKS

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
2. Koshy. T, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, Second Edition, 2007.
3. Eric Lehman, F. Thomson Leighton and Albert R. Meyer, "Mathematics for Computer Science", 14thEdition, MIT Open courseware, 2018.

REFERENCE BOOKS

1. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", sixth edition, Pearson Education Pvt Ltd., New Delhi, 2017
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Eighth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Eighth Edition, 2021.
3. 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 RESOURCES

1. https://onlinecourses.nptel.ac.in/noc23_cs109/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs120/preview
3. https://onlinecourses.nptel.ac.in/noc23_ma77/preview
4. https://onlinecourses.nptel.ac.in/noc23_ma72/preview

Course Articulation Matrix														
CO	**PO1**	**PO 2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO1	1	1	1										1		
CO2	1	2	1										2		
CO3	3	3	2										2		
CO4	1	1	2										1		
CO5	2	1	2										2		
CO	**2**	**2**	**2**										**2**		

23EC111	DIGITAL LOGIC DESIGN AND COMPUTER ARCHITECTURE	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. To understand number systems, logic gates and boolean functions
2. To familiarize combinational and sequential logic circuits
3. To learn the basic structure and operations of a computer
4. To understand control unit design and memory organization
5. To discuss pipelining and parallelism and multicore architecture
6. To explore the I/O communication and interfacing

MODULE I DIGITAL LOGIC 20

Number Systems - Boolean algebra – Minimization of Boolean Functions using Karnaugh Maps – Implementation of Logic Circuits using Gates – Combinational Logic: Adder, Subtractor, Multiplexer, Demultiplexer, Encoders, Decoders – Sequential Logic: Flip flops, Registers, Counters – Finite State Machines

MODULE II COMPUTER ORGANIZATION 20

Basic Operational Concepts - Instruction Format – Instruction Sets - Addressing Modes - Design of CPU - Hardwired Control unit design - Micro Programmed Control unit design – Memory organization - Programmable Logic Array - Programmable Array Logic - Cache memory - Virtual Memory – Multicycle MIPS

MODULE III PIPELINING AND COMMUNICATION 20

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets, Data Path and Control Consideration, Superscalar Operation, Instruction Level Parallelism, Multicore Architecture. I/O Communication: Handshaking, Buffering, I/O techniques, Buses, Interrupts

TOTAL PERIODS: 60

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Implement logic circuits and simplify boolean functions	[AP]
CO2	Analyze combinational and sequential logic circuits	[AN]
CO3	Interpret the design of control unit	[U]
CO4	Illustrate cache memory and virtual memory	[AP]
CO5	Examine parallelism in multicore and hazards in pipelining	[AP]
CO6	Distinguish the different ways of communication with I/O devices	[U]

TEXTBOOKS

1. David Harris, Sarah L. Harris, “Digital Design and Computer Architecture: RISC-V Edition”, 1st Edition, Morgan Kaufmann, 2021.
2. M. Morris R. Mano, Michael D. Ciletti, “Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog”, 6th Edition, Pearson Education Limited, 2019
3. William Stallings, “Computer Organization & Architecture”, Pearson ,11th Edition, 2022.
4. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, McGraw Hill, 6th Edition 2018.

REFERENCE BOOKS

1. John P. Hayes, “Computer Architecture and Organization”, McGraw-Hill, 3rd Edition, 2017.Ross and Wilson Anatomy and Physiology in Health and Illness, International Edition, Elsevier, 2022.
2. John F. Wakerly, “Digital Design: Principles and Practices”, 5th Edition, Pearson, 2018

WEB RESOURCES

1. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
2. https://www.tutorialspoint.com/digital_circuits/digital_circuits_logic_gates.htm
3. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

ONLINE RESOURCES

1. https://www.coursera.org/learn/comparch
2. https://onlinecourses.nptel.ac.in/noc23_ee29/preview

Course Articulation Matrix															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2									2	3		2
CO2	3	3	2									2	3		2
CO3	3	3	2									2	3		2
CO4	3	3	2									2	3		2
CO5	3	3	2									2	3		2
CO6	3	3	2									2	3		2
CO	**3**	**3**	**2**									**2**	**3**		**2**

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. To set 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 Values, 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 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 Components, Page Header, Breadcrumb, Button Groups, Dropdown, Nav & Navbars. JavaScript Essentials - Var, Let and Const keyword, Arrow functions, default arguments, Template Strings, String methods, Object de-structuring, Create, apply, prototype, bind method, Spread and Rest operator, Typescript Fundamentals, Types & type assertions, Creating custom object types, function types, Typescript OOPS - Classes, Interfaces, Constructor, Decorator & Spread Operator, Difference == & === , Asynchronous Programming in ES6, Promise Constructor, Promise with Chain, Promise Race.

TOTAL PERIODS(Theory): 15

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.
8. Create a website using HTML: To embed an image map in a web page, To fix the hot spots., Show all the related information when the hot spots are clicked.
9. Apply style specification in HTML page using CSS.
10. Develop dynamic web application using HTML, CSS and JavaScript.

TOTAL PERIODS(Lab): 60
TOTAL PERIODS:75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Relate the concepts of agile software engineering and its advantages in software development.	[R]
CO2	Demonstrate the roles and responsibilities of Scrum, Lean Software Development and how to setup the GitHub repository.	[U]
CO3	Analyze the working model and develop static, dynamic websites.	[AN]
CO4	Utilize the knowledge of HTML, CSS and Bootstrap using forms to build modern interactive web applications.	[AP]
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, 1st Edition, 2010.
2. Jeff Sutherland, “Scrum the Art of Doing Twice the Work in Half the Time”, Random House Publisher,1st Edition, 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.
5. Jennifer Niederst Robbins., “Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics”, O'Reilly Media, 5th Edition, 2018.
6. Jennifer Smith and the AGI Creative Team, “Web Design with HTML and CSS”, Wiley Publisher,1st Edition, 2011.
7. Stephen Blumenthal, “JavaScript: JavaScript for Beginners - Learn JavaScript Programming with ease”,1st Edition, 2017.

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.
5. Deitel, Deitel, Goldberg, “Internet and World Wide Web – How to program”, 5th Edition, Prentice Hall Publishers, 2012

WEB RESOURCES

1. https://www.coursera.org/specializations/agile-development
2. https://www.edx.org/learn/agile
3. https://nptel.ac.in/courses/106/105/106105182/
4. https://developer.mozilla.org/en-US/docs/Web/HTML
5. https://developer.mozilla.org/en-US/docs/Web/CSS
6. https://developer.mozilla.org/en-US/docs/Web/JavaScript

ONLINE RESOURCES

1. http://www.agilenutshell.com/
2. https://www.atlassian.com/agile/scrum
3. https://www.youtube.com/user/AgileMikeCohn
4. https://www.coursera.org/learn/html-css-javascript-for-web-developers
5. https://online-learning.harvard.edu/subject/javascript

Course Articulation Matrix															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	1								2	3	2	2
CO2	3	2	3	3	3	2						2	3	3	2
CO3	3	2	3	3	3	2						2	3	3	2
CO4	3	2	3	3	3	2						2	3	3	2
CO5	3	2	3	3	3	2						1	3	3	2
CO	**3**	**2**	**3**	**3**	**3**	**2**						**2**	**3**	**3**	**2**

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, while loop, do while loop, goto. **Arrays and Strings:** 1D array, 2D array, Strings, String functions. **Function:** Basics, call by value, call by reference & return by reference, Inline function, overloading Functions, inline Functions, Recursive Functions. **Pointers:** Pointer, Dynamic Memory Allocation.

MODULE II OBJECT ORIENTED CONCEPTS 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 WEB DEVELOPMENT FOUNDATIONS 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 PERIODS (Theory): 15

LIST OF EXPERIMENTS

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

TOTAL PERIODS (Lab): 60

TOTAL PERIODS: 75

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-time challenges 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/O operations, and lambda expressions in C++ programming.	[AP]

TEXTBOOKS

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

REFERENCE BOOKS

1. Herbert Schildt, “The Complete Reference C++”, 4th edition, MH, 2017.
2. John Hubbard, “Schaum's Outline of Programming with C++”, MH, 2016.

WEB RESOURCES

1. https://www.geeksforgeeks.org/c-plus-plus/
2. http://web.stanford.edu/class/cs106l/https://www.programiz.com/python-programming
3. https://nptel.ac.in/courses/106101208

Course Articulation Matrix															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3											3		
CO2	3	3	3	2	2				2	1		3	3	2	1
CO3	3	3	3	2	3				2	1		3	3	2	1
CO4	3	3	3	3	3				3	2		3	3	2	2
CO5	3	3	3	3	3				2	2		2	3	2	1
CO	**3**	**3**	**3**	**3**	**3**				**3**	**2**		**2**	**3**	**2**	**2**

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

LIST OF EXPERIMENTS 36

1. Determination of Magnetic field along the axis of current carrying coil- Stewart and Gee method and compare with the theoretical value.
2. Determination of Planck's Constant of an LED and compare with the standard value.
3. Determination of characteristics of LCR circuit and compare with the theoretical value.
4. Determination of characteristics of an RC circuit.
5. Determine the Specific resistance of a given coil of wire using the Carey Foster bridge.
6. Determination of Hysteresis loss of a ferromagnetic material.
7. Estimation of dissolved oxygen in waste water using Winkler's method.
8. Determination of strength of strong acid by pH metry.
9. Determination of single electrode potential of Zinc and Copper by Potentiometric method.
10. To determine the strength of acids (HCl & CH_3COOH) Vs NaOH by conductometric method.
11. Determination of cathode efficiency of Nickel using electroplating process.
12. Estimation of iron content in the given solution by spectrophotometry.

TOTAL PERIODS: 36

LIFE SKILLS EXPERIMENTS

1. Determination of pressure required to shut off the fuel pump nozzle.
2. Determination of capacitance required to shut off the circuit in a circuit breaker.
3. Determination of earth, neutral and phase line in a circuit.
4. To know the presence of dissolved oxygen in given water sample using glucose by redox principle.
5. To view the colour of the different medium of given water sample using litmus paper test.
6. To detect the chlorine content in tap water using simple chemical method.

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	To determine the magnetic field around a current-carrying conductor and Planck's constant.	[An]
CO2	To determine the rate of growth or decay in a resistor-capacitor circuit and to estimate the resonance frequency and Q-factor of an LCR circuit.	[An]
CO3	To determine the relationship between the magnetic flux density and the magnetizing field strength and to find the specific resistance of the wire.	[Ap]
CO4	To determine the dissolved oxygen using Winkler's method, pH, single electrode potential using reference electrodes, Strength of acids by conductometric titration.	[Ap]
CO5	To determine the Electroplating process based on electrolytic cell, and Interpret the principle and working of Spectroscopic technique.	[An]

TEXTBOOKS

1. S.L.Gupta and V Kumar "Practical Physics Volume -II", Pragati Prakashan., 2023.
2. Anoop Sing Yadav "Applied Physics Lab Manual" Vayu Education of India Publisher, 2018.
3. Method of Sampling and Test (Physical and Chemical) for Water and Wastewater, Chemical Oxygen Demand, 2012, Part-58.
4. Vogel's "Text book of Quantitative Analysis", Jeffery G H, Basset J. Menthom J, Denney R.C., 6th Edition, EBS, 2009.

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. American Public Health Association et al, Standard Methods for the Examinations of Water and Waste Water, APHA. 2017.
4. AWWA, WEF, APHA, 2017, Standard Methods for the Examination of Water and Wastewater (Method: 5210B, BOD).

WEB RESOURCES – VIRTUAL LAB LINK

1. https://vlab.amrita.edu/?sub=1&brch=192&sim=972&cnt=4
2. https://bop-iitk.vlabs.ac.in/exp/carey-foster-bridge/simulation.html
3. https://mpv-au.vlabs.ac.in/modern-physics/Determination_of_Plancks_Constant/ experiment.html
4. https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html
5. https://ee1-nitk.vlabs.ac.in/exp/determination-of-biological-oxygen/simulation.html
6. https://ee1-nitk.vlabs.ac.in/exp/determination-of-total-iron/simulation.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2					2			1	1	
CO2	3	2	1	2					2			1	1	
CO3	3	2	1	2					2			1	1	
CO4	3	2	1	2					2			1	1	
CO5	3	2	1	2					2			1	1	
CO	**3**	**2**	**1**	**2**					**2**			**1**	**1**	

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

Module 1: Physical Activity **5 Hours**

Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.

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.

Module 2: Universal Human Values **5 Hours**

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.

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

Module 3: Lectures By Eminent People **5 Hours**

Teaching with Lectures. ... It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts

Visit To Local Areas: Traveling is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near college to learn new things. Eg.Meditation centre/orphanage/Hospital

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.

TOTAL PERIODS: 15

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

C101.1 Explore academic interest and activities [AP]

C101.2 Work for excellence [AP]

C101.3 Promote bonding and give a broader view of life and character [AP]

No. of the CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C101.1						3	1	3	3	3		2			3
C101.2						3	1	3	3	3		2			3
C101.3						3	1	3	3	3		2			3
1	Reasonably Agreed				2	Moderately Agreed					3	Strongly Agreed			

SEMESTER – II

23TA201	TAMILS AND TECHNOLOGY / தமிழரும் தொழில்நுட்பமும்	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 PERIODS: 15

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. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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.

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/lLXZ_historical-heritage-of-the-tamils-edited-by-s-v-subrahmanian-and-k-d-thirunavukk

Course Articulation Matrix														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1										1		1	1	1
CO2										1		1	1	1
CO3										1		1	1	1
CO4										1		1	1	1
CO5										1		1	1	1
CO										**1**		**1**	**1**	**1**

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 PERIODS: 60

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	[AP]

intrinsic need for the analysis of random phenomena.

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]

TEXTBOOKS

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.
4. Erwin Kreyszig, ”Advanced Engineering Mathematics”, 13th Edition, John Wiley & Sons, Inc., 2011

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
4. Ross, Sheldon, “Stochastic Processes”, 2nd Edition, John Wiley & Sons, Inc. New York,1996.

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/
4. https://archive.nptel.ac.in/courses/111/106/111106113/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1										1	
CO2	1	2	1										2	
CO3	3	3	2										2	
CO4	1	1	2										1	
CO5	2	1	2										2	
CO	**2**	**2**	**2**										**2**	

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.

Lab Components 15

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

TOTAL PERIODS: 60

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

REFERENCE BOOKS

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

Course Articulation Matrix

CO	PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1										3				
CO2								2		3				
CO3								2		3	2			
CO4										3				
CO5										3		3		
CO								**2**		**3**	**2**	**3**		

23CD202	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To understand the fundamentals of object modelling.
2. To differentiate Unified Process from other approaches.
3. To design static and dynamic UML diagrams.
4. To analyze the use case driven requirements for a particular system.
5. To improve the design by applying appropriate design patterns.

MODULE I OBJECT ORIENTED MODEL 15

Introduction to OOAD - Object Oriented Basics – Unified Process - Classes and Objects: Object and Class Relationships. Building Quality Classes and Objects: Measuring Quality - Choosing Operations. Classification: Importance and Challenges - Incremental and Iterative Classification. Approaches for Identifying Classes and Objects: Classical and Modern - Key Abstractions and Mechanisms. Complexity - Structure and Attributes of Complex Systems - Designing Complex Systems. Application Case study: Inventory Management in Visual Paradigm and Enterprise Architect

MODULE II USE CASE MODELING 15

Use Case Modeling: Modeling Requirements - Components – Use Case Identification and Description – Use Case Relationships - Relating Use cases – include - extend - generalization. Class Diagram – Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes - Domain Modeling using class diagrams - Domain Model Refinement - Finding conceptual class hierarchies – Aggregation and Composition. Application Case study: E- Commerce Application in Lucid Chart and Astah

MODULE III UML DIAGRAMS AND DESIGN PATTERNS 15

UML Diagrams: UML Views - Classification of UML Diagrams - Extended UML – Interaction Diagram - System Sequence Diagram – Collaboration Diagram - Communication Diagram - State machine diagram and Modeling - Activity Diagram - Timing Diagram - Object Diagram- Implementation Diagram – Package Diagram - Composite Structure Diagram – Component Diagram - Deployment Diagram. GRASP: Designing objects with responsibilities – Design Patterns – Applying Gang of Four design patterns – Mapping design to code. Application Case Study: Next Gen Point of Sale(POS) system, Monopoly game system, Implementation of ChatBot System.

TOTAL PERIODS (Theory): 45

LIST OF EXPERIMENTS

1. Develop a new software system to streamline the process of managing tasks and projects within the organization and to identify the software system's requirements and document the Software Requirement Specification (SRS) for the Identified system.
2. Create a reservation and booking system for various clients and draw class diagrams to identify the key concepts and their relationships.
3. Develop a new inventory management system to streamline the operation to identify the use cases and create a comprehensive Use Case model for the proposed system.
4. Design a new online marketplace platform and identify the conceptual classes of the platform and create a comprehensive Domain Model with Class Diagrams.
5. Build an online banking application and identify the interactions between objects and represent these interactions in specific scenario using UML Sequence and Collaboration Diagrams.
6. Design an e-commerce website that allows users to browse products, add products and complete purchase process. As part of the design phase, create Activity and State Diagrams to visually represent the flow of actions and states within the application.
7. Develop a comprehensive customer relationship management (CRM) system for a medium-sized business. The system should include a user interface for employees, various domain objects representing customer data, and technical services for data processing and create a UML Package Diagram that visually represents the organization of these components.
8. Create a UML Component Diagram that illustrates the integration of reused and new components within the Learning Management System (LMS) to design new online learning management system (LMS) for a university.
9. Develop application that includes web front-end, a backend server, a database, and external services for payment processing, email notifications and draw deployment diagrams to model the runtime architecture of the application.
10. Apply appropriate design patterns to enhance the system's reusability and maintainability of the software system to Improve the modularity and reusability in the system.

TOTAL PERIODS (Lab): 30
TOTAL PERIODS: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Describe the structure and attributes for designing complex systems.	[U]
CO2	Choose appropriate classes from the requirements and determine their responsibilities, behaviors, interrelationships, and internal structures.	[AP]
CO3	Analyze use case models, domain model and conceptual classes.	[A]
CO4	Construct static and dynamic UML diagrams.	[AP]
CO5	Apply design patterns to transform UML based software design to pattern-based design.	[AP]

TEXTBOOKS

1. Booch G, Maksimchuk RA, Engel M W, Young B J, Conallen J, Houston K A, Object Oriented Analysis and Design with Applications, Third Edition, Addison- Wesley, 2020.
2. Alan Dennis, Barbara Wixom, David Tegarden, Systems Analysis and Design: An Object-Oriented Approach with UML, 6th Edition, 2020
3. Edwin Mach, Object Oriented Analysis and Design Cookbook: Introduction to Practical System Modeling, Independently Published, 2019.
4. Booch G, Rumbaugh J and Jacobson I, The Unified Modeling Language User Guide, Second Edition, Addison Wesley Professional, 2017.

REFERENCE BOOKS

1. Ali Bahrami, Object Oriented System Development, McGraw Hill International Edition, 2020.
2. Pressman RS, Software Engineering - A Practitioner's Approach, 9th Edition, McGraw Hill, 2019.
3. Craig Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education,2018.

WEB RESOURCES

1. https://www.tutorialspoint.com/object_oriented_analysis_design/index.htm
2. https://www.javatpoint.com/uml

Course Articulation Matrix															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	2	2						2	3	3	2
CO2	3	3	2	2	2	2						2	3	3	2
CO3	3	3	2	2	2	2						2	3	3	2
CO4	3	3	2	2	2	2						2	3	3	2
CO5	3	3	2	2	2	2						2	3	3	2
CO	**3**	**3**	**2**	**2**	**2**	**2**						**2**	**3**	**3**	**2**

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 PERIODS (Theory): 15

LIST OF EXPERIMENTS

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

TOTAL PERIODS (Lab): 60

TOTAL PERIODS: 75

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

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2									1	3	1	1
CO2	3	3	3	3	3				2	1		2	3	2	2
CO3	3	3	3	3	3				2	1		2	3	2	2
CO4	3	3	3	3	3				2	1		2	3	2	2
CO5	3	3	3	3	3				2	1		2	3	2	2
CO	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**2**	**3**	**2**	**2**

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 CONSTRAINS 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 III QUERIES 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 PERIODS (Theory): 15

LIST OF EXPERIMENTS

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions

5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views
7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
8. Mini Project (Application Development)
   i) IT Training Group Database
   ii) Blood Donation System
   iii) Salary Management System
   iv) Traffic Light Information System

TOTAL PERIODS (Lab): 60
TOTAL PERIODS: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Discuss the basic concepts and various data models used in database design	[U]
CO2	Illustrate Relational algebra, Relational calculus and Normalization.	[AP]
CO3	Write SQL commands and Subqueries with Constraints.	[AP]
CO4	Determine Appropriate transactions, views, cursors and triggers to perform the given task.	[AP]
CO5	Analyze database storage structures, query processing and recovery system.	[A]

TEXTBOOKS

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.

WEB RESOURCES

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

Course Articulation Matrix															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2								2	3	2	2
CO2	3	3	2	2	2				2	2	2	3	3	2	3
CO3	3	3	2	2	2				2	2	2	3	3	2	3
CO4	3	3	2	2	2				2	2	2	3	3	2	3
CO5	3	3	2	2								3	3	2	3
CO	**3**	**3**	**2**	**2**	**2**				**2**	**2**	**2**	**3**	**3**	**2**	**3**

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 - Data Types - 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 PERIODS (Theory): 15

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.

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 PERIODS (Lab): 60

TOTAL PERIODS: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

C203.1	Develop the features of Core Java Paradigm.	[AP]
C203.2	Apply Looping Statements, Arrays, Strings in Real Time Environment.	[AP]
C203.3	Apply OOPS Concepts in the Real Time Applications.	[AP]
C203.4	Apply the concepts of Exception Handling in real world applications and usage of collection frameworks.	[AP]
C203.5	Develop Multithreaded Applications.	[AP]

TEXTBOOKS

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.

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.

WEB RESOURCES

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

Course Articulation Matrix														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
C203.1	2	2	2						2			2	2		2
C203.2	3	3	3					2	2	2		2	2	2	2
C203.3	2	2	3		2				2			3			3
C203.4	3	2	2		2			2	2	2		3		2	3
C203.5	3	2	2		2			2	2	2		3		2	3
CO203	**3**	**2**	**2**		**2**			**2**	**2**	**2**		**3**	**2**	**2**	**3**

23MC102	ENVIRONMENTAL SCIENCES	L	T	P	C
		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 PERIODS: 30

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.

WEB RESOURCES

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

SEMESTER – III

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

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

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)

IMPLICATIONS OF 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 and eco-friendly production systems - Strategy for transition from the present state to Universal Human Order-Sum up: Self-evaluation of the students-Post test of UHV.

TOTAL : 30 PERIODS

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 P Bagaria, Excel Books, New Delhi, 2010

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.

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

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

COURSE OBJECTIVES

1. To understand the structure and functions of Operating System
2. To familiarize the OS mechanisms to handle processes and threads
3. To acquire the knowledge in CPU scheduling policies, synchronization techniques and deadlock handling
4. To articulate Memory management schemes
5. To explorethe device Management, I/O and File systems concepts

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

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

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

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

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. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Pearson, 2018

REFERENCE BOOKS

1. Andrew S. Tanenbaum, Modern Operating Systems 5thEdition, Pearson Education, 2016
2. Gary Nutt, "Operating Systems: A Modern Perspective", 3rd Edition, Pearson, 2004

3. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", 1st Edition, Arpaci-Dusseau Books, 2018

WEB RESOURCES

1. https://nptel.ac.in/courses/106108101
2. https://www.studocu.com/sg/course/nanyang-technological-university/operating-systems/1390534
3. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
4. https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/

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

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)

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

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

https://www.coursera.org/learn/introduction-to-ai

https://www.coursera.org/learn/ai-for-everyone

https://ai.google/get-started/for-developers/

https://nptel.ac.in/courses/106102220

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

23ITC02	DATA COMMUNICATION AND NETWORKS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1. To introduce students to the basics of computer networking, including network topologies, data flow, and various layering models
2. To teach students to understand the components used in the physical layer and their functionalities and their impact on network performance
3. To equip students with the concepts, functions, and protocols of the Data Link and Network layers
4. To train students in implementing the different types of protocols in the Transport layer and their roles in data transmission
5. To enable students to study advanced protocols in the Application layer and their applications in modern networking

DATA COMMUNICATION AND PHYSICAL LAYER **10**

Components of data communication - Data Representation – Data flow - Network Topology - Protocols and Standards - Layers in OSI Model - TCP / IP protocol suite – Repeaters - Hubs – Bridges – Switches - Routers and Gateways. Packet switching vs. circuit switching.

DATA LINK AND NETWORK LAYER **10**

Data Link Layer: Block Coding - Cyclic Codes – Checksum. Stop-and-Wait ARQ - Go-Back-N ARQ - Selective Repeat ARQ. Ethernet – IEEE 802.11 – Bluetooth. IP semantics and syntax - **IPv4:** Addresses, Datagram. **IPv6:** Addresses - Advantages, Packet Format – Subnetting. **Routing:** Distance Vector Routing – Link State Routing. ARP – RARP – DHCP - ICMP. Internet – Voice and video over IP. Computer Networks and the Internet

TRANSPORT LAYER AND APPLICATION LAYER **10**

Transport Layer: Elements of transport protocols - Process to Process delivery - UDP - TCP - Congestion - Congestion control in TCP, QoS, Marking, Shaping, Policing.

Application Layer: Domain Name System – Electronic Mail – FTP – WWW - HTTP - SNMP-DDoS Attacks and Application layer Attacks - Firewalls.

Case Study: Software Defined Networking for IoT, Network Troubleshooting with Wireshark

TOTAL (Theory): 30 PERIODS

LIST OF EXPERIMENTS

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

2. Build simple LANs, perform basic configurations for switches using simulator
3. Implement IPv4 and IPv6 addressing schemes and test it with comments
4. Build Connected LANs different subnets with router and Test performance using simulator
5. Performance analysis of TCP and UDP protocol using simulator
6. Performance analysis of routing protocols using simulator
7. Analyze the network traffic using Wireshark tool/Packet tracer tool
8. Write a program on a datagram socket for the client/server to display the messages on the client side typed at the server-side
9. Simulate a wireless network using cisco packet tracer
10. Implement email client server in packet tracer

TOTAL (Lab): 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Assess the functionalities of the layers in the OSI and TCP/IP models, highlighting their differences and similarities	[U]
CO2	Apply flow control and error control mechanisms using data link layer protocols	[AP]
CO3	Apply the concepts of various routing algorithms and IP addresses to fulfil network requirements of an organization	[AP]
CO4	Develop the reliable/unreliable communication model using various Transport Layer Protocols and assess their Quality of service	[AP]
CO5	Analyse the features and operations of various application layer protocols and demonstrate application layer attacks and its countermeasures	[AN]

TEXTBOOKS

1. Behrouz A. Forouzan, “Data Communications and Networking with TCP/IP Protocol Suite”, 6th Edition, McGraw Hill Education, 2022
2. Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, “Computer Networks”, 6th Edition, Pearson Education, 2021
3. Andrei Gurtov, Madhusanka Liyanage, Mika Ylianttila, “Software Defined Mobile Networks (SDMN): Beyond LTE Network Architecture”, Wiley, 2021
4. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, 8th Edition, Pearson Education, 2020

REFERENCE BOOKS

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 6th Edition, Elsevier, 2021

2. William Stallings, “Data and Computer Communications”, 10th Edition, PHI, 2017.
3. Xingqin Lin, Namyoon Lee, “5G and Beyond: Fundamentals and Standards”, Springer, 2021.

WEB RESOURCES

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
4. https://www.networkstraining.com/
5. Coursera: Computer Networking

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

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++

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

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

TOTAL: 75 PERIODS

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
4. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", 6th Edition, CareerMonk Publications, 2022

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
4. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures and Algorithms in Java”, 6th Edition, Wiley India, June 21, 2022

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

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.

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.

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.

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”, 3rd Edition, Wiley, 2003
2. Jobson. J.D, “Applied Multivariate Data Analysis”, Vol I & II, Springer, 2012
3. Magnus Lie Hetland, “Beginning Python: From Novice to Professional”, 2ndEdition, A press, 2008
4. Miller. I.R, Freund. J.E and Johnson. R, “Probability and Statistics for Engineers”, 9th Edition, Pearson Education, Asia, 2016

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
4. Mark Lutz, “Programming Python”, 3rd Edition, Shroff Publishers, 2006
5. Tim Hall and J-P Stacey, “Python 3 for Absolute Beginners”,Apress, 2009

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
4. https://people.duke.edu/~ccc14/sta-663/

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

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.

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.

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
4. Mark Tielens Thomas, *React in Action*, Manning Publications, 2018

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
4. Adam Freeman, *Pro React 16*, 2nd Edition, Apress, 2019

WEB REFERENCE

1. https://reactjs.org/docs/getting-started.html
2. https://javascript.info/
3. https://developer.mozilla.org/en-US/docs/Web/JavaScript
4. https://redux.js.org/introduction/getting-started

SEMESTER – IV

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

INTRODUCTION TO 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.- Lean Startup Methodology & Business Model Canvas - The Role of Incubators, Accelerators, and Startup Ecosystems - Government Initiatives & Policies for Startups in India and Globally

Blended Learning Components: Online Resources: TED Talks, YouTube case studies, startup success/failure analysis. Interactive Tools: Google Jamboard, Miro for brainstorming ideas. Peer Collaboration: Discussion forums, peer feedback on ideas

Blended Learning Activities: Online Case Study & Discussion: Analyze Airbnb's startup journey and discuss key success factors, Post reflections in an LMS discussion forum. Business Idea Brainstorming & Validation: Use Google Jamboard/ Miro for real-time ideation, Peer feedback and faculty guidance on feasibility Live Expert Q&A Session: Industry expert session (Incubator/Founder/Startup Mentor), Pre-session task: Students prepare 3-5 key questions. Mini Startup Pitch Challenge: Each student delivers a 2-minute elevator pitch to the class.

STARTUP FINANCE, LEGAL FRAMEWORK & BUSINESS STRATEGY 15

Startup Financial Planning: 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.

Blended Learning Components: Simulation-based Learning: Crowdfunding campaign simulation, Workshop-based Learning: Hands-on experience with legal forms, compliance, Industry Collaboration: Investor/VC guest lecture.

Blended Learning Activities: Crowdfunding Simulation: Develop a Kickstarter campaign for a startup idea, Create a video pitch, funding goal, and reward structure. Startup Legal Workshop: Draft a business contract or IP filing document in teams, Present the drafted document for peer review. Digital Marketing Challenge: Design a Google Ads or Social Media campaign for a startup, run a dummy ad campaign and analyze engagement. Shark Tank-Style Investment Pitch: Teams pitch ideas to a panel of faculty/industry investors, Evaluation based on Business Model, Financial Viability, Market Potential.

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 - Future Trends in Entrepreneurship & Startups (AI-driven Startups, Blockchain, Green Startups)

Blended Learning Components: Project-Based Learning: Startup failure analysis report, Role-Playing & Gamification: Crisis management simulation, Hackathons & Competitions: Sustainability-focused startup challenge.

Blended Learning Activities: Startup Failure Analysis Report: Study 3 failed startups (e.g., Quibi, Theranos, Juicero), Submit a failure report identifying key reasons & lessons learned. Crisis Management Role-Playing: Teams are given a real-world startup crisis (financial loss, leadership change, PR crisis), Create a crisis response plan & present solution. sustainability Hackathon: Design a social impact startup model, Pitch with impact assessment & business viability. Startup Exit Strategy Simulation: Teams simulate an IPO, merger, or acquisition, Prepare a strategic exit report & investor pitch.

TOTAL: 45 PERIODS

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	[AN]
CO4	Analyze real-world startup failures and crisis scenarios to identify root causes	[AN]

	and recommend corrective strategies for future ventures	
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", 2nd Edition, Routledge, 2017
3. David H. Hott, "Entrepreneurship New Venture Creation", PHI, 2018
4. P. Narayana Reddy, "Entrepreneurship – Text and Cases", 1st Edition. Cengage Learning 2019
5. Neck, Heidi, Christopher P. Neck, Emma L. Murray. "Entrepreneurship: The Practice and Mindset", Sage Publications, 2018

REFERENCE BOOKS

1. Greco, F. "Startup Ecosystems: Components for an Interpretative Model and International Benchmarks", Springer Nature Switzerland, 2023
2. Aulet, B., Disciplined "Entrepreneurship: 24 Steps to a Successful Startup". Wiley, 2013
3. Harris, T, "Start-up: A Practical Guide to Starting and Running a New Business", Springer International Publishing, 2018

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/

23IT401	FORMAL LANGUAGES AND AUTOMATA THEORY	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. To familiarize mathematical models such as Finite Automata, Pushdown Automata, and Turing Machines
2. To analyze languages using the Pumping Lemma to demonstrate their non-regularity
3. To construct context free grammar to represent and accept various programming constructs
4. To design Turing machines to accept recursive languages
5. To categorize different types of grammar based on their structural patterns

FINITE AUTOMATA AND REGULAR LANGUAGES **20**

Mathematical Preliminaries and Notations, Chomsky Hierarchy of languages, Concepts of Automata Theory, Finite Automata - Deterministic Finite Automata (DFA)- Non-Deterministic Finite Automata (NFA) - Finite Automata with epsilon transitions - NFA with epsilon to NFA - NFA with epsilon to DFA conversion - NFA to DFA conversion. Regular Expressions: Finite Automata and Regular Expressions - Applications of Regular Expressions-Regular Grammars. Properties of regular languages - Pumping lemma for regular languages - Equivalence of Minimization of Finite Automata - Closure properties of regular languages.

CONTEXT FREE LANGUAGES **20**

Context Free Grammar (CFG) - Derivation Trees-Ambiguous Grammar - Equivalence of Parse Trees and Derivation - Applications of Context Free grammar. Definition of Pushdown Automata-Language of Pushdown Automata - Acceptance of String in Pushdown Automata-Equivalence of CFG and Pushdown Automata - Pumping Lemma for CFL – Closure Properties of CFL - Deterministic Pushdown Automata - Simplification of CFG – Chomsky Normal Form - Greibach Normal form

TURING MACHINES **20**

Turing Machines - Language of Turing Machines - Instantaneous Description of Turing Machine - Turing machine as a computing device-Techniques of Turing Machine – Universal Turing Machine - Types of Turing Machine - Multiple Track Turing Machine-Two-way infinite tape Turing Machine - Multi Tape Turing Machine - Recursive and Recursive Enumerable Sets - Post Correspondence problem

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Design Finite Automata and formulate Regular Expressions to represent specific patterns of regular languages	[AP]
CO2	Develop Context-Free Grammars to model languages with recursive structures	[AP]
CO3	Construct Pushdown Automata and Turing Machines to represent computational models for language recognition	[AP]
CO4	Analyse the regularity and context-freeness of languages using the Pumping Lemma	[AN]
CO5	Analyse Turing Machines and their role in recognizing recursive languages and addressing problems	[AN]

TEXTBOOKS

1. Hopcroft J.E, Motwani R and Ullman J.D, “Introduction to Automata Theory, Language and Computations”, 3rdEdition, Pearson Education, 2014
2. Martin J, “Introduction to Languages and the Theory of Computation”, 4thEdition, TMH, 2011
3. Emre Sermutlu, “Automata, Formal Languages, and Turing Machines”, Paperback, 2020

REFERENCE BOOKS

1. Peter Linz, “An Introduction to Formal Language and Automata”, Narosa Publishers, 6thEdition, Jones and Bartlett Publishers, Inc, 2016
2. Kamala Krithivasan and Rama R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education, 2009
3. Ajit singh,” Formal Language and Automata Theory” Kindle Edition,2019
4. Michael Sipser, “Introduction to the Theory of Computation”, 3rdEdition, Cengage India, 2014

WEB RESOURCES

1. https://www.cl.cam.ac.uk/teaching/1213/RLFA/materials.html
2. https://www.cse.iitb.ac.in/~akg/courses/2019-cs310/index.html
3. https://www.udemy.com/course/theory-of-computation-online-course/
4. https://nptel.ac.in/courses/106/104/106104148/

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 understand and analyse the challenging Internet cyber-attacks and its countermeasures.
5. To associate the Compliance standards and Computer Ethics with cyber security.

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.

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.

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 countermeasures.	[A]
CO4	Analyze cyber-attacks and learn data privacy issues and preventive measures in the scalable network domain	[A]
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
4. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, “Security in Computing”, 5th Edition, Pearson Education, 2015

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 Ⅱ”, Cengage Learning, New Delhi,2009
4. MarttiLehto, Pekka Neittaanmäki, “Cyber Security: Analytics, Technology and Automation”, Springer International Publishing Switzerland 2015

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

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

NTRODUCTION 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

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.

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

Upon completion of the course, students shall have ability 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", 1st edition, Creative Commons License, 2020
2. Jason Bell, “Machine Learning – Hands on for Developers and Technical Professionals”, Second Edition, Wiley, 2020.
3. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2020.

4. Andriy Burkov, “Machine Learning Engineering”,1ST Edition, True Positive Inc, 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!", Illustrated Edition, Packt Publishing, 2022.
2. Sebastian Raschka and VahidMirjalili, “Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2”, 3rd Edition, Packt Publishing Ltd, 2019.
3. Mitchell, T. "Machine Learning", 1st edition, McGraw-Hill, 2017.
4. Arnold, T., Kane, M., Lewis, B. W. "Computational Approach to Statistical Learning", 1st edition, CRC Press, 2019.
5. Murphy, Kevin P. "Machine Learning: A Probabilistic Perspective", 1st edition, MIT Press, 2012.

WEB RESOURCES

1. 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

23ITC01	INTERNET OF THINGS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1. To understand the concepts of the Internet of Things (IoT) and its design methodologies
2. To summarize the architecture of the Internet of Things (IoT)
3. To familiarise with the design constraints and challenges of applications
4. To design basic solutions using embedded platforms for IoT
5. To assess suitable cloud solutions for IoT systems

INTRODUCTION TO INTERNET OF THINGS AND IoT DESIGN METHODOLOGIES 15

Characteristics of IoT, Physical Design of IoT, IoT Protocols, IoT Reference Architecture, Logical Design of IoT, IoT Levels & Deployment Templates, Domain Specific IoT, IoT Vs M2M Vs IoE, IoT Design Methodologies

SYSTEM HARDWARE FOR IoT 5

Sensors and Actuators – Hardware Kits: Arduino, Node MCU, Raspberry Pi. Arduino UNO: Physical Design – Interfaces – Arduino IDE – Arduino Programming with examples: Digital IO – Analog IO – Serial Communication – Condition and Looping statements. Raspberry Pi: Physical Design – Interfaces – Pi programming using Python with examples – Python Packages for IoT

CLOUD AND DATA ANALYTICS FOR IoT 10

Cloud: Types of Cloud - IoT with Cloud challenges - Selection of cloud for IoT applications - Fog and Edge computing for IoT - Cloud security aspects for IoT applications. Data Analytics for IoT: Overview of Hadoop ecosystem – MapReduce architecture – MapReduce Job Execution – MapReduce Schedulers. Case study: Internet of Medical Things (IoMT)

TOTAL (THEORY):30 PERIODS

LIST OF EXPERIMENTS

1. Study and Configuration of Arduino kit / Node MCU / Raspberry PI
2. Basic Programming using Arduino / Raspberry PI:
   a. LED and Switch Interface
   b. Analog & Digital Sensor Interface
   c. Serial Communication
   d. Local display of sensor data using LCD
   e. Display of Sensor values in Mobile handset using Bluetooth

3. Basic Programming using NodeMCU
   a. Remote control of Electrical appliances using Mobile handset and Wi-Fi
   b. Local Web server using NodeMCU and displaying Sensor values
4. Design and development of a System using LM35 temperature sensor
5. Design and development of a System using MQ5 sensor
6. Design and development of a System using Soil Moisture sensor
7. Design and development of a System using PIR sensor
8. Design and development of a System using Heart beat sensor

TOTAL (LAB): 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the core principles and architecture of IoT systems	[U]
CO2	Identify the design constraints and challenges in developing IoT systems	[AP]
CO3	Develop cost-effective IoT solutions and interface with embedded platforms like Arduino, Raspberry Pi, or similar boards	[AP]
CO4	Analyze cloud platforms for deploying, managing, and ensuring the security of IoT solutions	[AN]
CO5	Apply data analytics to IoT data using Hadoop and MapReduce, demonstrating effective IoT design and implementation	[AP]

TEXTBOOKS

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2015
2. Hanes David, Salgueiro Gonzalo, Grossetete Patrick, Barton Rob, Henry Jerome, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things”, Pearson Education, 2017
3. Mark Torvalds, “Arduino Programming: Step-by-step guide to mastering Arduino hardware and software”, 2nd Edition, 2018

REFERENCE BOOKS

1. Srinivasa K. G.,Siddesh G. M., Hanumantha Raju R., “Internet of Things”, Cengage Learning India Pvt. Ltd., 1st Edition, 2018
2. Raj Kamal, “Internet of Things”, 1st Edition, McGraw Hill Education, 2017
3. Dr. Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”,2nd Edition, McGraw-Hill Education, 2016
4. Arshdeep bahga, Vijay madisetti,“Internet of Things A Hands-On Approach”, Paperback, 2023

WEB RESOURCES

1. https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT
2. https://it.uw.edu/guides/internet-of-things-iot/iot-resources/
3. https://docs.arduino.cc/tutorials/
4. https://www.hackster.io/iot
5. https://www.coursera.org/learn/introduction-iot-boards

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

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall the basic concepts of Design Thinking	[U]
CO2	Utilize the equipment, tools and inventories associated with Design Thinking Laboratory	[AP]
CO3	Perform fundamental fabrication operation using hand tools, power tools, welding equipment, laser cutter and engraver	[AP]
CO4	Perform fundamental electrical and electronic circuit design using PCB machine	[AP]
CO5	Develop innovative products by implementing the design thinking approach	[C]

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

23CS404	BACKEND FRAMEWORKS	L	T	P	C
		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

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

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

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. Joshua Bloch, “Effective Java”, 3rd Edition, Kindle 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

Nature of Course Theory

Pre requisites -

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.

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]

Course Contents:

Module 1: Introduction and Types of Disasters 10 Hrs

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 2: Disaster Impacts and Preparedness Planning 10 Hrs

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 3: Disaster Risk Reduction and Management Systems **10 Hrs**

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 Hours 30 Hrs

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

Course Articulation Matrix														
CO	**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	-	-	2	-	-	2	-	2	-	-	2			
2	-	-	2	-	-	2	-	2	-	-	2			
3	-	-	2	-	-	2	-	2	-	-	2			
4	-	-	2	-	-	2	-	2	-	-	2			
5	-	-	2	-	-	2	-	2	-	-	2			
1 - Reasonably agreed					2 - Moderately agreed						3 - Strongly agreed			

OPEN ELECTIVE

23CS003	ANALYSIS OF ALGORITHMS	L	T	P	C
		2	0	2	3

Course Objectives

The objectives of this course are:

1. To introduce algorithm fundamentals and techniques for analyzing time and space complexity.
2. To develop problem-solving skills using major algorithmic paradigms such as Brute Force, Divide & Conquer, Dynamic Programming, Greedy, Backtracking, and Branch & Bound.
3. To enable students to design optimal and efficient algorithms for real-world computing and engineering problems.
4. To provide practical understanding of recursive algorithms and the implementation of classical problems like sorting, searching, and graph optimization.
5. To build ability to evaluate computational limitations through complexity classes and performance bounds.

TIME COMPLEXITY ANALYSIS & BRUTE FORCE **10**

Notion of an Algorithm, Fundamentals of the Analysis of Algorithmic Efficiency. Time Complexity Analysis: Mathematical analysis of recursive and non-recursive algorithms, Sieve of Sundaram. Recursion: Concept of recursion, base cases, and recursive problem-solving strategies. Introduction to Brute Force – String Matching

DIVIDE AND CONQUER & DYNAMIC PROGRAMMING **10**

Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers. Dynamic programming – Principle of optimality - Optimal Binary Search Trees – Knapsack Problem and Memory functions.

GREEDY TECHNIQUE, BACKTRACKING & BRANCH & BOUND **10**

Greedy Technique – Container loading problem - Prim‘s algorithm and Kruskal's Algorithm – 0/1 Knapsack problem - Huffman Trees. Backtracking — n-Queen problem — Hamiltonian Circuit Problem — Subset Sum Problem. Branch and Bound —Knapsack Problem — Travelling Salesman Problem

TOTAL (Theory): 30 PERIODS

List of Experiments

1. Implement Sieve of Sundaram to generate prime numbers and evaluate its efficiency
2. Implement recursive algorithms with proper base cases (Factorial / Fibonacci / Tower of Hanoi) and compare with iterative versions.

3. Implement Divide & Conquer searching and sorting algorithms Binary Search
4. Implement Divide & Conquer searching and sorting algorithms Merge Sort
5. Implement Divide & Conquer searching and sorting algorithms Quick Sort
6. Implement Travelling Salesman Problem
7. Implement 0/1 Knapsack Problem
8. Implement Prims & kruskals Algorithm.
9. Implement n queen Problem.

TOTAL (Lab): 30 PERIODS

TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Analyze and compare algorithm efficiency using time and space complexity	[AN]
CO2	Apply Brute Force and Divide & Conquer techniques to solve fundamental computational problems.	[AP]
CO3	Develop optimized solutions using Dynamic Programming for problems with overlapping subproblems	[AP]
CO4	Design algorithmic solutions using Greedy, Backtracking & Branch & Bound.	[AP]
CO5	Model real-world computational problems into a form amenable to brute-force solution, implement them	[AN]

REFERENCE BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, *"Introduction to Algorithms"*, 3rd Edition, MIT Press, 2009.
2. Jon Kleinberg and Éva Tardos, *"Algorithm Design"*, Pearson, 2013.
3. Steven S. Skiena, *"The Algorithm Design Manual"*, Springer, 2008.
4. Robert Sedgewick and Kevin Wayne, *"Algorithms"*, 4th Edition, Addison-Wesley, 2011.
5. Aditya Bhargava, *"Grokking Algorithms"*, Manning Publications, 2016.

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