GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore - 641 013

B. E. Computer Science and Engineering

(Artificial Intelligence and Machine Learning)

(Full Time)

2022

Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
GOVERNMENT COLLEGE OF TECHNOLOGY
THADAGAM ROAD,
COIMBATORE - 641 013
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VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind.

MISSION

- To achieve academic excellence through innovative teaching and learning practices.
- To enhance employability and entrepreneurship.
- To improve the research competence to address societal needs.
- To inculcate a culture that supports and reinforces ethical, professional behaviours for a harmonious and prosperous society.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION

VISION

To be in the frontier of Computer Science and Engineering and to produce globally competent graduates with moral values committed to build a vibrant nation.

MISSION

- To strengthen the core competence in Computer Science and Engineering through analytical learning.
- To produce successful graduates with personal and professional responsibilities and committed to lifelong learning.
- To uplift innovative research in Computer Science and Engineering to serve the needs of Industry, Government and Society.

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Graduates will be engaged in the computing profession as competent professionals capable of solving complex intelligent system and data-driven problems using strong foundations in **AI, ML, data analytics, and core computing knowledge**, or will pursue **higher studies and research** in related areas.

PEO 2: Graduates will possess **broad knowledge and analytical skills** in AI and computing that enable **continuous professional development and lifelong learning** to adapt to rapidly evolving technologies.

PEO3: Graduates will demonstrate **innovation and creativity** in designing intelligent solutions, including **entrepreneurial initiatives, collaborative projects, and research activities** in Artificial Intelligence and Machine Learning.

PEO4: Graduates will **communicate effectively, work in multidisciplinary teams, and develop ethical and socially responsible AI solutions**, considering societal needs, legal requirements, and professional standards.

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The Programme Specific Outcomes of B.E. CSE (Artificial Intelligence And Machine Learning) programme are:

PSO1:

Students at the time of graduation will be able to apply mathematical foundations, artificial intelligence, machine learning, and core computing concepts to develop intelligent solutions using modern AI frameworks, tools, and computing technologies.

PSO2:

Students at the time of graduation will be able to design and implement efficient AI and data-driven solutions for interdisciplinary and societal problems using standard AI/ML methodologies, tools, and technologies.

PSO3:

Students at the time of graduation will be able to apply theoretical knowledge of artificial intelligence, machine learning, and data analytics to carry out innovative research, development, and advanced technological applications

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013
B.E. COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

FIRST SEMESTER

SI. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
	22AMC1Z0	Induction Programme	MC	-	-	-	-	-	-	0
1	22AHS1Z1	தமிழர் மரபு Heritage of Tamils	HSMC	40	60	100	1	0	0	1
2	22AHS1Z2	Professional English	HSMC	40	60	100	2	1	0	3
3	22ABS1Z1	Linear Algebra and Calculus	BS	40	60	100	3	1	0	4
4	22ABS1Z2	Engineering Physics	BS	40	60	100	3	0	0	3
5	22AES101	Programming in C	ES	40	60	100	3	0	0	3
6	22AMC1Z1	Environmental Science and Engineering	MC	40	60	100	3	0	0	0
PRACTICAL										
7	22AHS1Z3	Cambridge English	HSMC	-	-	100	0	0	2	1
8	22ABS1Z3	Physics Laboratory	BS	60	40	100	0	0	3	1.5
9	22AES1Z2	Workshop Practice	ES	60	40	100	0	0	3	1.5
10	22AES103	Programming in C Laboratory	ES	60	40	100	0	0	3	1.5
		TOTAL		**480**	**520**	**1000**	**15**	**2**	**11**	**19.5**

SECOND SEMESTER

SI. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
	THEORY									
1	22AHS2Z4	தமிழரும் தொழில்நுட்பமும் Tamils and Technology	HSMC	40	60	100	1	0	0	1
2	22AHS2Z5	Values and Ethics	HSMC	40	60	100	3	0	0	3
3	22ABS204	Vector Spaces and Differential Equations with MATLAB	BS	40	60	100	3	1	0	4
4	22ABS205	Physics for Information Science	BS	40	60	100	3	0	0	3
5	22ABS206	Applied Chemistry	BS	40	60	100	3	0	0	3
6	22AES204	Basics of Electrical and Electronics Engineering	ES	40	60	100	3	0	0	3
		NCC Credit Course (Optional)					2	0	0	3
	PRACTICAL									
7	22ABS2Z7	Chemistry Laboratory	BS	60	40	100	0	0	3	1.5
8	22AES2Z5	Engineering Graphics	ES	60	40	100	1	0	4	3
		TOTAL		**360**	**440**	**800**	**17**	**1**	**7**	**21.5**

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013
B.E. CSE(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

THIRD SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22ABS308	Probability, Random Processes and Queueing Theory (Common to CSE ,IT & AI&ML)	BS	40	60	100	3	1	0	4
2	22AES306	Digital principles and Computer Organization	ES	40	60	100	3	0	0	3
3	22AES307	Discrete Structures (Common to CSE & AI &ML)	ES	40	60	100	3	0	0	3
4	22APC301	Data Structures (Common to *EEE*, *ECE , CSE & AI&ML*)	PC	40	60	100	3	0	0	3
5	22APC302	Foundations of Data Science (Common to CSE, IT & AI&ML)	PC	40	60	100	3	0	0	3
6	22APC303	Programming in Python	PC	40	60	100	3	0	0	3
PRACTICAL										
7	22AES308	Engineering Exploration for Artificial Intelligence and Machine Learning (Common to CSE , IT & AI&ML)	ES	100	-	100	0	0	3	1.5
8	22APC304	Data Structures Laboratory (Common to ECE , CSE & AI&ML)	PC	60	40	100	0	0	3	1.5
9	22APC305	Programming in Python Laboratory	PC	60	40	100	0	0	3	1.5
Total				**460**	**440**	**900**	**18**	**1**	**9**	**23.5**

FOURTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22APC406	Database Management Systems (Common to CSE, AI &ML)	PC	40	60	100	3	0	0	3
2	22APC407	Computer Networks (Common to *ECE,CSE, IT & AI&ML*)	PC	40	60	100	3	0	0	3
3	22APC408	Artificial Intelligence and its Applications	PC	40	60	100	3	0	0	3

4	22APC409	Design and Analysis of Algorithms (Common to CSE ,IT & AI &ML)	PC	40	60	100	3	1	0	4
5	22APC410	Theory of Computation (Common to CSE, IT & AI&ML)	PC	40	60	100	3	1	0	4
THEORY WITH PRACTICAL COMPONENT										
6	22APC411	Operating Systems Design	PC	50	50	100	3	0	2	4
PRACTICAL										
7	22APC412	Database Management Systems Laboratory (Common to CSE & AI &ML)	PC	60	40	100	0	0	3	1.5
8	22APC413	Computer Networks Laboratory (CSE, IT & *AI&ML*)	PC	60	40	100	0	0	3	1.5
Total				**370**	**430**	**800**	**18**	**2**	**8**	**24**

FIFTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22APC514	Machine Learning (Common to CSE & AI &ML)	PC	40	60	100	3	0	0	3
2	22APC515	Natural Language Processing	PC	40	60	100	3	0	0	3
3	22APC516	Web Programming (common to CSE & AI&ML)	PC	40	60	100	3	0	0	3
4	22APC517	Software Engineering Methodologies	PC	40	60	100	3	0	0	3
5	22AMC5Z2	Constitution of India (Common to all Branches)	MC	40	60	100	3	0	0	0
THEORY WITH PRACTICAL COMPONENT										
6	22APC518	Embedded Systems and IoT	PC	50	50	100	3	0	2	4
PRACTICAL										
7	22AEE501	Machine Learning Laboratory	EEC	60	40	100	0	0	3	1.5
8	22APC519	Natural Language Processing Laboratory	PC	60	40	100	0	0	3	1.5
Total				**370**	**430**	**800**	**18**	**0**	**8**	**19**

SIXTH SEMESTER

Sl. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22APC620	Knowledge Representation and Learning	PC	40	60	100	3	0	0	3
2	22APC621	Large Language Model	PC	40	60	100	3	0	0	3
3	22APC622	Deep learning	PC	40	60	100	3	0	0	3
4	22APC623	AI & Ethics	PC	40	60	100	3	0	0	3
5	22APE$XX	Professional Elective I	PE	40	60	100	3	0	0	3
6	22#OE / PE$XX	Open Elective I/ Professional Elective VI	OE1/PE6	40	60	100	3	0	0	3
PRACTICAL										
7	22APC624	Deep Learning Laboratory	PC	60	40	100	0	0	3	1.5
8	22AEE602	Design Thinking for Artificial Intelligence and Machine Learning	EEC	100	-	100	0	0	3	1.5
9	22AEE603	Integrated Business Data Solutions Laboratory	EEC	60	40	100	0	0	4	2
		TOTAL		**460**	**440**	**900**	**18**	**0**	**10**	**23**

SEVENTH SEMESTER

Sl. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22APC725	Computer vision	PC	40	60	100	3	0	0	3
2	22APC726	Gen AI and Agentic AI systems	PC	40	60	100	3	0	0	3
3	22APE$XX	Professional Elective II	PE	40	60	100	3	0	0	3
4	22APE$XX	Professional Elective III	PE	40	60	100	3	0	0	3
5	22#OE/ PE$XX	Open Elective II/ Professional Elective VII	OE2/PE7	40	60	100	3	0	0	3
PRACTICAL										
6	22AEE704	Computer vision Laboratory	EEC	60	40	100	0	0	3	1.5
7	22AEE705	Engineering Project in Community Service	EEC	50	50	100	0	0	6	3
8	22AEE706	Internship*	EEC	-	-	100				4
		TOTAL		**310**	**390**	**800**	**15**	**0**	**9**	**23.5**

EIGHTH SEMESTER

Sl. No.	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22APE$XX	Professional Elective IV	PE	40	60	100	3	0	0	3
2	22APE$XX	Professional Elective V	PE	40	60	100	3	0	0	3
PRACTICAL										
3	22AEE807	Capstone Project	EEC	100	100	200	0	0	16	8
		TOTAL		**180**	**220**	**400**	**6**	**0**	**16**	**14**

Note:

***Internship of four consecutive weeks or two 2 consecutive weeks which are completed during the vacation of fourth (and/or) fifth (and/or) sixth semester shall be considered here.**

TOTAL CREDITS : 168

CURRICULUM DESIGN FOR CBCS 2022 REGULATIONS

FULL TIME B.E. CSE(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING(U.G))

SUMMARY

Sl.NO	Course Category	Credits Per Semester									Total Credits	Total Credits in %	Credits As Per AICTE Model Curricula
		I	II	III	IV	V	VI	VII	VIII	Internship			
1	HS/HSMC	5	4								9	5.36	10
2	BS	8.5	11.5	4							24	14.29	16
3	ES	6	6	7.5							19.5	11.61	08
4	PC			12	24	17.5	13.5	6			73	43.45	71
5	PE						3	6	6		15	8.93	16
6	OE						3	3			6	3.57	6
7	EEC					1.5	3.5	4.5	8	4	21.5	12.8	`38
8	MC	0				0					0	0	Non Credit
Total		19.5	21.5	23.5	24	19	23	19.5	14	4	168	100	165*

SUMMARY OF CREDIT DISTRIBUTION

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS/HSMC)

SI.NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22AHS1Z1	Heritage of Tamils	HSMC	40	60	100	1	0	0	1
2	22AHS1Z2	Professional English	HSMC	40	60	100	2	1	0	3
3	22AHS1Z3	Cambridge English	HSMC	60	40	100	0	0	2	1
4	22AHS2Z4	Tamils and Technology	HSMC	40	60	100	1	0	0	1
5	22AHS2Z5	Values and Ethics	HSMC	40	60	100	3	0	0	3

BASIC SCIENCE (BS)

SI.NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22ABS1Z1	Linear Algebra and Calculus	BS	40	60	100	3	1	0	4
2	22ABS1Z2	Engineering Physics	BS	40	60	100	3	0	0	3
3	22ABS1Z3	Physics Laboratory	BS	60	40	100	0	0	3	1.5
4	22ABS204	Vector Spaces and Differential Equations with MATLAB	BS	40	60	100	3	1	0	4
5	22ABS205	Physics for Information Science	BS	40	60	100	3	0	0	3
6	22ABS206	Applied Chemistry	BS	40	60	100	3	0	0	3
7	22ABS2Z7	Chemistry Laboratory	BS	60	40	100	0	0	3	1.5
8	22ABS308	Probability, Random Processes and Queueing Theory (Common to *CSE ,IT & AI&ML*)	BS	40	60	100	3	1	0	4

ENGINEERING SCIENCE (ES)

SI. NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22AES101	Programming in C	ES	40	60	100	3	0	0	3
2	22AES1Z2	Workshop Practice	ES	60	40	100	0	0	3	1.5
3	22AES103	Programming in C Laboratory	ES	60	40	100	0	0	3	1.5
4	22AES204	Basics of Electrical and Electronics Engineering	ES	40	60	100	3	0	0	3
5	22AES2Z5	Engineering Graphics	ES	60	40	100	1	0	4	3
6	22AES306	Digital principles and Computer Organization	ES	40	60	100	3	0	0	3
7	22AES307	Discrete Structures	ES	40	60	100	3	0	0	3
8	22AES308	Engineering Exploration for Artificial Intelligence and Machine Learning (Common to *CSE, IT & AI&ML*)	ES	60	40	100	0	0	3	1.5

PROFESSIONAL CORE

SI. NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22APC301	Data Structures (Common to *EEE,ECE ,CSE & AI &ML*)	PC	40	60	100	3	0	0	3
2	22APC302	Foundations of Data Science (Common to *CSE,IT & AI&ML*)	PC	40	60	100	3	0	0	3
3	22APC303	Programming in Python	PC	40	60	100	3	0	0	3
4	22APC304	Data Structures Laboratory (Common to ECE,CSE & AI&ML)	PC	60	40	100	0	0	3	1.5
5	22APC305	Programming in Python Laboratory	PC	60	40	100	0	0	3	1.5

6	22APC406	Database Management Systems (Common to *CSE, AI&ML*)	PC	40	60	100	3	0	0	3
7	22APC407	Computer Networks (Common to *ECE,CSE, IT & AI&ML*)	PC	40	60	100	3	0	0	3
8	22APC408	Artificial Intelligence and its Applications	PC	40	60	100	3	0	0	3
9	22APC409	Design and Analysis of Algorithms (Common to CSE, IT &AI&ML)	PC	40	60	100	3	1	0	4
10	22APC410	Theory of Computation (Common to CSE, IT& AI&ML)	PC	40	60	100	3	1	0	4
11	22APC411	Operating Systems Design	PC	50	50	100	3	0	2	4
12	22APC412	Database Management Systems Laboratory (Common to CSE, AI&ML)	PC	60	40	100	0	0	3	1.5
13	22APC413	Computer Networks Laboratory (Common to CSE, IT &AI&ML)	PC	60	40	100	0	0	3	1.5
14	22APC514	Machine Learning (common to CSE & AL&ML)	PC	40	60	100	3	0	0	3
15	22APC515	Natural Language Processing	PC	40	60	100	3	0	0	3
16	22APC516	Web Programming (common to CSE, AI&ML)	PC	40	60	100	3	0	0	3
17	22APC517	Software Engineering Methodologies	PC	40	60	100	3	0	0	3
18	22APC518	Embedded Systems and IoT	PC	50	50	100	3	0	2	4
19	22APC519	Natural Language Processing Laboratory	PC	60	40	100	0	0	3	1.5
20	22APC620	Knowledge Representation and Learning	PC	40	60	100	3	0	0	3
21	22APC621	Large Language Model	PC	40	60	100	3	0	0	3
22	22APC622	Deep learning	PC	40	60	100	3	0	0	3
23	22APC623	AI & Ethics	PC	40	60	100	3	0	0	3

24	22APC624	Deep Learning Laboratory	PC	60	40	100	0	0	3	1.5
25	22APC725	Computer vision	PC	40	60	100	3	0	0	3
26	22APC726	Gen AI and Agentic AI	PC	40	60	100	3	0	0	3

OPEN ELECTIVE

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22AOE$20	AI for Everyone	OE	40	60	100	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES

SI. NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22AEE501	Machine Learning Laboratory	EEC	60	40	100	0	0	3	1.5
2	22AEE602	Design Thinking for Artificial Intelligence and Machine Learning	EEC	100	-	100	0	0	3	1.5
3	22AEE603	Integrated Business Data Solutions Laboratory	EEC	60	40	100	0	0	4	2
4	22AEE704	Computer vision Laboratory	EEC	60	40	100	0	0	3	1.5
5	22AEE705	Engineering Project in Community Service	EEC	50	50	100	0	0	6	3
6	22AEE706	Internship	EEC	100		100				4
7	22AEE807	Capstone Project	EEC	100	100	200	0	0	16	8

MANDATORY COURSES

SI. NO	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	22AMC1Z0	Induction Programme	MC	-	-	-	-	-	-	0
2	22AMC1Z1	Environmental Science and Engineering	MC	40	60	100	3	0	0	0
3	22AMC5Z2	Constitution of India (Common to all Branches)	MC	40	60	100	3	0	0	0

VALUE ADDED COURSES

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1		Swayam/NPTEL Course	EEC	100	-	100	1	0	0	1
2		Online Courses from Course	EEC	100	-	100	1	0	0	1
	22AVA$09	Marketing Tech 101	EEC	100	-	100	1	0	0	1
3	22AVA$10	Professional Skills and Career Readiness	EEC	100	-	100	0	0	2	1
4	22AVA$11	Placement Training	EEC	100	-	100	0	0	2	1
3	22AVA$12	Object Oriented Programming in Java	EEC	100	-	100	1	0	0	1

Professional Electives-Verticals

Verticals	Course Code	Course Name
Artificial Intelligence and Machine Learning	22APE$01	Reinforcement Learning
	22APE$02	Game Theory (Common to CSE,AI&ML &IT)
	22APE$03	Optimization Techniques
	22APE$04	Soft Computing (Common to CSE,AI&ML &IT)
	22APE$05	Cognitive Science (Common to CSE,AI&ML &IT)
	22APE$06	Data Warehousing and Data Mining (Common to CSE & AI &ML)
	22APE$07	Recommender Systems (Common to CSE,AI&ML &IT)

	22APE$08	Exploratory Data Analytics (Common to CSE ,AI&ML & IT)
	22APE$09	Explainable AI
Full Stack Development (Common to CSE ,AI&ML & IT)	22APE$10	Web Application Security (Common to CSE,AI&ML &IT)
	22APE$11	Dev-ops (Common to CSE,AI&ML &IT)
	22APE$12	MLOps
	22APE$13	Cloud Engineering
	22APE$14	Principles of Programming Languages (Common to CSE,AI&ML &IT)
	22APE$15	UI&UX design (Common to CSE,AI&ML &IT)
	22APE$16	App Development (Common to CSE,AI&ML &IT)
Emerging Technologies	22APE$17	IOT Architecture and Protocols
	22APE$18	Augmented Reality/Virtual Reality
	22APE$19	Robotic Process Automation
	22APE$20	IOT Security
	22APE$21	Edge Computing
	22APE$22	Quantum Computing
	22APE$23	Big Data Technologies (Common to CSE & AI&ML)
	22APE$24	Distributed Computing
	22APE$25	Stream
	22APE$26	Storage Technologies
Cyber Security and Data Privacy (Common to CSE & IT)	22APE$27	Modern Cryptography (Common to CSE,AI&ML &IT)
	22APE$28	Engineering Secure Software Systems (Common to CSE,AI&ML &IT)
	22APE$29	Security and Privacy in cloud (Common to CSE,AI&ML &IT)
	22APE$30	Crypto-currency and Block chain Technologies (Common to CSE,AI&ML &IT)
	22APE$31	Ethical Hacking (Common to CSE,AI&ML &IT)
	22APE$32	Digital and Mobile Forensics (Common to CSE,AI&ML &IT)
	22APE$33	Social Network Security (Common to CSE,AI&ML &IT)
	22APE$34	Cyber Security Essentials (Common to CSE,AI&ML &IT)

GOVERNMENT COLLEGE OF TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University)
Coimbatore–641013.

COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

22AMC1Z0	INDUCTION PROGRAMME	SEMESTER I

Details of the Programme:
Day 0: College Admission
Day1: Orientation Programme
Day2 Onwards: Induction Programme

Activities:
Physical activity,
Playground Events,
Yoga Practices,
Literary,
Proficiency modules,
Team Building,
Lectures by Eminent people,
Familiarization to department,
Branch oriented information,
Motivational speakers,
Talent exposure,
Quiz completion,
Visit to local areas….etc.

22AHS1Z1	தமிழர் மரபு Heritage of Tamils *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

Course Objectives		
UNIT – I	**LANGUAGE AND LITERATURE**	**3 Periods**
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		
UNIT – II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	**3 Periods**
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 ofTemples in Social and Economic Life of Tamils.		
UNIT – III	**FOLK AND MARTIAL ARTS**	**3 Periods**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT – IV	**THINAI CONCEPT OF TAMILS**	**3 Periods**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature- Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT – V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3 Periods**
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.		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1		
CO2		
CO3		
CO4		
CO5		

COURSE ARTICULATION MATRIX															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1															
CO2															
CO3															
CO4															
CO5															
22AHS1Z1															
1 – Slight, 2 – Moderate, 3 – Substantial															

22AHS1Z1	**தமிழர் மரபு Heritage of Tamils** *(Common to all Branches)*	**SEMESTER I**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

Course Objectives		
அலகு I	**மொழி மற்றும் இலக்கியம்**	**3 Periods**

இந்திய மொழிக் குடும்பங்கள்- திராவிட மொழிகள்- தமிழ் ஒரு செம்மொழி- தமிழ் செவ்விலக்கியங்கள் –சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை-சங்க இலக்கியத்தில் பகிர்தல் அறம்-திருக்குறளில் மேலாண்மைக் கருத்துக்கள்-தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்தசமயங்களின் தாக்கம்-பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள்-சிற்றிலக்கியங்கள்-தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி-தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II	**மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை–சிற்பக் கலை**	**3 Periods**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள்-பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ் , நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III	**நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**	**3 Periods**

தெருக்கூத்து, கரகாட்டம்-வில்லுப்பாட்டு-கணியான் கூத்து – ஒயிலாட்டம் - தோல்பாவைக் கூத்து-சிலம்பாட்டம் –வளரி-புலியாட்டம் - தமிழர்களின் விளையாட்டுகள்.

அலகு IV	**தமிழர்களின் திணைக் கோட்பாடுகள்**	**3 Periods**

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

அலகு V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3 Periods
இந்திய விடுதலைபோரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1		
CO2		
CO3		
CO4		
CO5		

COURSE ARTICULATION MATRIX															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1															
CO2															
CO3															
CO4															
CO5															
22AHS1Z1															
1 – Slight, 2 – Moderate, 3 – Substantial															

22AHS1Z2	PROFESSIONAL ENGLISH *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	2	1	0	3

Course Objectives	1. To engage learners in meaningful language activities to improve their LSRW skills 2. To enhance learners' awareness of general rules of writing for specific audiences 3. To help learners understand the purpose, audience, contexts of different types of writing 4. To develop analytical thinking skills for problem solving in communicative contexts 5. To demonstrate an understanding of job applications and interviews for internship and placements

UNIT – I	**FUNDAMENTALS OF COMMUNICATION**	**9 Periods**

Listening –Listening to Personal Introduction and Filling a form
Speaking - Self Introduction; Introducing someone in a formal context
Reading -Reading Biographies/ Autobiographies and E-mails relevant to technical contexts.
Writing - Writing Biographies/ Autobiographies; Drafting Professional E-mails.
Grammar - Present Tense (Simple Present, Present Progressive, Present Perfect, Present Perfect Continuous); Parts of Speech
Vocabulary - Word Formation with Prefixes; Antonyms; Portmanteau Words

UNIT – II	**SUMMATION AND PROBLEM SOLVING**	**9 Periods**

Listening - Listening to Short-Stories / Personal Experiences/Watching Movies.
Speaking - Narrating Personal Experiences / Events and Short Stories
Reading - Reading Travelogues and Books.
Writing - Report on an event (Field Trip, Industrial Visit, Educational Tours etc.), Review on Books and Movies.
Grammar –Past Tense (Simple Past, Past Progressive, Past Perfect, Past Perfect Continuous); Impersonal Passive
Vocabulary - Word Formation with suffixes; Synonyms; Phrasal Verbs.

UNIT – III	**DESCRIPTION OF A PROCESS / PRODUCT**	**9 Periods**

Listening - Listening to Digital Marketing Advertisements for Product /Process Descriptions
Speaking –Describing/Interpreting a Picture; Giving instructions to use the product.
Reading – Reading Advertisements, Gadget Reviews; User Manuals.
Writing - Writing Definitions; Product /Process Description; Transcoding; Content Writing
Grammar -Future Tense(Simple Future, future continuous, Future Perfect, Future Perfect Continuous); If Clauses
Vocabulary - Homonyms; Homophones, One Word Substitutes.

UNIT – IV	**EXPRESSION**	**9 Periods**

Listening – Listening to/Watching Formal Job interviews or Celebrity Interviews
Speaking – Participating in a Face to Face or Virtual Interview (Job/Celebrity Interview), virtual interviews
Reading – Company profiles, Statement of Purpose, (SOP), Excerpts of interview with professionals from Newspaper, Magazine and other Resources
Writing – Job / Internship Application – Cover letter & Resume
Grammar – Question types: 'Wh' / Yes or No/ and Tags; Subject- Verb Agreement.
Vocabulary – Idiomatic Expressions

UNIT – V	**PUBLIC SPEAKING**	**9 Periods**

Listening – Listening to Ceremonious Speeches on You Tube and Jotting down phrases
Speaking – Delivering Welcome Address; Introducing the Chief-Guest; Proposing Vote of Thank and Felicitation
Reading – Excerpts of Speeches from Newspaper, Magazines and Motivational Books
Writing – Drafting a Welcome Address, Introduction to the Chief-Guest, Vote of Thanks and Felicitation
Grammar –Common Errors
Vocabulary – Commonly Confused Words

Contact Periods:
Lecture: 30 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK

1	***English for Science & Technology*** *Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.*
2	***Communicative English,*** *Global Publishers, Chennai 2017 by Dr.J.Anbazhagan Vijay*

REFERENCES

1	*Raman.Meenakshi, Sharma.Sangeeta(2019).* ***Professional English.*** *Oxford University Press. New Delhi.*
2	***Learning to Communicate*** *– Dr. V. Chellammal, Allied Publishing House, New Delhi,2003*
3	***Using English****, Orient Blackswan, Chennai, 2017 by Board of Editors*
4	***OER****(Authentic Open Educational Resources)*

	COURSE OUTCOMES: On completion of the course, the students will be able to:	**Bloom's Taxonomy Mapped**
CO1	Participate in a basic communicative task.	K3
CO2	Analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.	K3
CO3	Describe a product or process or mechanism.	K2
CO4	Present their opinions in a planned and logical manner, and draft effective resumes in context of job search.	K3
CO5	Deliver speeches at formal functions.	K3

COURSE ARTICULATION MATRIX:

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	1	-	-	2	-	-	-	2	-	-	-	1	1
CO2	-	1	1	-	-	2	-	-	1	2	-	1	-	1	-
CO3	-	-	1	1	-	-	-	-	-	2	-	-	-	1	1
CO4	-	-	1	-	-	-	-	-	2	2	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-
22AHS1Z2	**-**	**1**	**1**	**1**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**1**	**-**	**1**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

22ABS1Z1	LINEAR ALGEBRA AND CALCULUS *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	1. To acquire knowledge of system of equations, eigenvalues, eigenvectors, diagonalization of matrices and reduction of quadratic forms to canonical forms. 2. To obtain the knowledge of analyze the functions using Limits and derivative recognize the appropriate tools of differential calculus to solve applied problems. 3. To obtain the knowledge of definite and improper integration and recognize the appropriate tools of Integral Calculus to solve applied problems 4. To develop the skills in solving the functions of several variables by partial derivatives. 5. To acquire knowledge of multiple integration and related applied problems in various geometry	
UNIT – I	**LINEAR ALGEBRA**	**9+3 Periods**
Consistency of System of Linear Equations - Eigen values and eigenvectors - Diagonalization of matrices by orthogonal transformation - Cayley-Hamilton Theorem - Quadratic to canonical forms.		
UNIT – II	**DIFFERENTIAL CALCULUS**	**9+3 Periods**
Limit and continuity of function - Rolle's theorem - Mean value theorems - Taylor's and Maclaurin's theorems. Application of Differential Calculus: Radius of curvature, Centre of curvature, Circle of curvature and Evolutes of a curve.		
UNIT – III	**INTEGRAL CALCULUS**	**9+3 Periods**
Evaluation of definite integral by trigonometric substitution - Convergence and Divergence of improper integrals - Beta & Gamma functions and their properties - Applications of definite integrals to evaluate surface areas and volume of revolution (Cartesian coordinates only).		
UNIT – IV	**PARTIAL DERIVATIVES AND ITS APPLICATIONS**	**9+3 Periods**
Partial derivatives - total derivative - Taylor's series – Jacobians - Maxima, minima and saddle points - Method of Lagrange multipliers.		
UNIT – V	**MULTI VARIABLE INTEGRAL CALCULUS**	**9+3 Periods**
Double integral - Area as double integral - change of order of integration in double integrals - Triple Integrals - Volume as Triple Integral. Change of variables: Cartesian to polar, Spherical polar coordinates, Cylindrical polar coordinates.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*Veerarajan T., **"Engineering Mathematics I"**, Tata McGraw-Hill Education(India)Pvt. Ltd, New Delhi,2015.*
2	*David C.Lay, **"Linear Algebra and Its Application"**, Pearson Publishers, 6th Edition, 2021.*

REFERENCES

1	*B.S.Grewal, **"Higher Engineering Mathematics"**, Khanna Publishers, 44th Edition, 2017.*
2	*Howard Anton, **"Elementry Linear Algebra"**, 11th Edition, Wiley Publication, 2013.*
3	*Narayanan.S and Manicavachagom Pillai. T.K. – **"Calculas Vol I and Vol II",** S.chand & Co, Sixth Edition, 2014.*
4	*H.K. Dass, **"Advance Engineering Mathematics"**, S. Chand and company, Eleventh Edition, 2015.*
5	*Jain R.K. and Iyengar S.R.K., **"Advanced Engineering Mathematics"**, Narosa Publicaitons, Eighth Edition, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Solve the linear system of equations, diagonalize matrix by orthogonal transformation and reduce quadratic form to canonical form.	K5
CO2	Compare and contrast the ideas of continuity and differentiability and use them to solve engineering problems.	K5
CO3	Acquire fluency in integration of one variable and apply them to find surface area and volumes.	K5
CO4	Apply the techniques of partial derivatives in functions of several variables.	K5
CO5	Use multiple integration for finding area, surface and volume of different geometry.	K5

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	-	-	-	-	-	-	-	1	3	3	2
CO2	3	3	1	1	-	-	-	-	-	-	-	1	3	3	1
CO3	3	3	1	1	-	-	-	-	-	-	-	1	3	2	1
CO4	3	3	1	1	-	-	-	-	-	-	-	1	3	2	-
CO5	3	3	1	1	-	-	-	-	-	-	-	1	3	2	-
22ABS1Z1	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

22ABS1Z2	ENGINEERING PHYSICS *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	0	0	3

Course Objectives	1. To understand the basics about crystal systems and defects. 2. To understand the principle, characteristics, working and applications of laser and optical fiber. 3. To solve problems in bending of beams. 4. To solve quantum mechanical problems with the understanding of Quantum Principles. 5. To understand the properties, production and applications of ultrasonic waves.

UNIT – I	**CRYSTAL PHYSICS**	**9 Periods**

Introduction – Crystalline and amorphous materials – Lattice – Unit Cell –Crystal system - Bravais lattices – Miller indices – Reciprocal lattice - d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC, and HCP structures – Crystal defects – Point, line and surface defects.

UNIT – II	**LASER PHYSICS AND FIBER OPTICS**	**9 Periods**

Introduction- Principle of laser action - characteristics of laser - Spontaneous emission and Stimulated emission –Einstein‘s coefficients - population inversion – methods of achieving population inversion – Optical Resonator -Types of Lasers – Principle, construction and working of CO_2 Laser - applications of laser.

Introduction – Basic Principles involved in fiber optics- Total internal reflection–Propagation of light through optical fiber –Derivation for Numerical Aperture and acceptance angle - fractional index change.

UNIT – III	**PROPERTIES OF MATTER**	**9 Periods**

Elasticity- Hooke’s law- stress-strain diagram - Factors affecting elasticity – Moment (Q) - Couple (Q) – Torque (Q) – Beam - Bending moment - Depression of a cantilever –Twisting Couple- Young’s modulus by uniform bending - I shaped girders.

UNIT – IV	**QUANTUM PHYSICS AND APPLICATIONS**	**9 Periods**

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy, and temperature –Heisenberg’s Uncertainty principle – verification – physical significance of a wave function- Schrödinger’s Time independent and Time dependent wave equations –- Particle in a one dimensional potential well - Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM).

UNIT – V	**ULTRASONICS**	**9 Periods**

Introduction - properties of ultrasonic waves - production of ultrasonic waves -Magnetostriction effect- Magnetostriction generator- Piezoelectric effect- Piezoelectric generator- Acoustic grating - Determination of wavelength and velocity of ultrasonic waves-cavitation - applications- ultrasonic drilling- ultrasonic welding- ultrasonic soldering and ultrasonic cleaning-Non- destructive Testing- Pulse echo system.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK:

1	*K. Rajagopal, **“Engineering Physics”**, PHI Learning Private Limited, 2015.*
2	*P. K. Palanisamy, “**Engineering Physics-I”,** Scitech publications Private Limited, 2015.*
3	*M. Arumugam, **“Engineering Physics”**, Anuradha Publishers, 2010.*

REFERENCES:

1	*Arthur Beiser, **"Concepts of Modern Physics"**, Tata McGraw-Hill, 2010.*
2	*D. Halliday, R. Resnick and J. Walker, **"Fundamentals of Physics"**, 6th Edition, John Wiley and Sons, 2001.*
3	*William T. Silfvast, **"Laser Fundamentals"**, 2nd Edition, Cambridge University Press, New York 2004.*
4	*M. N. Avadhanulu and P.G. Kshirsagar, **"A Textbook of Engineering Physics"**, S. Chand and Company Ltd, 2010.*
5	*R. K. Gaur and S. L. Gupta, **"Engineering Physics",** Dhanpat Rai Publishers, 2009.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Interpret the crystal structure and analyse the type of defect.	K4
CO2	Explain the principle, characteristics, working and applications of laser and optical fiber, Analyse and solve problems in laser and optical fiber.	K4
CO3	Solve problems in bending of beams. Apply the knowledge in construction of buildings.	K3
CO4	Explain the importance of quantum mechanics. Solve problems in basic quantum physics. Apply the wave equations in real time problems.	K3
CO5	Explain the properties and production of ultrasonic waves. Apply ultrasonic waves for industrial problems.	K3

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-	2	1	-
22ABS1Z2	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

22AES101	**PROGRAMMING IN C** *(Common to all Branches Except MECH & PRODN)*	**SEMESTER I**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	1. To study the basic concepts of computer and programming fundamentals. 2. To understand the data types in C , flow control statements, Arrays, Functions Pointers, Structures, Unions and File concepts in C.	
UNIT – I	**COMPUTER AND PROGRAMMING FUNDAMENTALS**	**9 Periods**
Computer fundamentals – Evolution, classification, Anatomy of a computer: CPU, Memory, I/O – Introduction to software –Classification of programming languages – Compiling –Linking and loading a program – Introduction to OS – Types of OS.		
UNIT – II	**DATATYPES AND FLOW OF CONTROL**	**9 Periods**
Structured programming – Algorithms – Structure of a C program – Variables – Data types – Operators and expressions – Input and Output statements – Tokens –Type Conversion – Control statements.		
UNIT – III	**ARRAYS AND FUNCTIONS**	**9 Periods**
1DArrays– 2D Arrays – Multidimensional Arrays – Strings – String handling functions – Functions – Recursion – Array as function arguments – Storage Classes – Enumerations.		
UNIT – IV	**POINTERS**	**9 Periods**
Introduction to pointers – Pointers arithmetic – call by reference – Relationship between Array and Pointers – Relationship between String and pointers – pointers to pointers – array of pointers – pointers to an array – Dynamic memory allocation – Arguments to main().		
UNIT – V	**STRUCTURES AND UNIONS, FILE OPERATIONS**	**9 Periods**
Preprocessor directives – Structures – Unions – Bit fields – Opening and closing a file – Working with file of records – Random access to file of records.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

PradipDey, Manas Ghosh, ***"Computer Fundamentals and Programming in C",*** *Second Edition, Oxford University Press, 2018.*

REFERENCES:

1	*Al Kelley, Ira Pohl* ***,"A Book on C- Programming in C*** *",Fourth Edition, Addison Wesley, 2001.*
2	*Herbert Schildt ,* ***"C: The Complete Reference"****, Fourth Edition, McGraw Hill Education, 2017.*
3	*YashavantP.Kanetkar,* ***"Let Us C",*** *15th edition, BPB Publications,2016.*
4	*Brian W. Kernighan and Dennis Ritchie,* ***"The C Programming Language",*** *Second Edition, Prentice Hall Software Series, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Articulate the basics of computer and evolution of programming languages.	K1
CO2	Write simple C programs using appropriate datatypes and control statements.	K3
CO3	Write C programs using arrays, functions and enumerations.	K3
CO4	Use pointers effectively to develop programs.	K3
CO5	Create user defined datatypes using structures & union and effectively manipulate them in file operations.	K6

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	3	3	3
CO2	1	2	1	-	-	-	-	-	-	-	-	-	3	3	3
CO3	1	2	1	-	-	-	-	-	-	-	-	-	3	3	3
CO4	2	2	1	-	-	-	-	-	-	-	-	-	3	3	3
CO5	1	2	1	-	-	-	-	-	-	-	-	-	3	3	3
22AES101	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

22AMC1Z1	ENVIRONMENTAL SCIENCE AND ENGINEERING *(Common to all Branches)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	MC	3	0	0	0

Course Objectives	1. To study the modern agriculture related problems, natural resources and its harnessing methods. 2. To study the interrelationship between living organism and environment. 3. To educate the people about causes of pollutions and its controlling methods. 4. To impart the knowledge of various environmental threats and its consequences. 5. To study the various water conservation methods, Act, Population policy, Welfare programs.	
UNIT – I	**ENVIRONMENTAL ENERGY RESOURCES**	**9 Periods**
Food-effects of modern agriculture, fertilizers, pesticides, eutrophication & biomagnifications-Energy resources: renewable resources - Hydro Energy, Solar & Wind. Non-renewable resources – Coal and Petroleum - harnessing methods.		
UNIT – II	**ECO SYSTEM AND BIODIVERSITY**	**9 Periods**
Eco system and its components - biotic and abiotic components. Biodiversity: types and values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity: In situ and ex situ conservation. Threats to biodiversity-destruction of habitat, habit fragmentation, hunting, over exploitation and man-wildlife conflicts. The IUCN red list categories.		
UNIT – III	**ENVIRONMENTAL POLLUTION**	**9 Periods**
Air pollution, classification of air pollutants – sources, effects and control of gaseous pollutants SO_2, NO_2, H_2S, CO, CO_2 and particulates. Water pollution - classification of water pollutants, organic and inorganic pollutants, sources, effects and control of water pollution. Noise pollution - decibel scale, sources, effects and control.		
UNIT – IV	**ENVIRONMENTAL THREATS**	**9 Periods**
Global warming-measure to check global warming - impacts of enhanced Greenhouse effect, Acid rain-effects and control of acid rain, ozone layer depletion- effects of ozone depletion, disaster management - flood, drought, earthquake and tsunami.		
UNIT – V	**SOCIAL ISSUES AND ENVIRONMENT**	**9 Periods**
Water conservation, rain water harvesting, e-waste management, Pollution Control Act, Wild life Protection Act. Population growth- exponential and logistic growth, variation in population among nations, population policy. Women and Child welfare programs. Role of information technology in human and health, COVID-19 - effects and preventive measures.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Sharma J.P., **"Environmental Studies"**, 4th Edition, University Science Press, New Delhi 2016.*
2	*Anubha Kaushik and C.P.Kaushik**, "Environmental Science and Engineering"**, 7th Edition, New Age International Publishers, New Delhi, 2021.*

REFERENCES:

1	*A K De, **"Environmental Chemistry"**, 8th Edition, New Age International Publishers, 2017.*
2	*G. Tyler Miller and Scott E. Spoolman, **"Environmental Science"**, Cengage Learning India Pvt, Ltd, Delhi, 2014.*
3	*ErachBharucha, **"Textbook of Environmental Studies"**, Universities Press(I) Pvt, Ltd, Hyderabad, 2015.*
4	*Gilbert M.Masters**, "Introduction to Environmental Engineering and Science"**, 3rd Edition, Pearson Education, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Recognize and understandabout the various environmental energy resources and the effective utility of modern agriculture.	K2
CO2	Acquire knowledge about the interaction of biosphere with environment and conservation methods of bio diversity.	K2
CO3	Be aware of the sources of various types of pollution, their ill effects and preventive methods.	K2
CO4	Identify and take the preventive measures to control the environmental threats and effects of Global warming, Ozone depletion, Acid rain, and natural disasters.	K2
CO5	Demonstrate an idea to save water and other issues like COVID -19.	K2

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	-	1	1	-	3	-	-	-	-	1	-	-	-
CO2	1	1	-	1	1	2	2	-	-	-	-	1	-	-	-
CO3	1	1	1	1	1	2	3	-	-	-	-	1	-	-	-
CO4	1	1	1	1	1	2	3	-	-	-	-	1	-	-	-
CO5	1	1	1	1	2	2	2	-	-	1	-	1	-	-	-
22AMC1Z1	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**-**	**-**	**1**	**-**	**1**	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

22ABS1Z3	**PHYSICS LABORATORY** *(Common to all Branches)*	**SEMESTER I**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	0	0	3	1.5

Course Objectives	1. To impart practical knowledge on the concept of properties of matter and utilize the experimental techniques to measure the properties 2. To impart practical knowledge on the modulii of elasticity 3. To analyze the properties of semiconductors 4. To learn practically the basic electronic concepts of transistor and logic gates 5. To realize the principle, concepts and working of a solar cell and study the properties of ferromagnetic material 6. To understand the concept of quantum physics
S. No.	**LABORATORY EXPERIMENTS**
1.	Determination of refractive index of the glass and given liquid – Spectrometer diffraction method.
2.	Determination of Planck's constant.
3.	Determination of Young's Modulus of the material in the form of bar – Cantilever Bending - Koenig's Method.
4.	a) Particle size determination using diode laser. b) Determination of numerical aperture and acceptance angle in an optical fiber.
5.	Hall effect - Determination of semiconductor parameters.
6.	Determination of band gap of semiconductor material.
7.	Determination of velocity of sound and compressibility of the given liquid-Ultrasonic Interferometer.
8.	Determination of moment of inertia of disc and rigidity modulus of a wire-Torsional pendulum.
9.	Transistor characteristics.
10.	Solar cell characteristics.
11.	Determination of Hysteresis losses in a Ferromagnetic material-B-H curve unit.
12.	Logic Gates – Verification and Construction.
Contact Periods: **Lecture: 0 Periods** **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**	

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Determine refractive index and compressibility of liquids, micro size of particles and numerical aperture of an optical fibre	K5
CO2	Measure the Young's and rigidity modulii of the given material	K5
CO3	Determine the bandgap of a given semiconductor material and identify the type of semiconductor and its carrier concentration through Hall measurement	K5
CO4	Analyze the characteristics of transistor and verify the truth table of logic gates	K4
CO5	Measure the efficiency of a solar cell and energy loss associated with the ferromagnetic material by plotting B-H curve	K5
CO6	Determine the Planck's constant and work function	K5

COURSE ARTICULATION MATRIX															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-	2	1	-
CO6	2	-	-	-	-	-	-	-	-	-	-	-	1	1	-
22ABS1Z3	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**
1 – Slight, 2 – Moderate, 3 – Substantial															

22AES1Z2	WORKSHOP PRACTICE *(Common to all Branches)*	SEMESTER I

PREREQUISTES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	1. To make various basic prototypes in the carpentry trade such as Half Lap joint, Lap Tee joint, Dovetail joint, Mortise & Tenon joint. 2. To make various welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint. 3. To make various moulds in foundry such as Cube, Straight pipe, V pulley, and Conical bush. 4. To make various components using sheet metal such as Tray, Frustum of cone and Square box. 5. To understand the working and identify the various components of CNC Machines.

LIST OF EXPERIMENTS			
1. Introduction to use of tools and equipment's in Carpentry, Welding, Foundry and Sheet metal 2. Safety aspects in Welding, Carpentry, Foundry and sheet metal. 3. Half Lap joint and Dovetail joint in Carpentry. 4. Welding of Lap joint and Butt joint and T-joint. 5. Preparation of Sand mould for Cube, Conical bush, Pipes and V pulley 6. Fabrication of parts like Tray, Frustum of cone and Square box in sheet metal 7. CNC Machines demonstration and lecture on working principle. 8. Electrical wiring and simple house wiring.			
Contact periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Safely Use tools and equipment's used in Carpentry, Welding, Foundry and Sheet metal to create basic joints.	**K2**
CO2	Prepare sand mould for various basic pattern shapes.	**K3**
CO3	Fabricate parts like Tray, Frustum of cone and Square box in sheet metal.	**K3**
CO4	Practice on the Welding and Carpentry	**K3**
CO5	Demonstrate the working of CNC Machines.	**K2**

COURSE ARTICULATION MATRIX

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	1	-	-	3	1	1	-	2	-	1	-	-	-
CO2	2	-	2	-	-	3	3	1	-	3	2	1	-	-	1
CO3	2	-	2	-	-	3	3	1	-	3	2	1	-	-	-
CO4	2	-	2	-	-	3	3	1	-	3	2	1	-	-	-
CO5	-	-	-	-	1	-	-	-	-	2	-	1	-	-	1
22AES1Z2	**1**	**-**	**1**	**-**	**1**	**2**	**2**	**1**	**-**	**3**	**1**	**1**	**-**	**-**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

22AES103	PROGRAMMING IN C LABORATORY *(Common to all Branches Except MECH & PRODN)*	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	To understand the concepts like Data types, Flow control statements, Functions, Arrays, command line arguments, Pointer, Dynamic memory allocation, Preprocessor Directives, Structures ,Unions and Files in C.

EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:	
1	Operators, Expressions and IO formatting.
2	Decision Making and Looping.
3	Arrays and Strings.
4	Functions and Recursion.
5	Pointers.
6	Dynamic Memory Allocation.
7	Command line arguments.
8	Preprocessor Directives.
9	Structures.
10	Unions.
11	Files.
12	MiniProject.

Contact periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Use appropriate data types and flow control statements to write C programs.	K6
CO2	Write C programs using arrays, functions and command line arguments.	K6
CO3	Write C programs using pointers, dynamic memory allocation and preprocessor directives.	K6
CO4	Implement user defined data types using structures & union and effectively manipulate them in file operations.	K6
CO5	Develop simple applications using C.	K6

COURSE ARTICULATION MATRIX															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	3	3	3
CO2	-	1	-	-	-	-	-	-	-	-	-	-	3	3	3
CO3	-	1	-	-	-	-	-	-	-	-	-	-	3	3	3
CO4	-	1	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	2	2	2	-	-	-	-	-	3	3	-	-	3	3	3
22AES103	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**3**	**3**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															

22AHS2Z4	தமிழரும் தொழில்நுட்பமும் **TAMILS AND TECHNOLOGY** *(Common to all Branches)*	**SEMESTER II**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

Course Objectives		
UNIT – I	**WEAVING AND CERAMIC TECHNOLOGY**	**3 Periods**
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW)– Graffiti on Potteries.		
UNIT – II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3 Periods**
Designing and Structural construction House & Designs in household materials during Sangam Age- Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.		
UNIT – III	**MANUFACTURING TECHNOLOGY**	**3 Periods**
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.		
UNIT – IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3 Periods**
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
UNIT – V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3 Periods**
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.		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1		
CO2		
CO3		
CO4		
CO5		

COURSE ARTICULATION MATRIX															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1															
CO2															
CO3															
CO4															
CO5															
22AHS2Z4															
1 – Slight, 2 – Moderate, 3 – Substantial															

22AHS2Z4	தமிழரும் தொழில்நுட்பமும் **TAMILS AND TECHNOLOGY** *(Common to all Branches)*	**SEMESTER II**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	1	0	0	1

Course Objectives		
அலகு I	**நெசவு மற்றும் பானைத் தொழில்நுட்பம்**	**3 Periods**
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள்– பாண் டங்களில் கீறல் குறியீடுகள்.		
அலகு II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**	**3 Periods**
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும்– சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும்- சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள்-மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சிஅம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர்மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.		
அலகு III	**உற்பத்தித் தொழில் நுட்பம்**	**3 Periods**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் –நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண் டுகள் –தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு IV	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்**	**3 Periods**
அணை, ஏரி, குளங்கள் , மதகு – சோழர்காலக் குமுழித்தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார்அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு –அறிவுசார் சமூகம்.		
அலகு V	**அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்**	**3 Periods**
அறிவியல் தமிழின் வளர்ச்சி-கணினித்தமிழ் வளர்ச்சி- தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods**		

TEXT BOOK:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல.சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)(Published by: The Author)
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –Reference Book.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1		
CO2		
CO3		
CO4		
CO5		

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1															
CO2															
CO3															
CO4															
CO5															
22AHS2Z4															

1 – Slight, 2 – Moderate, 3 – Substantial

22AHS2Z5	VALUES AND ETHICS *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	HSMC	3	0	0	3

Course Objectives	1. To understand and appreciate the ethical issues faced by an individual in profession, society and polity. 2. To learn about Engineering Ethics and case studies. 3. To understand the negative health impacts of certain unhealthy behaviours. 4. To appreciate the need and importance of physical, emotional health and social health. 5. To get familiar with the global issues.	
UNIT – I	**BEING GOOD AND RESPONSIBLE**	**9 Periods**
Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character		
UNIT – II	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9 Periods**
Engineering Ethics: Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Models of Professional Roles. Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – Case studies : Chernobyl disaster and Titanic disaster		
UNIT – III	**ADDICTION AND HEALTH**	**9 Periods**
Peerpressure - Alcoholism: Ethicalvalues, causes, impact, laws, prevention–Illeffects of smoking- Prevention of Suicides; Sexual Health: Prevention and impact of premarital pregnancy and Sexually Transmitted Diseases. DrugAbuse: Abuse of different types of legal and illegal drugs: Ethical values, causes, impact, laws and prevention		
UNIT – IV	**PROFESSIONAL ETHICS**	**9 Periods**
AbuseofTechnologies: Hacking and other cybercrimes, Addiction to mobile phone usage, Video games and Social networking websites		
UNIT – V	**GLOBAL ISSUES**	**9 Periods**
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Mike W Martin and Roland Schinzinger, **"Ethics in Engineering"**, 4 th Edition, McGraw-Hill, New York 2017.*
2	*Govindarajan M, Natarajan S and Senthil Kumar VS, **"Engineering Ethics"**, Prentice Hall of India, New Delhi, 2013.*

REFERENCES:

1	*Dhaliwal,K.K,* ***"Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts",*** *WritersChoice, NewDelhi, India, 2016.*
2	*Jayshreesuresh, B.S.Raghavan,****"Human values and professional ethics"****, S.Chand and company Ltd, New Delhi, 2nd Edition, 2007.*
3	*L.A. and Pagliaro,A.M,* ***"Handbook of Child and Adolescent Drug and Substance Abuse: Pharmacological, Developmental and Clinical Considerations",*** *Wiley Publishers, U.S.A,2012.*
4	*Pandey,P.K(2012****),"SexualHarassmentandLawinIndia",*** *LambertPublishers,Germany. 2012.*
5	*Kiran D.R,* ***"Professional ethics and Human values****," Tata McGraw Hill, New Delhi, 2007.*
6	*Edmund G See Bauer and Robert L Barry,* ***"Fundamentals of Ethics for Scientists and Engineers"****, Oxford University Press, Oxford, 2001.*
7	*David Ermann and Michele S Shauf,* ***"Computers, Ethics and Society"****, Oxford University Press, 2003.*
8	*Govindarajan M, Natarajan S, Senthil Kumar V. S,* ***"Engineering Ethics"****, Prentice Hall of India, New Delhi, 2004.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Follow sound morals and ethical values scrupulously to prove as good citizens.	K3
CO2	Assess the relevance of ethics and morals in engineering and to learn case studies.	K3
CO3	Describe the concept of addiction and how it will affect the physical and mental health.	K2
CO4	Identify ethical concerns while using advanced technologies.	K2
CO5	Judge the code of conduct, Environmental ethics and computer ethics.	K3

COURSE ARTICULATION MATRIX															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	-	-	-	3	3	3	3	2	1	-	-	-	-
CO2	-	-	-	-	-	3	-	3	3	-	1	-	-	-	-
CO3	-	-	-	-	-	3	-	3	3	2	1	-	-	-	-
CO4	-	-	-	-	-	3	3	3	3	1	1	1	-	-	2
CO5	-	-	-	-	-	3	3	3	3	-	1	3	-	-	2
22AHS2Z5	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**3**	**1**	**1**	**1**	**-**	**-**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

22ABS204	VECTOR SPACES AND DIFFERENTIAL EQUATIONS WITH MATLAB *(Common to CSE & IT Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	1. To be familiar with MATLAB and solving the simple equations 2. To gain methods to solve second order differential equations with constant and variable coefficients. 3. To acquire knowledge of testing convergence of sequences and series. 4. To gain the concepts of vector spaces and linear transformations. 5. To obtain the knowledge of decomposition and inner product spaces.	
UNIT – I	**MATLAB**	**9+3 Periods**
MATLAB Basics- Simple problems: solving equations, matrix operations, calculating eigen values and eigen vectors, solving linear system of equations, differentiation.		
UNIT – II	**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER**	**9+3 Periods**
Higher order linear differential equations with constant coefficients -variable coefficients: Cauchy-Euler equation, Cauchy-Legendre equation-Method of variation of parameters-Simultaneous first order linear equations with constant coefficients.		
UNIT – III	**SEQUENCES AND SERIES**	**9+3 Periods**
Convergence of sequence, tests for convergence of series of positive terms: comparison test, D' Alembert's ratio test, Cauchy's Integral test, Raabe's test, logarithmic test, Gauss test, Cauchy's root test- alternating series: Leibnitz test – power series: absolutely convergent, conditionally convergent.		
UNIT – IV	**VECTOR SPACES I**	**9+3 Periods**
Vector Space, linear dependence of vectors, basis, dimension, Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.		
UNIT – V	**VECTOR SPACES II**	**9+3 Periods**
Eigen bases, Cholesky Decomposition, Inner product spaces- norm, orthogonality, orthonormal set,Gram-Schmidt orthogonalization.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*B.S.Grewal, **"Higher Engineering Mathematics"**, Khanna Publishers, New Delhi, 44thEdition, 2018.*
2	*Howard Anton, Chris Rorres, **"Elements of Linear Algebra with Applications"**, Wiley, New Delhi, 2ndEdition, 2015.*
3	*Brain R.Hunt, Ronald L.Lipsman, Jonathan M. Rosenberg with Kevin R.Coombes, John E. Osborn and Garrett J.Stuck, **"A Guide to MATLAB for beginners and experienced users"**, Published in the United States of America by Cambridge University Press, New York 2001.*

REFERENCES

1	*E. A. Coddington,* ***"An Introduction to Ordinary Differential Equations"****, Prentice Hall India, 1995.*
2	*G.F. Simmons and S.G. Krantz,* ***"Differential Equations"****, Tata McGraw Hill, 2007.*
3	*Srimanta Pal and suboth.C.Bhunia,* ***"Engineering Mathematics"****, Oxford university publications, New Delhi, 2015.*
4	*Gilbert Strang,* ***"Linear Algebra and its Applications"****, Cengage Learning, Delhi, 4thEdition, 2006.*
5	*D.Poole,* ***"Linear Algebra: A Modern Introduction"****,2ndEdition, Brooks/Cole,2005.*
6	*V. Krishnamurthy, V.P. Mainra and J.L. Arora, "****An introduction to Linear Algebra"****, Affiliated East–West press, Reprint 2005.*
7	*Amos Gilat,* ***"MATLAB:An Introduction with Applications"****,Wiley, The Ohio State University, 6thEdition, 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Solve algebraic equations by using MATLAB.	K5
CO2	Find solution for higher order linear differential equation with constant and variable coefficients and simultaneous differential equation.	K5
CO3	Perform basic computation in convergence and divergence of sequences and series	K5
CO4	Demonstrate the concepts of vector spaces and linear transformation orientation with matrices.	K5
CO5	Use Cholesky Decomposition and orthogonal transformation including Inner product spaces in the applications of many different fields.	K5

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	3	-	4	-	-	-	1	-	2	3	3	2
CO2	2	1	-	-	-	4	-	-	-	-	-	2	3	3	1
CO3	2	1	-	-	-	4	-	-	-	-	-	2	3	2	1
CO4	2	1	-	-	-	4	-	-	-	-	-	2	3	2	-
CO5	2	1	-	-	-	4	-	-	-	-	-	2	3	2	-
22ABS204	**2**	**1**	**-**	**1**	**-**	**4**	**-**	**-**	**-**	**1**	**-**	**2**	**3**	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

22ABS205	PHYSICS FOR INFORMATION SCIENCE *(Common to CSE & IT Branches)*	SEMESTER II

PREREQUISTIES	CATEGORY	L	T	P	C
NIL	BS	3	0	0	3

Course Objectives	1. To understand the properties of electronic materials. 2. To understand the characteristics of semiconductors. 3. To explain different number systems and their application in logic gates 4. To understand the properties of magnetic and superconducting materials and apply them for specific purpose 5. To explain engineered semiconductor materials and their Applications

UNIT – I	**ELECTRONIC MATERIALS**	**9 Periods**

Classical Free electron theory of metals – Postulates – Electrical and Thermal conductivity of metals – Derivation of Wiedeman – Franz law – Lorentz number – Drawbacks of Classical theory – Fermi distribution Function – Effect of temperature – Density of energy states in metals (derivation) – Carrier concentration in metals - Calculation of Fermi energy at 0 K

UNIT – II	**SEMICONDUCTORS**	**9 Periods**

Properties of semiconductors – elemental and compound semiconductors - Direct and indirect band gaps - Intrinsic and extrinsic semiconductors - Fermi level - Carrier concentration in intrinsic semiconductor - Dependence of Fermi level on temperature – Electrical conductivity – band gap determination – extrinsic semiconductors – Carrier concentration in P-type and N-type semiconductors - Dependence of Fermi level on impurity concentration and temperature for P-type and N-type semiconductors.

UNIT – III	**DIGITAL ELECTRONICS**	**9 Periods**

Introduction – Binary number system – place value – decimal to Binary conversion – Binary to decimal conversion – Octal and hectadecimal numbers. Logic Gates – Three basic Logic Gates:OR, AND, NOT: operation, circuit, truth table, Boolean expression – Universal gate: NAND and NOR Gates:NOT, AND and OR from NAND & NOR Gates – Exclusive OR Gate - Problems

UNIT – IV	**MAGNETIC AND SUPER CONDUCTING MATERIALS**	**9 Periods**

Origin of magnetic moment - Bohr magneton - Dia, Para, and Ferro magnetic materials - Domain theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials. Magnetic recording – Magnetic Tapes – Floppy disk – Optical Recording – Magneto Optical Recording – Principle – Recording – Reading – Construction.

Superconductivity - Types of superconductors - BCS theory of superconductivity (qualitative) - properties- Meissner effect, effect of magnetic field and current - Applications of superconductors: Cryotron, Magnetic levitation.

UNIT – V	**ENGINEERED SEMICONDUCTOR MATERIALS**	**9 Periods**

Introduction - Quantum confinement – Density of states in 2D, 1D and 0D (qualitatively) - Practical examples of low-dimensional systems such as quantum wells, wires, and dots – Nanomaterials – Properties – Methods of synthesize – Top-down & Bottom-up Approach – Ball Milling – Chemical vapour deposition – Applications of Nanomaterials.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK:

1.	*P.K.Palanisamy, "**EngineeringPhysics-II**",Scitech Publications(India)pvt.Ltd, 2015.*
2.	*V.Rajendran, "**Material Science**", Tata McGraw-Hill Publications, 2011.*
3.	*S. Jayakumar, **"Materials Science"**, R.K.publishers, 2008.*
4.	*V. K. Mehta and Shalu Mehta, **"Principles of Electronics"**, S.Chand& Company Ltd., 2001.*

REFERENCES:

1.	*William D Callister and David G. Rithwish,* ***"Materials science & Engineering:An introduction****",Wiley, 2013.*
2.	*P. Bhattacharya,* ***"Semiconductor Optoelectronic Devices"****, Prentice Hall of India, 1997.*
3.	*G.W. Hanson,* ***"Fundamentals of Nanoelectronics"****, Pearson Education, 2009.*
4.	*M.Moris Mano,* ***"Digital Logic and Computer Design"****, Prentice- Hall of India Pvt. Ltd., 1998.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the physical properties of conducting materials.	K2
CO2	Explain the characteristics of intrinsic and extrinsic semiconductors.	K2
CO3	Explain different number systems. Apply logic gates in circuits.	K3
CO4	Explain magnetic and superconductor characteristics. Apply magnetic materials and superconductors for industrial problems.	K3
CO5	Explain low dimensional systems and Choose suitable method for the synthesis. Apply nanomaterials for real time problems.	K3

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	3	1	1	-	1	-	-	-	-	-	-	-	-	-	-
CO4	2	-	1	1	1	-	-	-	-	-	-	-	2	-	-
CO5	2	-	1	-	-	-	-	-	-	-	-	-	2	1	-
22ABS205	**2**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	-

1-Slight, 2 – Moderate, 3 - Substantial

22ABS206	APPLIED CHEMISTRY *(Common to EEE, ECE, EIE, CSE & IT Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	0	0	3

Course Objectives	1. To know about the second law of thermodynamics and its various functions. 2. To understand the concept of electrochemistry, primary, secondary batteries, construction and its uses. 3. To understand the basic principles of corrosion, mechanism and its protection methods. 4. To acquire basic knowledge about the nanoparticles, its preparations, properties, types and applications in various field. 5. To impart the knowledge of preparations of single crystal, wafer preparation, P-N junction formation by various methods.	
UNIT – I	**CHEMICAL THERMODYNAMICS**	**9 Periods**
The Second law of thermodynamics-Concepts of entropy, Work and free energy functions - Maxwell's relationships for reversible and irreversible process - Gibbs Helmholtz equation – Partial molar free energy-Chemical potential-Gibb's Duhem Equation, Clausius - Clapeyron equation.		
UNIT – II	**ELECTRO CHEMISTRY AND STORAGE DEVICES**	**9 Periods**
Cells–Electro chemical cell and electrolytic cell – electrodes– electrode potentials – standard oxidation and reduction potentials-Hydrogen and Calomel electrodes- EMF series and its significance. Batteries - Types of batteries- Primary - $Zn/MnO_2$and $Li/SOCl_2$ - Construction, working and applications. Secondary batteries-Lead acid battery and lithium-ion battery – $Li\text{-}TiS_2$- Construction, working and Applications.		
UNIT – III	**CORROSION**	**9 Periods**
Corrosion-Definition -Classifications: Chemical Corrosion and Electro chemical corrosion mechanism-Pilling Bedworth rule–Galvanic series and its importance- preventing methods-Cathodic protection (sacrificial anode and impressed current conversion method). Protective Coatings-Inorganic coating-surface preparation-Electro plating method applied to Cr and Ni, Organic coating- paints - constituents and its functions.		
UNIT – IV	**NANO MATERIALS**	**9 Periods**
Nanomaterials and bulk materials; Size-dependent properties (Optical, Electrical and Mechanical); Types of nanomaterials: Definition- properties and uses of nanoparticle, nanorod and nanotube. Preparation of nanomaterials: chemical vapour deposition, electrochemical deposition. Applications of nanomaterials in medicine and electronics.		
UNIT – V	**FABRICATION**	**9 Periods**
Silicon for IC chips - single crystal – preparation by Czochralski and float zone processes- wafer preparation, P-N junction formation – Ion implantation. Diffusion and epitaxial growth techniques - Insulator layer by oxidation- Printing of circuits by photolithography – masking and electron beam methods- etching by chemical and electrochemical methods.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Jain. P.C. and Monica Jain, **"Engineering Chemistry"**, DhanpatRai Publications Pvt Ltd, New Delhi, 16th Edition, 2017.*
2	*S.S. Dara**, "A text book of Engineering Chemistry"**, S. Chand Publishing, 12th Edition, 2018.*

REFERENCES:

1	*Dara. S.S, Umarae, **"Text book of Engineering Chemistry"**, S. Chand Publications, 2013.*
2	*M.S.Tyagi, **"Introduction to semiconductor materials and devices"**, WileyIndia, 2012.*
3	*B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday**, "Textbook of nanoscience and nanotechnology"**, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.*
4	*B.R Puri, L.R Sharma & M. S. Pathania, **"Principles of Physical Chemistry" S. Nagin** Chand and Co., 2017.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyzethe applications of thermodynamics and its various functions.	K3
CO2	Implement the new ideas related to batteries which find uses in the society including engineering fields.	K3
CO3	Identify the corrosion mechanisms and its controlling methods.	K3
CO4	Applying the concepts of nanoscience and nanotechnology in the synthesis of nanomaterials for engineering applications.	K3
CO5	Construct the silicon chips and their fabrication methods and to apply in preparation ofelectrical and electronic instruments.	K3

COURSE ARTICULATION MATRIX															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	-	-	-	1	-	-	-	-	-	-	-	-
CO2	2	2	1	-	1	-	1	-	-	-	-	-	-	1	-
CO3	2	2	1	1	-	-	1	-	-	-	-	-	-	-	-
CO4	2	2	1	1	1	-	1	-	-	-	-	-	-	-	-
CO5	3	2	1	1	1	-	1	-	-	-	-	-	-	1	-
22ABS206	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
1 – Slight, 2 – Moderate, 3 – Substantial															

22AES204	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING *(Common to CIVIL, MECH, PRODN, CSE, IT & IBT Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	1. To study the basic concepts of electric circuits, electronic devices and communication engineering. 2. To know the fundamentals of DC and AC machines. 3. To familiar with the basics of analog and digital electronics. 4. To understand the basics of house wiring. 5. To introduce the components of electrical installations and energy conservation.	
UNIT – I	**ELECTRICAL CIRCUITS**	**9 Periods**
Electrical circuit elements (R,L and C) - Voltage and Current sources – Ohm's Law – Kirchoff laws – Time domain analysis of First order RL and RC circuits – Representation of sinusoidal waveforms – Average, RMS and Peak values – Phasor representation – Real, Reactive, Apparent power and power factor.		
UNIT – II	**ELECTRICAL MACHINES AND MEASUREMENTS**	**9 Periods**
Construction, Principle of Operation, basic equations and Types, Characteristics and Applications of DC generators, DC motors, Single phase Transformer, Single phase and Three phase Induction motor. Operating principles of Moving coil, Moving iron Instruments (Ammeter and Voltmeters).		
UNIT – III	**ANALOG AND DIGITAL ELECTRONICS**	**9 Periods**
Analog Electronics: Semiconductor devices – P-N junction diode, Zener diode, BJT, Operational amplifier – principle of operation, Characteristics and applications. Digital Electronics: Introduction to numbers systems, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates.		
UNIT – IV	**FUNDAMENTAL OF COMMUNICATION AND TRANSDUCERS**	**9 Periods**
Types of Signals : Analog and Digital Signals – Modulation and Demodulation :Principles of Amplitude and Frequency Modulations – Resistive, Inductive, capacitive Transducers- Introduction.		
UNIT – V	**ELECTRICAL INSTALLATIONS AND ENERGY CONSERVATION**	**9 Periods**
Single phase and three phase system – phase, neutral and earth, basic house wiring -tools and components, different types of wiring - basic safety measures at home and industry – Energy efficient lamps - Energy billing. Introduction to UPS and SMPS.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*R.Muthusubramaniam,R.Salivaganan, Muralidharan K.A., **"Basic Electrical and Electronics Engineering"** Tata McGraw Hill , Second Edition 2010.*
2	*Mittle V.N and Aravind Mittal, **"Basic Electrical Engineering",** Tata McGraw Hill, Second Edition, New Delhi, 2005.*

REFERENCES:

1	*D.P.Kothari, I.J. Nagrath, **"Basic Electrical Engineering"**, Tata McGraw Hill, 2010.*
2	*Nagsarkar T.K and Sukhija M.S, **"Basic Electrical Engineering"**, Oxford Press, 2005.*
3	*E.Hughes,**"Electrical and Elecronics Technology"**, Pearson, 2010.*
4	*MohmoodNahvi and Joseph A.Edminister, **"Electric Circuits"**, Shaum Outline series, McGraw Hill, Sixth edition, 2014.*
5	*Premkumar N and Gnanavadivel J, **"Basic Electrical and Electronics Engineering"**, Anuradha Publishers, 4th Edition, 2008.*
6	*Allan S Morris, **"Measurement and Instrumentation Principles"** Elsevier, First Indian Edition, 2008.*
7	*S.L. Uppal, **"Electrical Wiring Estimating and Costing"**, Khanna publishers, New Delhi, 2006.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyze the DC and AC circuits.	K4
CO2	Describe the operation and characteristics of electrical machines.	K4
CO3	Classify and compare various semiconductor devices and digital electronics.	K3
CO4	Infer the concept of communication engineering and Transducers.	K2
CO5	Assemble and Implement electrical wiring and electrical installations.	K6

COURSE ARTICULATION MATRIX

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	1	-	-	-	-	-	-	-	3	-	-	-
CO2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	-	2
CO5	1	1	-	1	-	-	-	-	-	-	-	3	2	-	2
22AES204	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

22ABS2Z7	CHEMISTRY LABORATORY *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	0	0	3	1.5

Course Objectives	To inculcate the practical applications of Chemistry to students and make them apply in the fields of engineering and technology.

LIST OF EXPERIMENTS	
1.	Estimation of hardness by EDTA method.
2	Conductometric titration of mixture of strong acid and weak acid using strong base.
3.	Estimation of chloride by Argentometric method.
4.	Potentiometric titration of ferrous iron by dichromate.
5.	Determination of Saponification value of an oil.
6.	Estimation of Iron by Spectrophotometry.
7.	Estimation of Dissolved Oxygen.
8.	Estimation of HCl by pH titration.
9.	Estimation of Copper in brass sample.
10.	Estimation of Manganese in Pyrolusite ore.
11.	Anodiziation of aluminium.
12.	Determination of corrosion rate and inhibitor efficiency of mild steel in acid media by weight loss method.

Contact Periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

REFERENCE BOOKS:

1	*A.O. Thomas, "**Practical Chemistry"**, Scientific Book Centre, Cannanore, 2006.*
2	*Vogel's "**Text book of Quantitative Analysis"**, Jeffery G H, Basset J. Menthom J, Denney R.C., 6th Edition, EBS, 2009.*

COURSE OUTCOMES: Upon the completion of the course, the student will be able to:		Bloom's Taxonomy Mapped
CO1	Analyze the quality of water samples with respect to their hardness and DO.	K3
CO2	Determine the amount of metal ions through potentiometric and spectroscopic techniques.	K3
CO3	Infer the strength of acid, mixtures of acids by pH meter and conductivity cell.	K3
CO4	Estimate the chloride, manganese and copper from various samples.	K3
CO5	Interpret the corrosion rate determination and anodizing method.	K2

COURSE ARTICULATION MATRIX

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	-	-	2	3	-	2	1	-	1	-	-	-
CO2	2	1	-	-	-	-	3	-	2	1	-	1	-	-	-
CO3	2	1	-	1	-	-	3	-	2	1	-	1	-	-	-
CO4	2	1	-	-	-	-	3	-	2	1	-	1	-	-	-
CO5	2	1	1	1	-	-	3	-	2	1	-	1	-	1	-
22ABS2Z7	**2**	**1**	**1**	**1**	**-**	**1**	**3**	**-**	**2**	**1**	**-**	**1**	**-**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

22AES2Z5	ENGINEERING GRAPHICS *(Common to all Branches)*	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	1	0	4	3

Course Objectives	1. Understand the geometrical constructions. 2. Study the various types of projections. 3. Identify different section of solids. 4. Perform the development of surfaces and view of solids. 5. Familiarize with CAD packages.	
UNIT – I	**GEOMETRICAL CONSTRUCTIONS AND PLANE CURVES**	**3+12 Periods**
Principles of Engineering Graphics and their significance - Basic geometrical constructions. Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Drawing of tangents and normal to the above curves.		
UNIT – II	**ORTHOGRAPHIC PROJECTIONS**	**3+12 Periods**
Introduction to Orthographic Projection - Conversion of pictorial views to orthographic views. Projection of points - Projection of straight lines with traces - Projection of planes (polygonal and circular surfaces) inclined to both the principal planes.		
UNIT – III	**PROJECTION AND SECTION OF SOLIDS**	**3+12 Periods**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids, when the axis is inclined to both the principal planes by rotating object method. Sectioning of prisms, pyramids, cylinder and cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.		
UNIT – IV	**DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTIONS**	**3+12 Periods**
Development of lateral surfaces of simple and sectioned solids – prisms, pyramids, cylinder and cone. Principles of isometric projection – isometric scale – isometric projections of simple solids and truncated solids - prisms, pyramids, cylinder, cone- combination of two solid objects in simple vertical positions.		
UNIT – V	**COMPUTER AIDED DRAFTING**	**3+12 Periods**
Introduction to computer aided drafting package to make 2D Drawings. Object Construction: Page layout – Layers and line types – Creating, editing and selecting the geometric objects. Mechanics: Viewing, annotating, hatching and dimensioning the drawing – Creating blocks and attributes. Drafting: Create 2D drawing. A number of chosen problems will be solved to illustrate the concepts clearly. (Demonstration purpose only, not to be included in examination).		
Contact Periods: **Lecture: 15 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 75 Periods**		

TEXT BOOKS:

1	*K.Venugopal, **"Engineering Graphics"**, New Age International (P) Limited, 2016.*
2	*K.V.Natarajan, **"A text book of Engineering Graphics"**, Dhanalakashmi Publishers, Chennai, 2016.*

REFERENCES:

1	*K.L.Narayana and P.Kannaiah, **"Text book on Engineering Drawing"**, 2nd Edition, SciTech Publications (India) Pvt. Ltd, Chennai, 2009.*
2	*N.S.Parthasarathy and Vela Murali, **"Engineering Graphics"**, Oxford University Press, New Delhi, 2015.*
3	*K.R.Gopalakrishna, **"Engineering Drawing" (Vol. I&II combined),** Subhas Publications, Bangalore, 2014.*
4	*Basant Agarwal and C.M.Agarwal, **"Engineering Drawing"**, Tata McGraw Hill Publishers, New Delhi, 2013.*
5	*Kevin Lang and Alan J.Kalameja, "**AutoCAD 2012 Tutor for Engineering Graphics"**, Cengage Learning Publishers, 1st Edition, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Acquire on representing solids as per international standards.	K3
CO2	Impart knowledge on different types of projections.	K3
CO3	Generate and interrupt the true shape of section.	K3
CO4	Develop the various surfaces according to the standards.	K3
CO5	Know the concept of computers in drafting engineering diagrams.	K6

COURSE ARTICULATION MATRIX

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	1	1	1	2	-	-	1	2	-	-	-	-	-
CO2	2	-	1	1	1	-	-	1	1	2	-	-	-	-	-
CO3	1	1	1	1	1	-	-	-	1	2	-	-	-	-	-
CO4	1	1	1	1	1	2	-	-	1	2	-	-	-	-	-
CO5	1	1	1	1	1	-	-	-	1	2	-	-	-	3	3
22AES2Z5	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**2**	**-**	**-**	**-**	**1**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

22ABS308	PROBABILITY, RANDOM PROCESSES AND QUEUEING THEORY (Common to CSE ,IT & AI&ML)	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	To enhance the fundamental knowledge in probability concepts and its applications relevant to various streams of Engineering and Technology. This is a foundation course which mainly deals with topic such as probability, standard statistical distributions, statistical averages regarding one or more random variables, random process, Markov chains and queueing models with finite/infinite capacity in single/multi servers and plays an important role in the understanding of Science, Engineering and Computer Science among other disciplines.	
UNIT – I	**PROBABILITY AND RANDOM VARIABLES**	**9+3 Periods**
Sample spaces–Events – Probability Axioms–Conditional Probability–Independent Events – Baye's Theorem. Random Variables: Distribution Functions–Expectation–Moments–Moment Generating Functions.		
UNIT – II	**PROBABILITY DISTRIBUTIONS**	**9+3 Periods**
Binomial, Poisson, Geometric, Uniform, Exponential, Normal, Gamma, Weibull (Mean, Variance and Simple problems). Functions of random variables.		
UNIT – III	**MULTI DIMENSIONAL RANDOM VARIABLES**	**9+3 Periods**
Two dimensional: Joint distributions – Marginal Distributions – Conditional distributions – Covariance – Correlation and Regression lines. Multidimensional: Mean vectors and covariance matrices.		
UNIT – IV	**RANDOM PROCESSES**	**9+3 Periods**
Definition and Examples – first and Second order, Strict sense stationary, Wide sense stationary and ergodic processes- Markov processes – Poisson processes – Birth and Death processes – Markov chains – Transition probabilities – Limiting distributions.		
UNIT – V	**QUEUEING THEORY**	**9+3 Periods**
Markovian models-M/M/1 and M/M/C, finite and infinite capacity, M/G/1 queue (steady state solutions only) PollazackKhintchine formula-Problems only.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*Veerarajan T.,**Probability and Random Processes**,with Queueing Theory and Queueing Networks, Fourth Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.*
2	*Veerarajan T.,**Higher Engineering Mathematics**,McGraw Hill Education (India) PvtLtd,New Delhi, 2016.*

REFERENCES

1	*Gupta S.C and KapoorV.K..,**Fundamentals of Mathematical Statistics**,Sultan Chand & Sons,New Delhi,2015.*
2	*Gupta S.P.,**Statistical methods**,Sultan Chand & Sons,New Delhi,2015.*
3	*Trivedi K.S.,**Probability and Statistics with Reliability, Queueing and Computer Science Applications**, Prentice Hall of India, New Delhi.*

4	*Hwei Hsu.,**SchauPm's outline series of Theory and Problems of Probability and Random Process,** Tata Mc Graw Hill Publishing Co.,New Delhi,2015.*
5	*Kandasamy,Thilagavathy and Gunavathy,, **Probability and Random Process,** S.Chand & Co. Ramnagar,New Delhi, Reprint 2013.*
6	*Richard A.Johnson and Dean W.Wichern.,**Applied Multivariate Statistical Analysis,** Sixth Edition, Pearson Education, Asia, 2012.*

COURSEOUTCOMES: Uponcompletionofthecourse,thestudentswillbe ableto:		**Bloom's Taxonomy Mapped**
CO1	Apply the knowledge of basic probability concepts in engineering problems.	K5
CO2	Identify various standard probability distributions and apply them in real life.	K5
CO3	Find the correlation and regression for multi dimensional random variables.	K5
CO4	Apply the random process in Markovian and Birth- death problems.	K5
CO5	Utilize queuing models in real life problems.	K5

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
22ABS308	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,3.1.1,3.1.5,3.2.3, 3.3.1,3.4.1,4.1.1,4.1.2,4.2.1,4.2.2,12.1.2,12.2.1,12.2.2
CO2	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,3.1.1,3.1.5,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.2.1,4.2.2,12.1.2,12.2.1,12.2.2
CO3	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,3.1.1,3.1.5,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.2.1,4.2.2,12.1.2,12.2.1,12.2.2
CO4	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,3.1.1,3.1.5,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.2.1,4.2.2,12.1.2,12.2.1,12.2.2
CO5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,3.1.1,3.1.5,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.2.1,4.2.2,12.1.2,12.2.1,12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category *	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	40	20	10	-	-	100
CAT2	30	40	20	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	40	20	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	40	20	10	-	-	100
ESE	30	40	20	10	-	-	100

22AES306	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of the course is to analyze and design combinational and sequential circuits, understand the structure and operation of a digital computer, study the design of processor components including data path and control unit with associated hazards, and comprehend memory organization along with I/O interfacing techniques in computer systems.

UNIT – I	**COMBINATIONAL LOGIC**	**9 Periods**

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers

UNIT – II	**SYNCHRONOUS SEQUENTIAL LOGIC**	**9 Periods**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters

UNIT – III	**COMPUTER FUNDAMENTALS**	**9 Periods**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT – IV	**PROCESSOR**	**9 Periods**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard – Control Hazards.

UNIT – V	**MEMORY AND I/O**	**9 Periods**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK :

1	*M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018*
2	*David A. Patterson, John L. Hennessy, "Computer Organization and Design MIPS edition : the hardware/software interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.*

REFERENCE BOOK:

1	*Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2023*
2	*William Stallings, "Computer Organization and Architecture – Designing for Performance", Eleventh Edition, Pearson Education, 2019.*
3	*M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016*
4	*M. Morris Mano ,Michael D. Ciletti "Digitsl Design "Pearson Education, 2018*

COs	**COURSE OUTCOMES:** At the end of the course, students will be able to	Blooms Taxonomy
CO1	Explain the principles of combinational circuits, sequential circuits, computer organization, processor design, and memory & I/O systems.	K2
CO2	Apply and analyze state minimization and assignment, instruction encoding and addressing modes, control unit design (hardwired and microprogrammed), and I/O interfacing techniques (DMA, interrupts) through structured problem-solving assignments.	K3
CO3	Use digital design techniques to develop combinational and sequential circuits, and apply computer organization principles to examine instruction execution, processor functionality, and memory operations	K3
CO4	Analyze digital systems including circuit behavior, instruction execution flow, control unit design, pipelining hazards, and memory hierarchy performance.	K4
CO5	Apply tools such as Logisim, HDL (Verilog/VHDL), and RISC-V simulators (Ripes/Venus) to model, simulate, and analyze digital circuits and pipelining concepts, demonstrated through a video presentation (YouTube).	K4
CO6	Work effectively as an individual and in teams to design and implement digital systems, considering sustainability and ethics, and communicate outcomes through reports and a team-based video (YouTube) with peer evaluation.	K6

COURSE ARTICULATION MATRIX:

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1
CO2	2	1	1	1	1	-	-	-	1	-	-	1	3	2	1
CO3	2	1	1	-	1	-	-	-	-	-	-	1	3	3	2
CO4	1	1	-	-	1	-	-	-	-	-	-	1	3	2	2
CO5	-	-	1	-	2	-	-	-	-	2	-	1	3	3	2
CO6	-	-	1	-	1	-	2	2	2	1	1	1	2	3	2
22AES306	2	1	1	1	2	-	1	1	1	1	1	1	3	3	2

b) CO and Key Performance Indicators Mapping		
CO1		---
CO2		1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.4.1, 3.1.1, 3.2.1, 4.1.1, 4.2.1, 5.1.1, 12.1.2
CO3		1.3.1, 1.4.1, 2.1.2, 2.3.1, 3.1.1, 3.2.2, 4.1.1, 4.2.2, 5.1.1, 5.2.1, 9.2.1, 12.3.1
CO4		1.4.1, 2.2.3, 2.3.1, 2.4.2, 4.1.1, 4.2.1, 4.2.2, 5.1.1, 12.2.2
CO5		3.2.2, 4.2.2, 4.4.1, 5.1.1, 5.2.1, 5.2.2, 1-.1.2, 1-.2.2, 1-.3.2, 12.3.1
CO6		3.1.1, 5.2.1, 7.1.1, 7.1.2, 8.1.1, 8.2.2, 9.1.2, 9.2.1, 9.3.1, 1-.1.2, 1-.2.2, 11.3.1, 12.1.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category *	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1		20	80				100
CAT2		20	70	10			100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1				80		20	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2				80		20	100
ESE		40	60				100

22AES307	DISCRETE STRUCTURES *(Common to CSE & AI &ML)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of the course is to equip students with the necessary skills to apply propositional and predicate calculus to evaluate the truth value of statements, use counting techniques to develop an understanding of relations, apply algebraic structures and morphisms to solve related problems, analyze graphs, and understand the patterns and laws of graph mining.	
UNIT – I	**PROPOSITIONAL AND PREDICATE CALCULUS**	**9 Periods**
Proposition: Logical connectives and its truth tables – Conditional and Biconditionals – Applications of Propositions: Boolean Searches, Logic Puzzles – Logical Equivalences and Implications – Theory of inference for statement calculus. Predicate Calculus: Quantifiers – Formulas – Free & Bound variable – Inference theory of predicate calculus.		
UNIT – II	**COUNTING, RELATIONS AND FUNCTIONS**	**9 Periods**
Counting: The Basics of Counting – The Pigeonhole Principle – Permutation and Combinations. Relations: Graph and Matrix representation of a relation – Properties of Binary Relation – Closure of relation – Warshall's algorithm – Equivalence Relation and Partitions – Partial Ordering Relations and Lattices. Functions: Mathematical Induction - Types and Composition of Functions - Inverse Function.		
UNIT – III	**ALGEBRAIC STRUCTURES AND MORPHISM**	**9 Periods**
Groups: Subgroups – Generators and Evaluation of Powers – Cosets and Lagrange's Theorem Permutation groups and Burnside Theorem – Codes and Group Codes. Morphism: Isomorphism and Automorphism, Homomorphism and Normal Subgroups – Rings, Integral domains and Fields.		
UNIT – IV	**GRAPH THEORY**	**9 Periods**
Introduction - Basic Terminology – Multigraphs and Weighted graphs - Digraphs and relations representation of graphs - operations on graphs - Paths and Circuits - Graph traversals - shortest paths in weighted graphs - Euclidian paths and circuits - Hamiltonian Paths and Circuits - The Traveling Salesperson Problem - Planar Graphs - Graph Coloring – Case Study.		
UNIT – V	**GRAPH MINING LAWS**	**9 Periods**
Patterns in Static Graph –Patterns in Evolving Graph – Patterns in Weighted Graph – Structure of Specific Graph: The Internet – The World Wide Web – Graph Generators: Random Graph Models – Generators for Internet Topology.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*C.L. Liu, D.P. Mohapatra "**Elements of Discrete Mathematics: A Computer Oriented Approach**", Third Edition Tata MCgraw Hill, (SIE), 2012.[Unit 1 – 4]*
2	*Deepayan Chakrabarti, Christos Faloutsos "**Graph Mining: Laws, Tools, and Case Studies**" Margon & Claypool publishers 2012.[Unit 5]*

REFERENCES

1	*Kenneth H Rosen,**Discrete Mathematics and its Applications with Combinatorics and Graph Theory**, Seventh Edition, MCgraw Hill Education India Private Limited, New Delhi, 2013.*
2	*Krishnaiyan Thulasiraman,Subramanian Arumugam,Andreas Brandstädt,Takao Nishizeki, "**Handbook of Graph Theory, Combinatorial Optimization, and Algorithms**", CRC press, 2016.*
3	*William Kocay, Donald L.Kreher **"Graphs, Algorithms, and Optimization",** Second Edition, CRC Press, 2017.*
4	*J.P.Tremblay and R.Manohar,**"Discrete Mathematical Structure and Its Application to Computer Science",** TMG Edition, Tata Mcgraw-Hill, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Demonstrate the ability to use propositional and predicate calculus to evaluate the truth value of statements and solve logic problems.	K5
CO2	Apply counting techniques and develop an understanding of relations and their properties, and use graph and matrix representation to solve problems.	K3
CO3	Demonstrate the ability to apply algebraic structures and morphism to solve problems related to groups, subgroups, rings, and fields.	K3
CO4	Analyze graphs and solve problems related to shortest path,Hamiltonian Paths, and graph coloring	K4
CO5	Use graph mining as a powerful pattern tool by understanding their laws to derive valuable information.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	1	-	-	-	-	-	-	-	2	3	1	2
CO2	3	2	-	1	-	-	-	-	-	-	-	2	3	2	2
CO3	3	2	-	1	-	-	-	-	-	-	-	2	3	2	3
CO4	3	2	-	2	1	-	-	-	-	-	-	2	3	3	3
CO5	3	3	-	3	1	-	-	1	-	-	-	2	3	3	3
22AES307	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**2**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,4.1.1,12.1.1,12.2.2,12.3.2
CO2	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.3.1,2.3.2,2.4.1,4.3.3,4.3.4,12.1.1,12.2.2,12.3.2
CO3	1.1.1,1.1.2,1.3.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.2,2.4.3,2.4.4,4.1.1,4.3.3,12.1.1,12.2.2, 12.3.2
CO4	1.1.1,1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.3.1,2.4.3,2.4.4,4.1.1,4.3.3,4.3.4,5.1.2, 12.1.1,12.2.2, 12.3.2
CO5	1.1.1,1.1.2,10.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.2,4.3.3,4.3.4,5.1.2,5.2.2,8.2.2,12.1.1,12.1.2,12.2.2,12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Rememberin g (K1) %**	**Understandin g (K2) %**	**Applyin g (K3) %**	**Analyzin g (K4) %**	**Evaluatin g (K5) %**	**Creatin g (K6) %**	**Tota l %**
CAT1	10	20	50	-	20	-	100
CAT2		20	60	20	-	-	100
Individual Assessmen t 1 /Case Study 1/ Seminar 1 / Project1	-	30	40	-	30	-	100
Individual Assessmen t 2 /Case Study 2/ Seminar 2 / Project 2	-	30	30	40	-	-	100
ESE	10	20	40	20	10	-	100

22APC301	DATA STRUCTURES *(Common to EEE, ECE, CSE & AI&ML)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PROGRAMMING IN C	PC	3	0	0	3

Course Objectives	The objective of the course is to enable the students to analyze the time complexity of an algorithm, Understand and Use List, Stack, Queue, Tree and graph Data structures and effectively use sorting and searching techniques.	
UNIT – I	**INTRODUCTION AND ABSTRACT DATATYPES**	**9 periods**
Algorithm Analysis: Calculation of Running Time – Abstract Data Type- List ADT: Array implementation of List, Linked Lists, Doubly Linked List, Circularly Linked Lists- Cursor implementation of Linked List.		
UNIT – II	**STACK AND QUEUE ADT**	**9 periods**
Stack ADT: Stack Model, Implementation of stacks, Applications: Balancing Symbols, Postfix expression evaluation, Infix to postfix conversion, Function Calls – Queue ADT: Queue Model, Implementation of Queues, Applications.		
UNIT – III	**TREE ADT**	**9 periods**
Preliminaries – Implementation of Trees – Tree Traversals – Binary Tree: Implementation, Expression Tree – Search Tree ADT – AVL Trees - BTrees – Red Black Trees.		
UNIT – IV	**GRAPH ALGORITHMS**	**9 periods**
Definitions – Representation of Graphs – Traversal- Topological sort – Shortest Path Algorithms: Dijkstra's Algorithm – Network Flow Problem – Minimum Spanning Tree: Prim's and Kruskal's algorithm.		
UNIT – V	**SORTING AND SEARCHING**	**9 periods**
Sorting: Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – Bucket Sort – External Sorting: Simple Algorithm, Multi way merge, Poly Phase Merge – Searching: Linear Search – Binary Search – Hashing: Hash Functions– Collision Resolution: Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Mark Allen Weiss* ***"Data Structures and Algorithm Analysis in C"*** *Second Edition, Pearson Education Limited, 2002.*

REFERENCES

1	*Thomas H. Cormen, Charles E.Leiseron, Ronald L. Rivest, Clifford Stein,* ***"Introduction to Algorithms",*** *Third Edition, PHI learning Pvt. Ltd., 2011.*
2	*Sartaj Sahni,* ***"Data Structures, Algorithms and applicationsin C++",*** *Second Edition, Universities Press, 2005.*

COURSE OUTCOMES: Upon completion of the course,the students will be able to:		Bloom's Taxonomy Mapped
CO1	Analyze the time complexity of various algorithms	K4
CO2	Define and use list,stack and queue Data Structures	K3
CO3	Define and useTree Data Structure	K3
CO4	Define and use Graph Data Structure	K4
CO5	Use appropriate sorting and searching Techniques	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
CO1	2	1	2	1	-	-	-	-	-	-	-	1	2	1	1
CO2	2	2	2	2	2	2	-	-	-	1	-	1	3	2	2
CO3	2	2	2	2	2	2	-	-	-	1	-	1	3	2	2
CO4	2	2	2	2	2	2	-	-	-	1	-	1	3	3	2
CO5	2	2	1	1	-	-	-	-	-	-	-	1	2	3	2
22APC301	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1,1.3.1,1.4.1,2.1.2,2.2.2,2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.														
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2,4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2														
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2,4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2														
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2,4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2														
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6,3.2.3,3.3.2,4.1.2,4.2.1,4.3.1,6.1.1,10.3.1,11.2.1,12.1.1,12.2.2,12.3.2														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	20	30	50	-	-	100
CAT2	-	10	80	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	80	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	80	20	-	-	100
ESE	-	30	50	20	-	-	100

22APC302	FOUNDATIONS OF DATA SCIENCE (Common to CSE ,IT & AI&ML)	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	This course will introduce the fundamental concepts in the field of data science required for solving data science problems	
UNIT – I	**R FOR DATASCIENCE**	**9 periods**
Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions and statistical models in R - Introduction to graphical analysis –plots – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph using graphics parameters.		
UNIT – II	**INTRODUCTION TO DATA SCIENCE AND DESCRIBING DATA**	**9 periods**
Data Science Process: Roles and stages. Basic Statistical descriptions of Data - Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores		
UNIT – III	**DESCRIBING RELATIONSHIPS**	**9 periods**
Correlation –correlation coefficient for quantitative data –computational formula for correlation coefficient – Populations, Samples and Probability – Sampling distribution of the mean		
UNIT – IV	**GENERALIZING BEYOND DATA**	**9 periods**
Hypothesis testing: z-test, Null Hypothesis and Alternate Hypothesis, One tailed and Two Tailed Tests, Estimation of Confidence Interval		
UNIT – V	**MODELING METHODS**	**9 periods**
Choosing and evaluating models -Linear and logistic regression: Building a model, Making Predictions, Reading Model summary and characterizing co-efficient quality unsupervised methods: Cluster Analysis		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014. (Unit I and V)
2	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units II, III and IV)

REFERENCES

1	W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.
2	Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
3	Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014
4	Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011

COURSE OUTCOMES: Upon completion of the course,the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Use R Libraries for Data Wrangling	K3
CO2	Define the data science process	K1
CO3	Analyze and interpret data using an ethically responsible approach.	K4
CO4	Apply hypotheses and data into actionable predictions	K3
CO5	Formulate and use appropriate models of data analysis to solve problems	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	2	1	3	-	-	-	-	-	1	-	2	2	2
CO2	1	1	1	1	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	3	-	3	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	1	2	2	2
22APC302	**3**	**3**	**3**	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1,2.3.2,3.1.2,3.2.1,3.2.2,4.1.3,5.1.1,5.1.2,5.2.2,5.3.1,5.3.2, 11.3.2
CO2	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.2.1,2.2.3,2.3.2,3.1.2,3.2.1,3.2.2, 4.1.3
CO3	1.3.1,1.4.1,2.2.4,2.4.1,2.4.2,2.4.4,3.1.5,3.2.2,3.4.2,4.1.2,4.1.4,4.3.2,5.2.1,5.3.1,5.3.2,6.2.1,8.1.1,8.2.1

CO4	1.3.1,1.4.1,2.2.4,2.4.1,2.4.2,2.4.4,3.1.5,3.2.2,3.4.2,4.1.2,4.1.4,4.3.2
CO5	1.3.1,1.4.1,2.2.4,2.4.1,2.4.2,2.4.4,3.1.5,3.2.2,3.4.2,4.1.2,4.1.4,4.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	20	40	5	5	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	20	30	10	5	5	100
ESE	30	30	40	-	-	-	100

22APC303	PROGRAMMING IN PYTHON	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objectives of this course is to develop problem solving skills, apply modular and object-oriented programming concepts, work with files, exceptions and libraries; and perform data analysis and visualization using python.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Tokens, Identifiers, Keywords - Variables and Data Types - Input and Output Statements - Operators and Expressions - Type Conversion - Conditional Statements - Iterative Statements - Nested Control Structures - Range Function - Basic Problem-Solving Programs - Functions - Function Arguments - Return Values - Scope of Variables - Recursive Functions - Lambda Functions.		
UNIT – II	**DATA STRUCTURES**	**9 Periods**
Modules and Packages - Python Standard Library - Strings and String Operations - Lists and List Methods - Tuples - Sets and Set Operations - Dictionaries and Dictionary Methods - List Comprehensions - Nested Data Structures		
UNIT – III	**OBJECT ORIENTED PROGRAMMING AND FILE HANDLING**	**9 Periods**
Classes and Objects - Constructors - Instance and Class Variables - Inheritance - Method Overriding - Polymorphism - Encapsulation - Exception Handling - Try, Except, Finally - User Defined Exceptions - File Handling - Reading and Writing Text Files - Working with CSV Files - Command Line Arguments		
UNIT – IV	**NUMERICAL COMPUTING AND DATA VISUALIZATION**	**9 Periods**
Introduction to Scientific Computing - NumPy Arrays - Array Operations - Indexing and Slicing - Mathematical Functions - Statistical Operations - Introduction to Pandas - Series and DataFrames - Data Cleaning and Manipulation - Introduction to Matplotlib - Line, Bar and Pie Charts - Seaborn Basics - Mini Applications using Scientific Libraries		
UNIT – V	**DATA ANALYSIS**	**9 Periods**
Data Analysis Process - Importing and Exporting Data - Handling Missing Values - Data Aggregation and Grouping - Data Filtering and Transformation - Exploratory Data Analysis - Correlation and Covariance - Data Visualization for Analysis - Introduction to Machine Learning Workflow - Classification and Regression using Scikit-learn - Case Studies using Real-world Datasets		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOKS:

1	*John V. Guttag, "Introduction to Computation and Programming Using Python with Application to Computational Modeling and Understanding Data", Third edition, MIT Press, 2021*
2	*Wes McKinney, "Python for Data Analysis Data Wrangling with pandas, NumPy, and Jupyter", Third edition, O'Reilly, 2022*

REFERENCES:

1	*John M Zelle, "Python Programming an introduction to computer science", Third Edition, Franklin, Beedle & associates, 2017*
2	*David I. Schneider, "Introduction to Programming Using Python", First edition, Pearson, 2016*
3	*Allen B Downey, "Think Python", Second Edition, O'Reilly, 2016*
4	*https://www.coursera.org/specializations/python*
5	*https://www.coursera.org/learn/programming-in-python*
6	*https://www.coursera.org/specializations/data-science-python*
7	*https://nptel.ac.in/courses/106106182*
8	*https://nptel.ac.in/courses/106106212*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply Python programming constructs, control structures and functions to develop solutions for computational problems.	K3
CO2	Analyze and implement suitable Python data structures, modular programming techniques and object-oriented concepts for real-world applications.	K4
CO3	Create Python programs incorporating exception handling, file processing and reusable modules for efficient software development.	K6
CO4	Analyze numerical data and develop visualization models using Python scientific and analytical libraries.	K4
CO5	Create data analysis applications using Pandas, NumPy and machine learning workflows for extracting meaningful insights from datasets.	K6
CO6	Analyze and develop real-world applications integrating programming, data processing and visualization techniques using Python	K6

COURSE ARTICULATION MATRIX:

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PS O1**	**PSO2**	**PSO 3**
CO1	**3**	**2**	**1**									**1**	**3**	**1**	**1**
CO2	**3**	**3**	**2**	**1**								**1**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**								**1**	**2**	**2**	**1**
CO4	**2**	**3**	**2**	**3**	**3**							**2**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**			**1**		**1**		**2**	**3**	**3**	**2**
CO6	**3**	**3**	**3**	**3**	**3**	**3**		**1**		**1**		**2**	**3**	**3**	**3**
22APC303	**3**	**3**	**2**	**2**	**2**	**1**		**1**		**1**		**2**	**3**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2, 2.2.2, 3.1.1, 12.1.1
CO2	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.1, 4.1.1, 4.3.2, 12.2.1
CO3	1.4.1, 2.2.4, 2.4.1, 3.2.2, 3.4.1, 4.2.1, 5.1.2, 12.3.2
CO4	1.3.1, 2.3.2, 2.4.4, 3.3.1, 4.1.2, 4.3.1, 4.3.3, 5.3.1, 12.2.2
CO5	1.4.1, 2.4.4, 3.3.2, 3.4.2, 4.3.4, 5.2.1, 5.3.2, 8.1.1, 10.2.2, 12.1.2
CO6	1.4.1, 2.2.3, 3.4.2, 4.3.4, 5.1.2, 6.1.1, 8.2.2, 10.1.3, 12.3.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	10	30	60	-	-		100%
CAT2	-	20	50	30	-	-	100%
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	10	50	40	-	-	100%
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	50	-	-	100%
ESE	-	20	40	40	-	-	100%

22AES308	ENGINEERING EXPLORATION FOR ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING *(Common to CSE, IT & AI&ML)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	The objective of the course is to provide an introduction to the engineering exploration	
UNIT – I	**Introduction**	**15 Periods**
Introduction to Engineering and Engineering study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st century engineer and Graduate Attributes- Evolution of OS - Software Requirement Specification Document- Engineering Failures and Software bugs.		
UNIT – II	**PC HARDWARE AND TROUBLESHOOTING**	**15 Periods**
Formatting PC- Installation of Operating system - Device Drivers Installation –study on Networking devices -network interfacing - Troubleshooting PC .		
UNIT – III	**APPS AND GAME DESIGN**	**15 Periods**
Case Study 1: Tic Tac Toe -Hangman- Rock, Paper and scissor game - Pacman Case Study 2: Text to Speech convertor- Voice based calculator- ChatGPT App Classification of Images Case study 3: Pong game -Space invaders game- Dobble game- Snake and ladder		
Contact Periods: **Lecture: 0 Periods** **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**		

REFERENCES:

1	*Ryan A Brown, Joshua W. Brown and Michael Berkihiser, "**Engineering Fundamentals: Design, Principles, and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.*
2	Saeed Moaveni, "Engineering Fundamentals: An Introduction to Engineering", Cengage learning, Fourth Edition, 2011.
3	G. Polya, "How to Solve It: A New Aspect of Mathematical Method", Princeton Science Library, Second Edition, 2014.
4	K.L. James, "COMPUTER HARDWARE, Installation, Interfacing, Troubleshooting and Maintenance", PHI learning, 2013
5	https://appinventor.mit.edu/
6	https://gamemaker.io/en

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Understand basic engineering concepts	K2
CO2	Write SRS for the given problem statement	K4
CO3	Format and configure OS and device drivers	K4
CO4	TTrouble shoot PC and configure networking	K4
CO5	Design apps and games	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	2	-	-	2	2	2	2
CO2	3	3	2	3	2	-	-	-	2	-	3	2	2	2	2
CO3	3	3	2	1	2	-	-	-	2	-	-	2	2	2	2
CO4	3	3	2	1	2	-	-	-	2	-	-	2	2	2	2
CO5	3	3	3	1	3	3	-	3	2	2	3	2	2	2	2
22AES308	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1,1.3.1,3.1.1,3.1.4,3.1.6,4.1.1,4.1.3,4.1.4,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,6.2.1, 8.1.1, 9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO2	1.2.1,1.3.1,3.1.1,3.1.4,3.1.6,4.1.1,4.1.3,4.1.4,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,6.2.1,8.1.1, 9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO3	1.2.1,1.3.1,3.1.1,3.1.4,3.1.6,4.1.1,4.1.3,4.1.4,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,6.2.1, 8.1.1, 9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO4	1.2.1,1.3.1,3.1.1,3.1.4,3.1.6,4.1.1,4.1.3,4.1.4,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,6.2.1, 8.1.1, 9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO5	1.2.1,1.3.1,3.1.1,3.1.4,3.1.6,4.1.1,4.1.3,4.1.4,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,6.2.1, 8.1.1, 9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO6	1.2.1,1.3.1,3.1.1,3.1.4,3.1.6,4.1.1,4.1.3,4.1.4,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,6.2.1, 8.1.1, 9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1

ASSESSMENT PATTERN – CDIO:

Component	Preparation/ Design	Presentation	Viva	Total
Study on Engineering Exploration	10	-	-	10
Software Requirement Specification Document Preparation for given problem	10	5	5	20
Formatting PC, Installation of OS and Device drivers	5	5	10	20
Troubleshooting of PC and configuration of Networks	5	5	10	20
Design of Apps and Games	10	10	10	30
Continuous Assessment				100
Model Lab				100

Weightage for record of work done: 75%; Weightage for Model Exam: 25%

22APC304	DATA STRUCTURES LABORATORY *(Common to ECE , CSE & AI&ML)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PROGRAMMING IN C LABORATORY	PC	0	0	3	1.5

Course Objectives	The objective of the course is to Implement linear data structures and nonlinear data structures, use appropriate data structures and implement appropriate sorting and searching techniques.

LIST OF EXPERIMENTS

1. Implementation of Stack Operations using array and Linked List
2. Implementation of Queue operations using array and Linked List
3. Application of stacks in Recursion and Infix to postfix conversion
4. Application of Queue in Simulation of FCFS and Round Robin Scheduling
5. Implementation of Linear list, circularly linked list and Doubly linked list.
6. Application of Linked List in Polynomial Manipulations
7. Implementation of binary tree operations
8. Implementation of Tree Traversal Algorithms
9. Implementation of Graph Traversal Algorithms
10. Implementation of Minimum Spanning Algorithms
11. Implementation of hashing techniques.
12. Implementation of sorting techniques.
13. Implementation of searching techniques.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Implement queue and stack data structures using arrays and Linked Lists	K5
CO2	Implement Tree Data structure and perform tree traversals.	K5
CO3	Implement traversal on Graph Data structure.	K5
CO4	Implement hashing Techniques	K6
CO5	Implement sorting and searching Techniques.	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	3	3	-	-	-	-		-	1	2	1	1
CO2	3	2	2	3	3	2	-	-	-	2	-	2	3	2	2
CO3	3	2	2	3	3	2	-	-	-	2	-	2	3	2	2
CO4	3	2	2	3	3	2	-	-	-	2	-	2	3	3	2
CO5	3	2	2	3	3	-	-	-	-	-	-	1	2	3	2
22APC304	**3**	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1,1.3.1,1.4.1,2.1.2,2.2.2,2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3, 4.2.2,4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3, 4.2.2,4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3, 4.2.2,4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6,3.2.3,3.3.2,4.1.2,4.2.1,4.3.1,6.1.1,10.3.1, 11.2.1,12.1.1,12.2.2,12.3.2

22APC305	PROGRAMMING IN PYTHON LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	1. To implement Python programs using basic programming constructs. 2. To develop object-oriented applications using Python. 3. To apply Python libraries for numerical computing and data analysis. 4. To generate visualizations using Matplotlib and Seaborn. 5. To develop real-world analytical applications using Python.

LIST OF EXPERIMENTS

1.Conditional and looping constructs
- a.if-elif-else
- b.for and while

2.Functions and classes
- a.User-defined functions
- b.Banking application using classes
- c.Demonstrate different types of inheritance
- d.Polymorphism using multiple classes

3.Strings
- a.Implementation of slicing of a string (with positive, negative and both positive and negative indices).

4.Programs using different data structures like list, tuple, set and dictionary
- a.Create, Insert, Delete, Modify each data structure
- b.Work with all methods and built-in functions

5.File Handling applications using
- a.Text files
- b.CSV files

6.Exception Handling

7.NumPy Data Creation and Mathematical operations
- a.Array operations
- b.Matrix manipulation
- c.Statistical computations

8.Generate visualizations using Matplotlib
- a.Line chart
- b.Bar chart
- c.Pie chart
- d.Histogram

9.Pandas
- a.Merging, Reindexing, and aligning data across multiple Data Frames
- b.Read a CSV file and display statistical summary
- c.Identify missing values in a dataset.
- d.Remove duplicate rows from a dataset

10.Correlation analysis in a dataset using Pandas/ Seaborn / NumPy / Matplotlib

11.Seaborn plots, plot styling and customization, Heatmaps

12.Implement machine learning workflow using Scikit-learn
- a.Data preprocessing

b.Classification model
c.Model evaluation

13.Mini Project

Develop a complete Python-based Data Analysis and Visualization Dashboard for domains like

- Student Performance
- Sales Prediction
- Employee Management
- Healthcare
- Weather Forecast

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES: **Upon completion of the course, the students will be able to:**		**Bloom's Taxonomy Mapped**
CO1	Apply Python programming constructs, control structures and user-defined functions to implement computational solutions.	K3
CO2	Analyze and develop object-oriented Python applications using classes, inheritance and polymorphism concepts.	K4
CO3	Create applications using Python built-in data structures, string processing and file handling techniques.	K6
CO4	Analyze and evaluate numerical and structured data using NumPy and Pandas libraries.	K5
CO5	Create customized graphical visualizations and interpret analytical results using Matplotlib and Seaborn libraries.	K6
CO6	Develop and evaluate machine learning and data analysis solutions using Scikit-learn for real-world applications.	K5
CO7	Create an end-to-end Python-based data analysis and visualization mini project integrating programming, analytical and visualization techniques	K6

COURSE ARTICULATION MATRIX:

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**	**2**	**1**		**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**1**	**1**
CO2	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**1**
CO4	**2**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**2**
CO5	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**2**
CO6	**3**	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**3**
CO7	**3**	**3**	**3**	**3**	**3**	**1**		**1**	**2**	**2**	**1**	**2**	**3**	**3**	**3**

22APC305	**3**	**3**	**2**	**2**	**3**	**1**		**1**	**1**	**1**	**1**	**2**	**3**	**2**	**2**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.3.1, 2.1.1, 2.1.2, 2.2.2, 3.1.1, 12.1.1														
CO2	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.1, 4.1.1, 4.3.2, 12.2.1														
CO3	1.4.1, 2.2.4, 2.4.1, 3.2.2, 3.4.1, 4.2.1, 5.1.2, 12.3.2														
CO4	1.3.1, 2.3.2, 2.4.4, 3.3.1, 4.1.2, 4.3.1, 4.3.3, 5.3.1, 12.2.2														
CO5	1.4.1, 2.4.4, 3.3.2, 3.4.2, 4.3.4, 5.2.1, 5.3.2, 8.1.1, 10.2.2, 12.1.2														
CO6	1.4.1, 2.2.3, 3.4.2, 4.3.4, 5.1.2, 6.1.1, 8.2.2, 10.1.3, 12.3.1														

22APC406	DATABASE MANAGEMENT SYSTEMS (Common to CSE & AI&ML)	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to learn about database design and query processing. To develop transaction processing applications considering concurrency control and recovery issues. To learn about enhanced data models	
UNIT – I	**DATABASE SYSTEM CONCEPTS AND DATA MODELS**	**9 Periods**
Data base approach: Characteristics, Advantages, Applications – Data Models - Three Schema Architecture- Data base System Environment- Data Modeling with ER model-Enhanced ER Model.		
UNIT – II	**RELATIONAL DATA MODEL AND SQL**	**9 Periods**
Relational Model: Concepts - Mapping ER and EER model to relations – Constraints - Schemas – Basic SQL: Data Definition, Data types, Constraint Specification, Data retrieval Queries - Relational Algebra – Triggers - Views		
UNIT – III	**DATABASE DESIGN AND QUERY PROCESSING**	**9 Periods**
Design Guidelines – Functional Dependencies – Normal Forms based on Primary Keys –Second and Third Normal Forms – BCNF – Multi valued Dependencies and Fourth Normal Form – Join Dependency and Fifth Normal Form - Strategies for Query Processing – Query Optimization		
UNIT – IV	**TRANSACTION PROCESSING, CONCURRENCY CONTROL AND RECOVERY**	**9 Periods**
Transaction: Desirable properties, Schedules based on recoverability and serializability - Transaction support in SQL. Concurrency Control: Locking technique -Time stamp based ordering - Multi version concurrency control - Validation and snapshot isolation concurrency control. Recovery Techniques: Concepts, NOUNDO/ REDO recovery based on deferred update, Recovery based on immediate update, Shadow paging, ARIES algorithm, Recovery in multi database systems		
UNIT – V	**NOSQL DATABASES AND ENHANCED DATA MODELS**	**9 Periods**
Introduction to NOSQL Systems: CAP Theorem, Document based systems, NOSQL Key-value stores, CRUD operation using NOSQL- Enhanced Data models: Active Database, Temporal Database, Spatial, multimedia and Deductive Databases.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Ramez Elmasri, Shamkant B. Navathe* ***"Fundamentals of Database Systems"*** *Seventh Edition, Pearson Education Limited, 2015*

REFERENCES

1	*Abraham Silberschatz , Henry F. Korth and S. Sudarshan,* ***"Database System Concepts"****, Sixth Edition, McGraw-Hill, 2012.*
2	*Raghu Ramakrishnan and Gehrke,* ***"Database Management Systems"****, Third Edition, McGraw Hill, 2003*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design a database management system using ER and EER model	K4
CO2	Design a relational database system and write SQL queries in an optimized way	K4
CO3	Write transaction processing applications considering concurrency control and recovery issues	K3
CO4	Perform CRUD operation using NOSQL database	K4
CO5	Explain Active Database, Temporal Database, Spatial, multimedia and Deductive Databases	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO2	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO3	2	3	3	2	-	-	-	-	-	1	-	-	3	3	1
CO4	2	3	3	2	-	-	-	-	-	1	-	-	3	3	2
CO5	2	2	2	2	-	-	-	-	-	1	-	-	2	3	1
22APC406	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**3**	**1**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.1.3,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.3.1,4.3.3,10.1.1
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.1.3,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.2.1,4.3.1,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,10.1.1
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.1.3,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.2.1,4.3.1,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,10.1.1
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.1.3,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.2.1,4.3.1,4.3.3,5.1.1,5.1.2,5.2.1,5.3.1,10.1.1
CO5	1.3.1,1.4.1,2.1.1,2.1.2,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.3.1,4.3.3,10.1.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Rememberin g (K1)%**	**Understandin g (K2) %**	**Applyi ng (K3)%**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	40	-	-	10	100
CAT2	20	30	40	-	-	10	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	-	-	50	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	-	-	50	100
ESE	20	30	50	-	-	-	100

22APC407	COMPUTER NETWORKS *(Common to ECE,CSE, IT & AI&ML)*	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to make students familiar with 1.The division of network functionalities into layers, 2.The component required to build different types of networks, 3.Identifying the solution for the functionalities in each layer.	
UNIT – I	**INTRODUCTION AND PHYSICAL LAYER**	**9 Periods**
Overview of how the Internet works: browser, webserver, URL, domain name, IP address, packets, Hubs, Bridges, Switches. Overview of the design principles of the Internet: packet switching vs circuit switching, store-and forward networks, layering for modularity. Introduction to the various layers in the Internet. Introduction to performance metrics: end-to-end throughput, delay, jitter and drop rates in a network. Statement of Little's Law. How performance is measured. Physical layer: signal to-noise ratio, bit error rate, modulation, multipath interference. Data Transmission – Transmission Media – Signal Encoding Techniques – Multiplexing – Spread Spectrum		
UNIT – II	**DATALINK LAYER**	**9 Periods**
Medium access protocols: Polling vs. contention-based: TDM, Aloha, CSMA/CD. Data Link Layer: Mechanisms for error detection/recovery: Parity checks, CRC and data link layer protocols. Switched LANs: L2 addressing and ARP– Virtual LAN (VLAN) –Ethernet frame structure, Wireless LAN (802.11)		
UNIT – III	**NETWORK LAYER**	**9 Periods**
Network Layer: Network architecture and performance: Network topology; Router architecture: queueing and switching. Performance evaluation of a network link: traffic characteristics, performance measures, Kendall's notation. IP Protocol: - Need for an Internet address, and its design. Hierarchical IP addressing, Subnetting, IPv4 and IPv6, structure of IP datagram, IP forwarding. Routing protocols: Link state routing. Distance vector routing: count-to-infinity, routing convergence. Structure of the Internet: end-user organizations and ISPs. difference between intra-domain (OSPF) and inter-domain (BGP) routing, Congestion Avoidance in Network Layer		
UNIT – IV	**TRANSPORT LAYER**	**9 Periods**
Transport Layer: Importance of the transport layer; end-to-end principle. Transport layer protocols: TCP and UDP, process-toprocess delivery, multiplexing, port numbers, header structure - Reliable transmission of packets over an unreliable network: sequence numbers, ACKs, timeout, retransmissions. Stop and wait, and sliding window - TCP connection setup and teardown - Flow control and congestion control at the transport layer. Differences between the two. Overview of TCP congestion control: Slow start and reaction to timeouts - TCP congestion control: Slow start; congestion avoidance using loss-based and delay-based control. Introduction to Quality of services (QOS).		
UNIT – V	**APPLICATION LAYER**	**9 Periods**
Application Layer: Internet names, how DNS works, Application layer protocols: HTTP, SMTP, SNMP, web applications. Security attacks and defences: DMZ, firewalls. Peer-to-peer applications. P2P file distribution. Audio and video streaming. Challenges of streaming over best effort IP		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*A.S. Tanenbaum and D.J. Wetherall,* ***Computer Networks****, 5th edition, Pearson, 2013.*
2	*J.F. Kurose and K.F. Ross,* ***Computer networking: a top-down approach,*** *6th edition, Pearson, 2017.*

REFERENCES:

1	*Larry L. Peterson, Bruce S. Davie,* ***"Computer Networks: A Systems Approach",*** *Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.*
2	*William Stallings,* ***"Data and Computer Communications",*** *Eighth Edition, Pearson Education, 2011.*
3	*Behrouz A. Forouzan and Firouz Mosharraf,* ***"Computer Networks a Top Down Approach",*** *Tata McGraw-Hill, 2011.*
4	*R. Jain,* ***The art of computer systems performance analysis,*** *Wiley India, 1991*
5	*S.K. Bose,* ***An Introduction to Queueing Systems,*** *Springer Science + Business Media New York, 2012*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarize layering as a means of tackling complexity, layering applied to the Internet	K2
CO2	Explain protocols as a structured means of reliable communications	K3
CO3	Explain the architecture principles that have enabled the orders of magnitude expansion of the Internet	K3
CO4	Explain networked applications and their protocols, their installation, operation and performance tuning	K3
CO5	Choose the required functionality at each layer for a given application and trace the flow of information from one node to another node in the network.	K3

Course Articulation Matrix

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	-	-	-	1	-	-	-	-	2	2	2
CO2	2	2	2	2	-	-	-	1	-	-	-	-	2	2	2
CO3	2	2	2	2	-	-	-	1	-	-	-	-	2	2	2
CO4	2	2	2	2	-	-	-	1	-	-	-	-	2	2	2
CO5	2	3	3	3	-	-	-	1	-	-	-	-	3	2	3
22APC407	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO2	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO3	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO4	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO5	1.1.1, 1.2.1, 2.1.1, 2.1.2, 2.3.1, 3.1.1, 3.1.2, 3.4.1, 4.1.1, 4.2.1, 4.2.2, 8.1.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	20	40	5	5	-	100
Assignment 2	30	20	30	10	5	5	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22APC408	ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objectives of this course are to understand the basic concepts of AI and problem solving techniques and be able to apply them in real world applications.	
UNIT – I	**INTELLIGENT AGENTS**	**9 Periods**
Introduction to AI – Agents and Environments – Concept of rationality – Nature of environments – Characteristics of Intelligent Agents– Typical Intelligent Agents -Structure of agents - Problem solving agents -Agents and Objects - Evaluation of Agents – Agent Design Philosophies		
UNIT – II	**SOLVING PROBLEMS BY SEARCH**	**9 Periods**
Problem characteristics, production systems, control strategies, breadth-first search, depth-first search, hill climbing and its variations, heuristics search techniques: best-first search, A* algorithm, constraint satisfaction problem, means-end analysis, introduction to game playing, min-max and alpha-beta pruning algorithms.		
UNIT – III	**LOGICAL AGENTS**	**9 Periods**
Knowledge-Based agents, The Wumpus World, Logic, agents based on propositional logic - Propositional Logic: A Very Simple Logic, Reasoning Patterns in Propositional Logic, Resolution, Forward and Backward chaining; - FIRST ORDER LOGIC – Syntax and Semantics of First-Order Logic, Using First-Order Logic , Knowledge Engineering in First-Order Logic – Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution ;		
UNIT – IV	**SOFTWARE AGENTS**	**9 Periods**
Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Mobile Agents - Multi-agent System - Trust and Reputation in Multi-agent systems.		
UNIT – V	**APPLICATIONS OF AI**	**9 Periods**
AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robotics: Hardware – Perception – Planning – Motion		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK):

1	Stuart Russell and Peter Norvig, **"Artificial Intelligence – A Modern Approach",** Fourth Edition, Pearson Education, 2022.
2	David L. Poole and Alan K. Mackworth, **"Artificial Intelligence: Foundations of Computational Agents"**, Third Edition, Cambridge University Press, 2023

REFERENCES

1	Nils J. Nilsson, "**The Quest for Artificial Intelligence**", Cambridge University Press, 2013
2	Deepak Khemani, **"Artificial Intelligence",** Tata McGraw Hill Education, 2016.
3	Kevin Night, Elaine Rich, and Nair B., **"Artificial Intelligence",** McGraw Hill, 2017
4	Gerhard Weiss, **"Multi Agent Systems**", Second Edition, MIT Press, 2016.
5	M. Tim Jones, **"Artificial Intelligence: A Systems Approach (Computer Science)",** Jones and Bartlett Publishers, Inc.; First Edition, 2008

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand and analyze the concept of intelligent agents, environments, rationality, and agent design principles for solving real-world problems.	K4
CO2	Apply uninformed and informed search algorithms, optimization techniques, and game playing strategies to solve AI problems efficiently.	K3
CO3	Demonstrate knowledge representation and reasoning using propositional and first-order logic, including inference mechanisms.	K3
CO4	Analyze multi-agent systems, agent communication, negotiation, and trust mechanisms in distributed AI environments.	K4
CO5	Explore real-world AI applications including NLP and robotics.	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	1	-	-	-	-	-	-	2	3	1	1
CO2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
CO3	3	3	1	2	1	-	-	-	-	-	-	2	3	2	1
CO4	2	2	2	1	2	-	-	-	-	-	-	2	3	2	2
CO5	2	2	3	2	3	-	-	-	-	-	-	3	3	3	3
22APC408	3	2	2	2	2	-	-	-	-	-	-	2	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2,12.1.1, 12.1.2
CO2	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2
CO3	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1
CO4	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.4, 3.1.1, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2,4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2
CO5	1.3.1, 2.1.1, 2.1.2,2.1.3, 2.2.1,2.2.2,2.2.3,2.2.4, 2,3,1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.3,4.2.1, 4.3.1, 4.3.2,4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.1.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	50	-	-	-	100%
CAT2	10	20	30	40	-	-	100%
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	10	50	40	-	-	100%
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	50	50	-	-	100%
ESE	--	20	40	40	-	-	100%

22APC409	DESIGN AND ANALYSIS OF ALGORITHMS *(Common to CSE, IT & AI &ML)*	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
DATA STRUCTURES	PC	3	1	0	4

Course Objectives	To apply important algorithmic design paradigms and methods of analysis and synthesize efficient algorithms in common engineering design situations	
UNIT – I	**INTRODUCTION TO ALGORITHM ANALYSIS**	**9+3 Periods**
Fundamentals of Algorithmic Problem Solving - Important Problem Types - Fundamentals of the Analysis of Algorithm Efficiency - Asymptotic Notations and Basic Efficiency Classes - Mathematical Analysis of Non-recursive Algorithms - Mathematical Analysis of Recursive Algorithms - Amortized Analysis		
UNIT – II	**DECREASE AND CONQUER TECHNIQUE**	**9+3 Periods**
Decrease by constant: Insertion sort - Topological algorithm. Decrease-by-a-Constant-Factor:Binary Search - Fake-Coin Problem - Russian Peasant Multiplication -Josephus Problem. Variable-Size Decrease - Computing a Median and the Selection Problem – Interpolation Search - Searching and Insertion in a Binary Search Tree - The Game of Nim.		
UNIT – III	**ALGORITHM DESIGN TECHNIQUES - I**	**9+3 Periods**
Greedy Approach : Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm - Huffman Trees and codes .Divide and Conquer : Merge Sort – Quick sort - Matrix Multiplication of Large Integers - Strassen's Matrix Multiplication Dynamic Programming : Matrix Chain Multiplication – Knapsack problem and Memory Function – optimal binary search tree - Warshall's and Floyd's Algorithms – Longest common Subsequence		
UNIT – IV	**ALGORITHM DESIGN TECHNIQUES - II**	**9+3 Periods**
Backtracking: n-Queen problem – Hamilton Circuit Problem – Subset sum problem - CNF –SAT. Branch and Bound: Assignment problem – Knapsack problem - Travelling Salesman Problem		
UNIT – V	**NP COMPLETENESS**	**9+3 Periods**
Limitations of algorithm power – Lower bound arguments – Decision Trees - P,NP and – NP Complete problem - Approximation Algorithm for NP Hard Problems: TSP - Knapsack problem Case study (not for evaluation) : Randomized Algorithms - Exact Exponential Algorithm		
Contact Periods **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK:

1	*Anany Levitin "**Introduction to the Design and Analysis of Algorithms**" Third Edition, Pearson Education, 2012*
2	*Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein "**Introduction to Algorithms**" Fourth Edition, MIT Press/McGraw-Hill, 2022.(unit 1-Amortized analysis)*

REFERENCES:

1	*Singhal, Shefali, and Neha Garg **"Analysis and Design of Algorithms: A Beginner's Hope"**, BPB Publications, 2018.*
2	*Sedgewick , Robert, and Kevin Wayne. **"Algorithms"**. Fourth edition , Addison-wesley professional, 2011.*
3	*Michael T Goodrich and Roberto Tamassia, **"Algorithm Design: Foundations, Analysis, and Internet Examples"**, Second Edition, Wiley, 2006*
4	*NPTEL Course : Design and Analysis of Algorithms* *https://archive.nptel.ac.in/courses/106/106/106106131/*

COURSE OUTCOMES: On completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Argue the correctness of algorithms and analyze the running time using asymptotic notations and amortized analysis	K4
CO2	Explore different algorithmic approaches, such as Decrease by Constant, Decrease by a Constant Factor, and Variable-Size Decrease and solve problems associated with these paradigms.	K2
CO3	Develop problem-solving skills through practical application of Greedy Approach, Divide and Conquer, and Dynamic Programming.	K3
CO4	Cultivate proficient problem-solving abilities through the utilization of advanced Backtracking and Branch and Bound algorithms.	K3
CO5	Grasp the limitations of algorithmic capabilities and explore approaches to address them through the use of approximation algorithms.	K2

COURSE ARTICULATION MATRIX

a) CO and PO Mapping															
COs/Pos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	1	1	1	-	-	-	-	-	1	2	3	-	-
CO2	2	2	1	1	1	-	-	-	-	-	1	2	3	-	-
CO3	2	2	3	1	1	-	-	-	-	-	1	2	-	3	-
CO4	2	2	1	1	1	-	-	-	-	-	1	2	-	3	-
CO5	2	1	1	1	1	-	-	-	-	-	1	2	-	-	3
22APC409	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**3**	**3**
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	1.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2,3.2.3,3.3.1,4.1.2,4.2.1,5.1.2,5.3.1,11.3.1, 12.3.2														
CO2	1.1.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2,3.1.6,3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1,11.3.1,12.3.2														
CO3	1.1.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2,3.1.6,3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1,11.3.1,12.3.2														
CO4	1.1.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2,3.1.6,3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1,11.3.1,12.3.2														
CO5	1.1.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.3.1,2.4.1,3.2.2,3.1.6,3.2.3,3.3.1, 4.1.2,4.2.1,5.1.2,5.3.1,11.3.1,12.3.2														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	-	30	30	40	-	-	100
CAT2	10	40	50	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	10	40	50	-	-	-	100

22APC410	THEORY OF COMPUTATION (Common to CSE,IT & AI&ML)	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	1	0	4

Course Objectives	Understand the foundations of computation including grammars, formal languages, Automata and Turing machines.	
UNIT–I	**INTRODUCTION TO FORMAL LANGUAGES AND FINITE AUTOMATA**	**9+3 Periods**
Introduction to Formal Languages, Grammars and Automata; Types of Grammars - Chomsky's hierarchy of languages, Regular Languages and Regular Expressions, Deterministic Finite Automata (DFA), Non- deterministic Finite Automata (NFA),Non-deterministic Finite Automata with Epsilon transitions, Conversion of NFA into DFA,DFA Minimization.		
UNIT–II	**REGULAR LANGUAGES, CONTEXT FREE GRAMMARS AND NORMAL FORMS**	**9+3Periods**
Kleene's theorem-Equivalence of Regular Expressions and Finite Automata, Myhill- Nerode Theorem, Moore and Mealy machines and its equivalence, Closure properties of Regular Languages, Pumping Lemma for regular languages. Context-FreeGrammar(CFG)and Languages, Derivations And Parse trees,Ambiguity in grammars and languages, Normal forms for CFG, Simplification of CFG,Chomsky Normal Form (CNF) and Greibach Normal Form (GNF)		
UNIT–III	**CONTEXT FREE LANGUAGES AND PUSHDOWN AUTOMATA**	**9+3 Periods**
Closure properties of Context Free Languages, Pumping lemma for CFL, Ogden's Lemma, Push Down Automata (PDA), Languages of pushdown automata, Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG, Deterministic Pushdown Automata.		
UNIT–IV	**TURING MACHINES**	**9+3 Periods**
Turing Machines, Language of a Turing Machine, Turing Machine as a Computing Device, Modifications of Turing Machines, Two-way Infinite Tape, Equivalence of One Way Infinite Tape and Two-way Infinite Tape Turing Machines, Multi Tape Turing Machines, Nondeterministic Turing machine, Universal Turing machines.		
UNIT–V	**RECURISVE, RECURSIVELY ENUMERABLE PROBLEMS AND UNDECIDABILITY**	**9+3 Periods**
Recursive and recursively enumerable languages, Properties, Reducibility Theory, Rice Theorem for Recursive and Recursively Enumerable Languages, Halting Problem and undecidability, Post's Correspondence Problem (PCP), Modified Post Correspondence Problem		
Contact Periods: **Lecture:45 Periods** **Tutorial:15 Periods** **Practical:0 Periods** **Total:60 Periods**		

TEXT BOOK

1	*John C Martin,**"Introduction to Languages and the Theory of Computation"**,4th Edition,Tata McGraw Hill, 2015*

REFERENCES

1.	*Harry R Lewis and Christos H Papadimitriou, **"Elements of the Theory of Computation"**,2nd Edition, Prentice Hall of India, 2015.*
2.	*PeterLinz,**"An Introduction to Formal Language and Automata "**,6th Edition, Jones & Bartlett, 2016.*

3.	*Michael Sipser,**"Introduction to Theory of Computation "**,Third Edition, Cengage learning, 2013*
4.	*Adam Brooks Webber,**" Formal languages: a practical introduction"**,Jim Leisy,2008.*
5.	*Hopcroft J.E.,Mtwani R.& Ullman J.D.,**"IntroductiontoAutomata Theory, Languages and Computations"**, 3rd Edition, Pearson Education, 2008.*

COURSEOUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Write Regular Expression/Context free grammar for the given language.	K2
CO2	Construct Automata/Turing Machines for the given language	K3
CO3	Explain the properties of Regular/Context Free/Recursive/Recursively Enumerable languages	K1
CO4	Use Pumping lemma	K2
CO5	Identify and prove the given problem is un-decidable using reducibility theory	K3

COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**	**PS O 1**	**PS O2**	**PS O 3**
CO1	2	2	3	-	-	-	-	-	-	1	-	1	3	1	-
CO2	2	2	3	-	-	-	-	-	-	1	-	1	3	1	-
CO3	2	2	-	-	-	-	-	-	-	1	-	1	3	1	-
CO4	2	2	3	-	-	-	-	-	-	1	-	1	3	-	3
CO5	2	2	3	-	-	-	-	-	-	1	-	1	-	-	3
22APC410	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**1**	**3**
1-Slight , 2-Moderate, 3-Substantial															

COURSEARTICULATIONMATRIX:

b)CO and Key Performance Indicators Mapping	
CO1	2.1.1,2.1.2,3.1.1,3.1.2,1.1.1,1.1.1
CO2	2.1.1,2.1.2,3.1.1,3.1.2,1.1.1,1.1.1
CO3	2.1.1,2.1.2,1.1.1,1.1.1
CO4	2.1.1,2.1.2,3.1.1,3.1.2,1.1.1,1.1.1
CO5	2.1.1,2.1.2,3.1.1,3.1.2,1.1.1,1.1.1

ASSESSMENT PATTERN –THEORY							
Test/Bloom's Category*	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6)%**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment1/ CaseStudy1/ Seminar 1 / Project1	30	20	40	5	5	-	100
Individual Assessment2/ CaseStudy2/ Seminar 2 / Project2	30	20	30	10	5	5	100
ESE	30	30	40	-	-	-	100

22APC411	OPERATING SYSTEMS DESIGN	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	2	4

Course Objectives	This course has two components: a theory component that introduces the fundamental concepts, structures, and principles underlying modern operating systems, and an integrated laboratory component to provide practical exposure to operating system implementation and analysis using Linux tools and programming exercises. The course enables students to apply process, memory, storage, file management, synchronization, inter-process communication, deadlock handling, and virtualization concepts while developing practical skills in Linux environments, system calls, distributed systems, and mobile operating systems through simulation and implementation exercises.	
UNIT – I	**INTRODUCTION**	**9 + 6 Periods**
Operating System Structure – Operating System Operations – Types of Operating Systems – Resource Management – Kernel Data Structures – Open Source Operating Systems – System Calls – System Programs – Operating System Security – Program Threats – System and Network Threats.		
UNIT – II	**PROCESS MANAGEMENT AND PROCESS SYNCHRONIZATION**	**9 + 6 Periods**
Process Concept – Process Scheduling – Operations on Processes – Inter-process Communication – CPU Scheduling Criteria – Scheduling Algorithms – Threads and Multithreading Models – Critical Section Problem – Synchronization Hardware – Semaphores – Mutex – Monitors – Deadlocks: Prevention, Avoidance, Detection, and Recovery.		
UNIT – III	**MEMORY MANAGEMENT**	**9 + 6 Periods**
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.		
UNIT – IV	**STORAGE MANAGEMENT**	**9+6 Periods**
Mass Storage Structure – Disk Structure – Disk Scheduling – File Concept – Access Methods – Directory Structure – File Sharing and Protection – File System Structure – Allocation Methods – Free Space Management – I/O Hardware – Application I/O Interface – Kernel I/O Subsystem.		
UNIT – V	**VIRTUAL MACHINES AND ADVANCED OPERATING SYSTEMS**	**9+ 6 Periods**
Virtual Machines - Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations- Virtualization and Operating-System Components-CPU Scheduling-Memory Management-I/O-Storage Management. **Advanced OS** – Distributed Operating Systems: Design issues in Distributed OS – Distributed File Systems-DFS Naming and Transparency- Mobile Devices & Mobile Operating System- Android Operating System and iOS- Other Mobile Operating System.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 75 Periods**		

LIST OF EXPERIMENTS:

(Experiments should be implemented in C++/Java)

1. Execution of Linux commands:

   file and directory commands
   process management commands
   permission management commands

2. Implementation of Inter Process Communication

3. Implementation of various CPU Scheduling Algorithms

4. Implementation of synchronization using Semaphores and Mutex.

5. Implementation of Deadlock Detection Algorithm

6. Implementation of various Page Replacement Algorithms

   a. FIFO b.LRU c. Optimal

7. Installation and configuration of Virtual Machines using VirtualBox/VMware.

TEXT BOOK

1	*Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "**Operating System Concepts**", John Wiley & Sons Pvt. Ltd., Tenth Edition, 2018*
2	*Dr. Ankit R. Bhavsar,Prof. (Dr.) ManojDevare,Dr. Pravin Yannawar , "**Mobile Operating Systems**", Printed and published by: Dr. Babasaheb Ambedkar Open University, ahmedabad,2019.*

REFERENCES

1	*William Stallings, **"Operating Systems : Internals and Design Principles",** Pearson Education, 2019.*
2	*Andrew S Tanenbaum, **"Modern Operating Systems",** Pearson, 4th Edition, New Delhi, 2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain operating system structure, types, system calls, and security issues.	K2
CO2	Identify and apply appropriate CPU scheduling algorithms and Deadlock detection techniques for the given scenario	K4
CO3	Apply appropriate memory management techniques and Storage management techniques for the given scenario	K3
CO4	Apply file system structures, disk scheduling, and I/O management techniques.	K3
CO5	Examine virtualization concepts, distributed and advanced operating systems.	K4

Course Articulation Matrix															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	1	-	-	-	-	1	2	1	2	3	2	1
CO2	3	3	2	2	-	-	-	-	1	1	2	2	3	3	2
CO3	3	3	2	2	-	-	-	-	1	1	2	2	3	3	2
CO4	3	3	2	2	1	-	-	-	1	2	2	2	3	3	2
CO5	2	3	2	3	2	1		1	1	2	3	2	2	3	3
22APC411	3	3	2	2	1	1	-	1	1	2	2	2	3	3	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.1.2, 3.1.3, 3.2.1, 5.1.1, 10.1.1, 10.1.2, 12.2.1, 12.2.2
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 3.1.3, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 10.1.1, 10.1.3, 12.2.1, 12.3.1
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.3.2, 2.4.1, 3.1.3, 3.2.2, 3.2.3, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.1, 5.1.1, 10.1.1, 10.1.3, 12.2.1, 12.3.2
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.3.2, 2.4.1, 3.1.3, 3.2.2, 3.2.3, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 7.1.1, 7.2.2, 10.1.1, 10.1.3, 12.2.1, 12.3.1
CO5	1.3.1, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.3.2, 2.4.1, 2.4.2, 3.1.3, 3.2.2, 3.3.1, 4.1.1, 4.1.2, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 7.1.1, 7.2.2, 10.1.1, 10.1.3, 12.1.1, 12.2.1, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	10	40	50	-	-	-	100
CAT2	10	40	40	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	20	40	40	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	10	50	30	10	-	100
ESE	10	20	50	20	-	-	100

22APC412	DATABASE MANAGEMENT SYSTEMS LABORATORY (Common to CSE & AI &ML)	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of this course is to practice DDL, DML, DCL and TCL commands, relational algebra operations, Views, stored procedures, cursors, functions, triggers and to develop a simple application with front end and back end design with report generation.

LIST OF EXPERIMENTS

Experiments should be implemented in MySQL/NoSQL

1.DDL and DML commands.

2.Views & Subqueries.

3.Relational Algebra Operations

4.Stored Procedures and Cursors.

5.Stored Functions.

6.Triggers.

7.DCL and TCL commands.

8.Form Design and report generation using PHP/Java/Django

9.Mini Project

Contact Periods:
Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 45 Periods** **Total: 45 Periods**

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Create and Manipulate a database using DDL, DML, DCL and TCL commands	K6
CO2	Implement a database schema for any real world problem with integrity constraints	K6
CO3	Apply PL/SQL constructs for designing stored procedures, functions, cursors, packages and triggers to access database.	K6
CO4	Design and develop a simple application with front end and back end design with report generation.	K6

COURSE ARTICULATION MATRIX:

Course Articulation Matrix															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	3	3	-	-	-	-	3	-	-	3	2	-
CO2	2	3	3	3	3	-	-	-	-	3	-	-	3	2	-
CO3	2	3	3	3	3	-	-	-	-	3	-	-	3	3	2
CO4	2	3	3	3	3	-	-	-	-	3	-	-	3	3	2
22APC412	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.2,3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.3.1,4.3.3,4.3.4,5.1.1, 5.1.2,5.2.1,5.2.2,5.3.1,10.1.1,10.1.2,10.1.3,10.3.1,10.3.2
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.2,3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.3.1,4.3.3,4.3.4, 5.1.1, 5.1.2,5.2.1,5.2.2,5.3.1,10.1.1,10.1.2,10.1.3,10.3.1,10.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.2,3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.3.1,4.3.3,4.3.4,5.1.1, 5.1.2,5.2.1,5.2.2,5.3.1,10.1.1,10.1.2,10.1.3,10.3.1,10.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.2,2.4.3,2.4.4,3.1.2,3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.3.1,4.3.3,4.3.4,5.1.1, 5.1.2,5.2.1,5.2.2,5.3.1,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1,10.1.2,10.1.3,10.3.1, 10.3.2

22APC413	COMPUTER NETWORKS LABORATORY *(Common to CSE , IT & AI&ML)*	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of this course is to make the students familiar with Linux and web based tools, Socket programming,NS2/NS3 Simulators

LIST OF EXPERIMENTS

1. (i) Use Linux tools like ifconfig, dig, ethtool, route, netstat, nslookup, and ip to understand the networking configuration of the computer that the student is working on.

   (ii) Install and configure some network applications, e.g. Apache, Bind (DNS)
2. (i) Use Wireshark to capture packets when browsing the Internet. Examine the structure of packets: the various layers, protocols, headers, payload

   (ii) Understand various header fields and their usage in different application layer protocols using Wireshark packet capture
3. Socket programming:

   a. write a simple clientserver program using TCP and UDP sockets

   b. Modify server to handle multiple clients concurrently

4. Measure TCP throughput between two hosts in a network using tools like iperf. Modify TCP configuration parameters. Use the tc Linux utility or similar to control bandwidth, delay, loss. Observe impact on measured throughput.

5. Experiment with multiple applications running concurrently to generate congestion: Observe the behaviour of congestion control protocols in ns-2/ns-3, change various network parameters and observe evolution of the TCP congestion window.

6. Use tools like ping and trace route to explore various Internet paths to popular servers.

7. Use web-based tools like the who is utility to query Internet registries, and understand which IP addresses are allocated to the student's network. Find out which are the major ISPs, and which is the ISP of the student's network.

8. Configure a simple mesh network using computers in the lab, or using Mininet. Setup static routes to conform to the desired mesh topology.

9. Use NS-2/NS-3 to simulate a mesh of at least 4 nodes and 3 links to evaluate performance under various conditions

10. Use Linux network tools like ethtool to observe and analyze link layer packet statistics and errors

11. Use NS- 2/NS-3 to simulate medium access protocols. Observe contention, collisions and packet loss in medium access protocols. Observe the working of error detection/recovery mechanisms.

12. Understand the behavior of Wi-Fi using NS-2/NS-3.
13. Simulate transport protocols optimized for data centers in NS-2/NS-3.
14. Use cell phone to measure cellular signal strength (RSS) at various places in the campus. Draw a contour map with cell phone towers and RSS levels. Correlate with upload/download speed using tools like Measurement Lab speed test.
15. Implement a streaming audio/video server using open-source software.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Install and configure network applications	K3
CO2	Write a simple client server program using socket programming	K3
CO3	Measure TCP throughput between two hosts in a network using tools	K3
CO4	Use linux/web based tools to understand the network architecture	K3
CO5	Use NS- 2/NS-3 to simulate protocols	K3

Course Articulation Matrix

COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO 3**
CO1	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
CO2	2	2	2	2	2	1	-	1	-	-	-	-	2	2	2
CO3	2	2	2	2	2	1	-	1	-	-	-	-	2	2	2
CO4	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
CO5	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
22APC 413	2	2	2	2	3	1	-	1	-	-	-	-	2	2	2

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO	Key Performance Indicators
CO1	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2, 3.1.1, 3.2.1, 4.1.1, 4.1.2, 5.1.1, 5.2.1, 8.1.1
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2, 3.1.1, 3.2.1, 4.1.1, 4.1.2, 5.1.1, 5.2.1, 8.1.1
CO4	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1
CO5	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1