B.E. COMPUTER SCIENCE AND ENGINEERING

BATCH 2023 - 2027

REGULATION – 2021

CHOICE BASED CREDIT SYSTEM

I - VIII SEMESTERS CURRICULA AND SYLLABI

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

1. **Profession:** Graduates excel in computer technology in order to pursue higher education and research, or have a successful career in industries or as entrepreneurs.
2. **Technophile:** Graduates will have the ability and attitude to adapt emerging technological changes in the field of Computer Science and Engineering.
3. **Team Player:** Possess an ability to collaborate as a team member and team leader to affect technical solutions for computing systems, providing improved function and outcomes.

PROGRAM 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.

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **Efficacy:** Ability to apply mathematical methodologies and foundational concepts of Computer Science and Engineering to solve computational tasks, model the real world problem using appropriate data structure and algorithm with suitable programming languages.
2. **Potentiality to design:** Analyze, design and evaluate a computer based system by applying software engineering principles and practices for developing quality software for scientific and business applications.
3. **Technical expertise:** Adapt to modern engineering technologies and thereby build robust, reliable, maintainable, scalable, innovative and efficient computing systems by considering social, environmental, economic, and security constraints

MAPPING OF PROGRAM OUTCOMES (POs) WITH

PROGRAM EDUCATIONAL OBJECTIVES (PEOs) & PROGRAM SPECIFIC OUTCOMES (PSOs)

Program Outcomes (POs)	Program Educational Objectives (PEOs)			Program Specific Outcomes (PSOs)		
	Profession	Technophile	Team Player	Efficacy	Potentiality to design	Technical expertise
Engineering knowledge	3	3	1	3	3	3
Problem analysis	3	3	2	3	3	2
Design/development of solutions	3	3	2	3	3	3
Conduct investigations of complex problems	3	3	3	3	3	2
Modern tool usage	2	3	1	3	3	3
The engineer and society	2	2	2	2	2	3
Environment and sustainability	2	2	2	2	2	3
Ethics	3	2	3	2	2	2
Individual and team work	3	2	3	2	2	2
Communication	3	2	3	2	2	3
Project management and finance	2	2	2	3	3	2
Life-long learning	3	3	2	3	2	3

Correlation Level 1, 2 or 3 as defined below:

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES (REGULAR COURSES)

A broad relation between the Course Outcomes and Program Outcomes (POs) and Program Specific Outcomes (PSOs) are given in the following table

Sem	Course Title	Program Outcomes (POs)												PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	Communicative English		√	√	√	√		√		√	√			√		√
	Engineering Mathematics - I	√	√	√	√	√	√			√	√	√	√	√	√	√
	Engineering Physics	√	√	√	√	√	√	√		√	√		√	√	√	√
	Engineering Chemistry	√	√	√	√		√	√	√	√	√		√	√	√	√
	Problem Solving and Programming in Python	√	√	√	√	√					√	√	√	√	√	√
	Engineering Graphics	√	√	√	√	√	√			√	√	√	√		√	√
	தமிழர் மரபு / Heritage of Tamils	√	√										√	√	√	√
	Python Programming Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Physics and Chemistry Laboratory	√	√	√	√		√		√	√	√			√	√	√
II	Professional English		√	√	√	√		√	√	√	√			√		√
	Engineering Mathematics –II	√	√	√	√	√	√	√			√	√	√	√	√	√
	Physics for Information Science	√	√	√	√	√	√			√	√		√	√	√	√
	Environmental Science and Engineering	√	√	√	√	√	√	√	√	√	√		√	√	√	√
	Basic Electrical, Electronics and Measurement Engineering	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Programming in C	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	√	√										√	√	√	√
	Engineering Practices Laboratory	√	√	√			√						√	√	√	√
	Programming in C Laboratory	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
III	Probability and Statistics	√	√	√	√	√	√	√				√	√	√	√	√
	Digital Principles and Logic Design	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Data Structures	√	√	√	√	√	√				√	√	√	√	√	√
	Object Oriented Programming	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Computer Architecture	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Agile Software Engineering	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Data Structures Laboratory using C	√	√	√	√	√			√	√	√	√	√	√	√	√
	Object Oriented Programming Laboratory	√	√	√	√	√			√	√	√	√	√	√	√	√

Sem	Course Title	Program Outcomes (POs)												PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
IV	Discrete Mathematics	√	√	√	√	√	√				√	√	√	√	√	√
	Design and Analysis of Algorithms	√	√	√	√	√				√		√	√	√	√	√
	Operating Systems	√	√	√	√	√					√	√	√	√	√	√
	Database Design and Management (Lab Integrated)	√	√	√	√	√	√	√			√	√	√	√	√	√
	Computer Networks	√	√	√										√	√	√
	Fundamentals of Data Science	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Operating Systems Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Data Science Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Professional Skills Laboratory		√	√	√	√		√		√	√			√	√	√
V	Algebra and Number Theory	√	√	√		√			√	√	√		√	√	√	√
	Object Oriented Analysis and Design	√	√	√	√	√					√	√	√	√	√	√
	Artificial Intelligence (Lab Integrated)	√	√	√	√	√	√			√	√	√	√	√	√	√
	Full Stack Development	√	√	√	√	√	√			√	√	√	√	√	√	√
	Object Oriented Analysis and Design Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Full Stack Development Laboratory	√	√	√	√	√					√	√	√	√	√	√
VI	Compiler Design	√	√	√	√	√					√	√	√	√	√	√
	Mobile Computing	√	√	√	√	√	√	√		√	√	√	√	√	√	√
	Data Science and Analytics	√	√	√	√	√					√	√	√	√	√	√
	Introduction to Quantum Computing	√	√	√	√	√				√	√	√	√	√	√	√
	Mobile Application Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Design Thinking and Innovations	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
VII	Graph Theory	√	√	√	√	√	√	√					√	√	√	√
	Cloud Computing	√	√	√	√	√					√	√	√	√	√	√
	Cryptography and Network Security	√	√	√	√	√				√	√	√	√	√	√	√
	Edge Computing	√	√	√	√		√	√	√	√	√		√	√	√	√
	Cloud Computing Laboratory	√	√	√	√	√			√	√	√		√	√	√	√
	Project Work Phase – I	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
VIII	Project Work Phase – II	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES (ELECTIVE COURSES)

A broad relation between the Course Outcomes and Program Outcomes (POs) and Program Specific Outcomes (PSOs) are given in the following table

Sem	Course Title	Program Outcomes (Pos)												PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
V	Computer Graphics	√	√	√	√	√	-	-	√	-	-	√	√	√	√	√
	Machine Learning Techniques	√	√	√	√	-	-	√	√	-	-	√	√	√	√	√
	Image Analysis and Computer Vision	√	√	√	√	√	-	-	-	-	√	-	√	√	√	√
	Multicore Architecture	√	√	√	√	-	-	-	√	√	-	√	√	√	√	√
	Fundamentals of Digital Image Processing	√	√	√	√	-	-	-	√	√	-	√	√	√	√	√
VI	Theory of Computation	√	√	√	√	√	-	-	-	-	√	√	√	√	√	√
	Software Testing	√	√	√	√	√	√	√	-	-	√	√	√	√	√	√
	Advanced Java Programming	√	√	√	√	√	-	-	-	√	√	√	√	√	√	√
	Introduction to Deep Learning	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Professional Ethics in Engineering	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
VII	Software Project Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Virtualization Techniques	√	-	√	√	√	√	√	-	-	-	√	√	√	√	√
	Principles of Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	GPU Architecture and Programming	√	√	√	√	√	-	-	-	-	-	√	-	√	√	√
	Resource Management Techniques	√	√	√	√	√	-	-	√	-	-	-	-	√	-	√
VII	Soft Computing	√	√	√	√	√	-	-	-	-	√	√	√	√	√	√
	Software Architecture	√	√	√	√	√	-	-	-	-	√	√	√	√	√	√
	Multimedia and Graphics Packages	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Human Computer Interaction	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Business Analytics	√	√	√	√	√				√	√	√	√	√	√	√
VIII	Natural Language Processing	√	√	√	√	√	√	-	-	√	√	√	√	√	√	√
	Microcontroller Based System Design	√	√	√	√	√	√	√		√	√	√	√	√	√	√
	Forensics and Cyber Law	√	√	√	√	√	√	√			√	√	√	√	√	√
	Data Warehousing and Data Mining	√	√	√	√	√			√		√	√	√	√	√	√
	Software Quality Assurance	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
VIII	Software Defined Networks	√	√	√	√	√	-	-	-	-	√	√	√	√	√	√
	iOS Application Development	√	√	√	√	√	√	-	√	-	√	√	√	√	√	√
	Network Simulation using NS3	√	√	√	√	√	-	-	√	-	-	√	√	√	√	√
	Blockchain Technologies	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Information Retrieval Techniques	√	√	√	√	√	√	-	-	-	√	√	√	√	√	√

SEMESTER I

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	**HS1101**	Communicative English **(Common to all Branches of B.E. / B. Tech Programmes)**	HSMC	45	3	0	0	3
2	**MA1102**	Engineering Mathematics – I **(Common to all Branches of B.E. / B. Tech Programmes)**	BSC	60	3	1	0	4
3	**PH1103**	Engineering Physics **(Common to all Branches of B.E. / B. Tech Programmes)**	BSC	45	3	0	0	3
4	**CY1104**	Engineering Chemistry **(Common to all Branches of B.E. / B. Tech Programmes)**	BSC	45	3	0	0	3
5	**GE1105**	Problem Solving and Python Programming**(Common to all Branches of B.E. / B. Tech Programmes)**	ESC	45	3	0	0	3
6	**GE1106**	Engineering Graphics **(Common to all Branches of B.E. / B. Tech Programmes)**	ESC	90	2	0	4	4
7	**GE1209**	**தமிழர் மரபு / Heritage of Tamils (Common to all Branches of B.E. / B. Tech Programmes)**	HSMC	15	0	0	0	1
PRACTICAL								
8	**GE1107**	Python Programming Laboratory **(Common to all Branches of B.E. / B. Tech Programmes)**	ESC	60	0	0	4	2
9	**BS1108**	Physics and Chemistry Laboratory **(Common to all Branches of B.E. / B. Tech Programmes)**	BSC	60	0	0	4	2
Total				**465**	**17**	**1**	**12**	**25**

SEMESTER II

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	HS1201	Professional English **(Common to all Branches of B.E. / B. Tech Programmes)**	HSMC	45	3	0	0	3
2	MA1202	Engineering Mathematics –II **(Common to all Branches of B.E. / B. Tech Programmes Except AI-DS & AI-ML)**	BSC	60	3	1	0	4
3	PH1252	Physics for Information Science **(Common to CSE, IT, AI-DS & AI-ML)**	BSC	45	3	0	0	3
4	GE1204	Environmental Science and Engineering **(Common to all Branches of B.E. / B. Tech Programmes)**	HSMC	45	3	0	0	3
5	BE1251	Basic Electrical, Electronics and Measurement Engineering **(Common to CSE, IT, AI-DS & AI-ML)**	ESC	45	3	0	0	3
6	CS1206	Programming in C (Common to CSE, IT, AI-DS & AI-ML)	PCC	45	3	0	0	3
7	**GE1210**	**தமிழரும் தொழில்நுட்பமும் / Tamils and Technology (Common to all Branches of B.E. / B. Tech Programmes)**	**HSMC**	**15**	**0**	**0**	**0**	**1**
PRACTICAL								
8	GE1207	Engineering Practices Laboratory **(Common to all Branches of B.E. / B. Tech Programmes)**	ESC	60	0	0	4	2
9	CS1208	Programming in C Laboratory (Common to CSE, IT, AI-DS & AI-ML)	PCC	60	0	0	4	2
Total				**420**	**18**	**1**	**8**	**24**

SEMESTER III

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1351	Probability and Statistics **(Common to CSE, IT & AI-DS)**	BSC	60	3	1	0	4
2	CS1302	Data Structures **(Common to CSE, IT, AI-DS, AI-ML & ECE Semester IV)**	PCC	45	3	0	0	3
3	CS1303	Object Oriented Programming	PCC	45	3	0	0	3
4	CS1304	Computer Architecture **(Common to CSE & IT)**	PCC	45	3	0	0	3
5	CS1306	Digital Principles and Logic Design	ESC	60	3	1	0	4
6	CS1309	Agile Software Engineering **(Common to CSE & IT)**	PCC	45	3	0	0	3
PRACTICAL								
7	CS1307	Data Structures Laboratory using C **(Common to CSE, IT & ECE Semester IV)**	PCC	60	0	0	4	2
8	CS1308	Object Oriented Programming Laboratory	PCC	60	0	0	4	2
Total				**28**	**18**	**2**	**8**	**24**

SEMESTER IV

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1453	Discrete Mathematics **(Common to CSE, IT & AI-DS)**	BSC	60	3	1	0	4
2	CS1401	Design and Analysis of Algorithms **(Common to CSE, IT, AI-DS & AI-ML)**	PCC	45	3	0	0	3
3	CS1402	Operating Systems **(Common to CSE, IT, AI-DS)**	PCC	45	3	0	0	3
4	CS1403	Database Design and Management (Lab Integrated) **(Common to CSE, IT & AI-DS)**	PCC	75	3	0	2	4
5	CS1404	Computer Networks **(Common to CSE, IT)**	PCC	45	3	0	0	3
6	CS1410	Fundamentals of Data Science	PCC	45	3	0	0	3
PRACTICAL								
7	CS1407	Operating Systems Laboratory **(Common to CSE, IT & AI-DS)**	PCC	60	0	0	4	2
8	CS1411	Data Science Laboratory	PCC	60	0	0	4	2
9	HS1310	Professional Skills Laboratory **(Common to CSE & AI-DS)**	HSMC	30	0	0	2	1
Total				**465**	**18**	**1**	**12**	**25**

SEMESTER V

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1501	Algebra and Number Theory **(Common to CSE & IT)**	BSC	60	3	1	0	4
2	CS1502	Object Oriented Analysis and Design **(Common to CSE & IT)**	PCC	45	3	0	0	3
3	CS1503	Artificial Intelligence (Lab Integrated)	PCC	75	3	0	2	4
4	CS1509	Full Stack Development	PCC	45	3	0	0	3
5		Open Elective – I	OEC	45	3	0	0	3
6		Professional Elective – I	PEC	45	3	0	0	3
PRACTICAL								
7	CS1508	Object Oriented Analysis and Design Laboratory **(Common to CSE & IT)**	PCC	60	0	0	4	2
8	CS1510	Full Stack Development Laboratory	PCC	60	0	0	4	2
Total				**435**	**18**	**1**	**10**	**24**
9		Employability Enhancement Skill Based Course - I	EEC	45 Periods	1	0	2	2

SEMESTER VI

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	CS1601	Compiler Design	PCC	45	3	0	0	3
2	CS1602	Mobile Computing	PCC	45	3	0	0	3
3	CS1604	Data Science and Analytics	PCC	45	3	0	0	3
4	CS1609	Introduction to Quantum Computing	PCC	45	3	0	0	3
5		Open Elective – II	OEC	45	3	0	0	3
6		Professional Electives – II	PEC	45	3	0	0	3
PRACTICAL								
7	CS1607	Mobile Application Laboratory	PCC	60	0	0	4	2
8	CS1610	Design Thinking and Innovations	EEC	60	0	0	4	2
Total				**435**	**18**	**0**	**8**	**22**
9		Value Added Course	EEC					2
10		Audit Course (Optional)	AC					
11		Employability Enhancement Skill Based Course - II	EEC	45 Periods	1	0	2	2

For Value Added Course, the grades earned by the students will be recorded in the Mark Sheet, However the same shall not be considered for the computation of CGPA.

SEMESTER VII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	CS1701	Graph Theory	PCC	45	3	0	0	3
2	CS1702	Cloud Computing	PCC	45	3	0	0	3
3	CS1703	Cryptography and Network Security **(Common to CSE & IT)**	PCC	45	3	0	0	3
4	CS1709	Edge Computing	PCC	45	3	0	0	3
5		Professional Electives - III	PEC	45	3	0	0	3
6		Professional Electives - IV	PEC	45	3	0	0	3
PRACTICAL								
7	CS1707	Cloud Computing Laboratory	PCC	60	0	0	4	2
8	CS1708	Project Work Phase -I	EEC	60	0	0	4	2
9	CS1716	Internship	EEC					1
10		Employability Enhancement Skill Based Course - III	EEC	45 Periods	1	0	2	2
Total				**390**	**18**	**0**	**8**	**22**

#Two weeks Summer Internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester. *Credit Course-Evaluation is Fully Internal

SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Professional Elective - V	PEC	45	3	0	0	3
2		Professional Elective - VI	PEC	45	3	0	0	3
PRACTICAL								
3	CS1807	Project Work Phase -II	EEC	300	0	0	20	10
Total				**390**	**6**	**0**	**20**	**16**

TOTAL NO. OF CREDITS: 182

HUMANITICS SCIENCE AND MANAGEMENT COURSES (HSMC)

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	HS1101	Communicative English	45	3	0	0	3
2	**GE1209**	**தமிழர் மரபு / Heritage of Tamils**	15	0	0	0	1
3	HS1201	Professional English	45	3	0	0	3
4	GE1204	Environmental Science and Engineering	45	3	0	0	3
5	**GE1210**	**தமிழரும் தொழில்நுட்பமும் /Tamils and Technology**	15	0	0	0	1
6	HS1310	Professional Skills Laboratory	30	0	0	2	1

BASIC SCIENCE COURSES (BSC)

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	MA1102	Engineering Mathematics – I	60	3	1	0	4
2	PH1103	Engineering Physics	45	3	0	0	3
3	CY1104	Engineering Chemistry	45	3	0	0	3
4	BS1108	Physics and Chemistry Laboratory	60	0	0	4	2
5	MA1202	Engineering Mathematics -II	60	3	1	0	4
6	PH1252	Physics for Information Science	45	3	0	0	3
7	MA1351	Probability and Statistics	60	3	1	0	4
8	MA1453	Discrete Mathematics	60	3	1	0	4
9	MA1501	Algebra and Number Theory	60	3	1	0	4

ENGINEERING SCIENCE COURSES (ESC)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	GE1105	Problem Solving and Python Programming	45	3	0	0	3
2	GE1106	Engineering Graphics	90	2	0	4	4
3	GE1107	Python Programming Laboratory	60	0	0	4	2
4	BE1251	Basic Electrical, Electronics and Measurement Engineering	45	3	0	0	3
5	GE1207	Engineering Practices Laboratory	60	0	0	4	2
6	CS1306	Digital Principles and Logic Design	60	3	1	0	3

PROFESSIONAL CORE COURSES (PCC)

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1206	Programming in C	60	3	1	0	3
2	CS1208	Programming in C Laboratory	60	0	0	4	2
5	CS1302	Data Structures	45	3	0	0	3
6	CS1303	Object Oriented Programming	45	3	0	0	3
7	CS1304	Computer Architecture	45	3	0	0	3
10	CS1308	Object Oriented Programming Laboratory	60	0	0	4	2
11	CS1306	Digital Principles and Logic Design	60	3	1	0	4
12	CS1309	Agile Software Engineering	45	3	0	0	3
14	CS1307	Data Structures Laboratory using C	60	0	0	4	2
16	CS1401	Design and Analysis of Algorithms	45	3	0	0	3
17	CS1402	Operating Systems	45	3	0	0	3
18	CS1403	Database Design and Management (Lab Integrated)	75	3	0	2	4
19	CS1404	Computer Networks	45	3	0	0	3
20	CS1407	Operating Systems Laboratory	60	0	0	4	2
22	CS1410	Fundamentals of Data Science	45	3	0	0	3
23	CS1411	Data Science Laboratory	60	0	0	4	2
25	CS1502	Object Oriented Analysis and Design	45	3	0	0	3
26	CS1503	Artificial Intelligence (Lab Integrated)	75	3	0	2	4
28	CS1506	Full Stack Development	45	3	0	0	3
29	CS1508	Object Oriented Analysis and Design Laboratory	60	0	0	4	2
30	CS1510	Full Stack Development Laboratory	60	0	0	4	2
32	CS1601	Compiler Design	45	3	0	0	3
33	CS1602	Mobile Computing	45	3	0	0	3
35	CS1604	Data Science and Analytics	45	3	0	0	3
36	CS1609	Introduction to Quantum Computing	45	3	0	0	3
37	CS1607	Mobile Application Laboratory	60	0	0	4	2
38	CS1701	Graph Theory	45	3	0	0	3
39	CS1702	Cloud Computing	45	3	0	0	3
40	CS1703	Cryptography and Network Security	45	3	0	0	3
41	CS1709	Edge Computing	45	3	0	0	3
42	CS1707	Cloud Computing Laboratory	60	0	0	4	2

PROFESSIONAL ELECTIVE COURSES (PEC) PROFESSIONAL ELECTIVE - I

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1511	Computer Graphics	45	3	0	0	3
2	CS1512	Machine Learning Techniques	45	3	0	0	3
3	CS1513	Image Analysis and Computer Vision	45	3	0	0	3
4	CS1514	Multicore Architecture	45	3	0	0	3
5	CS1515	Fundamentals of Digital Image Processing (Common to CSE & IT)	45	3	0	0	3

PROFESSIONAL ELECTIVE – II

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1611	Theory of Computation	45	3	0	0	3
2	CS1612	Software Testing	45	3	0	0	3
3	CS1613	Advanced Java Programming	45	3	0	0	3
4	CS1614	Introduction to Deep Learning	45	3	0	0	3
5	GE1003	Professional Ethics in Engineering	45	3	0	0	3

PROFESSIONAL ELECTIVE – III

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1711	Software Project Management	45	3	0	0	3
2	CS1712	Virtualization Techniques (Common to CSE & IT)	45	3	0	0	3
3	CS1713	GPU Architecture and Programming	45	3	0	0	3
4	CS1714	Resource Management Techniques	45	3	0	0	3
5	MG1001	Principles of Management (Common to CSE & AI-DS)	45	3	0	0	3

PROFESSIONAL ELECTIVE - IV

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1721	Soft Computing	45	3	0	0	3
2	CS1723	Software Architecture	45	3	0	0	3
3	CS1724	Multimedia and Graphics Packages	45	3	0	0	3
4	CS1725	Human Computer Interaction **(Common to CSE & AI-ML)**	45	3	0	0	3
5	CS1726	Business Analytics	45	3	0	0	3

PROFESSIONAL ELECTIVE – V

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1811	Natural Language Processing	45	3	0	0	3
2	CS1812	Microcontroller Based System Design	45	3	0	0	3
3	CS1813	Forensics and Cyber Law	45	3	0	0	3
4	CS1814	Data Warehousing and Data Mining	45	3	0	0	3
5	CS1815	Software Quality Assurance	45	3	0	0	3

PROFESSIONAL ELECTIVE – VI

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1821	Software Defined Networks	45	3	0	0	3
2	CS1822	iOS Application Development	45	3	0	0	3
3	CS1823	Network Simulation using ns3	45	3	0	0	3
4	CS1824	Blockchain Technologies **(Common to CSE & IT)**	45	3	0	0	3
5	CS1825	Information Retrieval Techniques	45	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	CS1610	Design Thinking and Innovations	60	0	0	4	2
2	CS1708	Project Work Phase - I	60	0	0	4	2
3	CS1807	Project Work Phase - II	300	0	0	20	10
4		Value Added Course					2
5	CS1716	Internship					1
6		Employability Enhancement Skill Based Courses	45 Periods	1	0	2	2

Value Added Courses

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	VAC001	INDUSTRIAL INTERNET OF THINGS	**45**	**1**	**0**	**2**	**2**
2	VAC002	AUGMENTED REALITY & VIRTUAL REALITY	**45**	**1**	**0**	**2**	**2**
3	VAC003	ETHICAL HACKING - CYBER SECURITY	**45**	**1**	**0**	**2**	**2**
4	VAC004	BLOCKCHAIN AND CRYPTO CURRENCIES	**45**	**1**	**0**	**2**	**2**
5	VAC005	INDUSTRIAL PRACTICES WITH DEVOPS	**45**	**1**	**0**	**2**	**2**
6	VAC006	APPLIED MACHINE LEARNING WITH PYTHON	**45**	**1**	**0**	**2**	**2**

OPEN ELECTIVE COURSES – I & II

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	OBT101	Industrial Biotechnology	45	3	0	0	3
2	OBT104	Bio Sensors	45	3	0	0	3
3	OBT105	Introduction to Nano Science and Nano Technology	45	3	0	0	3
4	OCE102	Introduction to Geographic Information System	45	3	0	0	3
5	OCH101	Hospital Management	45	3	0	0	3
6	OEC103	Basics of Embedded Systems and IoT	45	3	0	0	3
7	OEE101	Basic Circuit Theory	45	3	0	0	3
8	OEE103	Introduction to Renewable Energy Systems	45	3	0	0	3
9	OEI102	Robotics	45	3	0	0	3
10	OMB101	Total Quality Management	45	3	0	0	3
11	OME104	Industrial Safety Engineering	45	3	0	0	3

OPEN ELECTIVE COURSES OFFERED BY CSE, IT, AIDS & AIML

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	OCS101	Introduction to C Programming	45	3	0	0	3
2	OCS102	Programming and Data Structures	45	3	0	0	3
3	OCS103	Introduction to Cloud Computing	45	3	0	0	3
4	OCS104	Fundamentals of Database Design	45	3	0	0	3
5	OCS105	Data Analytics with R Programming	45	3	0	0	3
6	OCS106	Data Communications and Networking	45	3	0	0	3
7	OCS107	Machine Learning for Intelligent Systems	45	3	0	0	3
8	OCS109	Fundamentals of Database Management systems	45	3	0	0	3

AUDIT COURSES (AC)

S.No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	AD1001	Constitution of India	30	2	0	0	0
2	AD1002	Value Education	30	2	0	0	0
3	AD1003	Pedagogy Studies	30	2	0	0	0
4	AD1004	Stress Management by Yoga	30	2	0	0	0
5	AD1005	Personality Development Through Life EnlightenmentSkills	30	2	0	0	0
6	AD1006	Unnat Bharat Abhiyan	30	2	0	0	0
7	AD1007	Essence of Indian Knowledge Tradition	30	2	0	0	0
8	AD1008	Sanga Tamil LiteratureAppreciation	30	2	0	0	0

* Registration for any of these courses is optional to students

CREDIT SUMMARY

S. No.	SUBJECT AREA	I	II	III	IV	V	VI	VII	VIII	TOTAL CREDIT	PERCENTAGE
1	HSMC	4	7		1					12	6.59
2	BSC	12	7	4	4	4				31	17.03
3	ESC	9	5	4						18	9.89
4	PCC		5	16	20	14	14	14		83	45.60
5	PEC					3	3	6	6	18	9.89
6	OEC					3	3			6	3.30
7	EEC						2	2	10	14	7.69
TOTAL CREDIT		25	24	24	25	24	22	22	16	182	100.00

HS1101	COMMUNICATIVE ENGLISH	L	T	P	C
	(Common to all Branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I	SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS	9
Reading — critical reading — finding key information in a given text — shifting facts from opinions - Writing - autobiographical writing - developing hints. Listening- short texts- short formal and informal conversations. Speaking- basics in speaking - introducing oneself - exchanging personal information- speaking on given topics & situations Language development– voices- Wh- Questions- asking and answering-yes or no questions– parts of speech. Vocabulary development-- prefixes- suffixes- articles - Polite Expressions.		CO1

UNIT II	GENERAL READING AND FREE WRITING	9
Reading: Short narratives and descriptions from newspapers (including dialogues and conversations ; Reading Comprehension Texts with varied question types - Writing — paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –. Listening - long texts - TED talks - extensive speech on current affairs and discussions Speaking — describing a simple process — asking and answering questions - Language development — prepositions, clauses. Vocabulary development- guessing meanings of words in context – useofsequence words.		CO2

UNIT III	GRAMMAR AND LANGUAGE DEVELOPMENT	9
Reading- short texts and longer passages (close reading) & making a critical analysis of the given text Writing — types of paragraph and writing essays — rearrangement of jumbled sentences. Listening: Listening to ted talks and long speeches for comprehension. Speaking- role plays - asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- Direct vs. Indirect Questions. Vocabulary development – idioms and phrases- cause & effect expressions, adverbs.		CO3

UNIT IV	READING AND LANGUAGE DEVELOPMENT	9
Reading- comprehension-reading longer texts- reading different types of texts- magazines. Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening: Listening comprehension (IELTS, TOEFL and others). Speaking -Speaking about friends/places/hobbies - Language development- Tenses- simple present-simple past- present continuous and past continuous- conditionals — if, unless, in case, when and others Vocabulary development- synonyms-antonyms- Single word substitutes- Collocations.		CO4

UNIT V	EXTENDED WRITING	9
Reading: Reading for comparisons and contrast and other deeper levels of meaning –Writing- brainstorming -writing short essays — developing an outline- identifying main and subordinate ideas- dialogue writing- Listening - popular speeches and presentations - Speaking - impromptu speeches & debates Language development-modal verbs- present/ past perfect tense - Vocabulary development-Phrasal verbs- fixed and semi-fixed expressions.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2020
2. Sanjay Kumar & Pushp Lata Communication Skills Second Edition, Oxford University Press: 2015.
3. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCE BOOKS

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means, L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning ,USA: 2007
3. Redston, Chris & Gillies Cunningham Face 2 Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeevan Geeta Basic Communication Skills, Foundation Books: 2013
6. John Eastwood et al: Be Grammar Ready: The Ultimate Guide to English Grammar, Oxford University Press: 2020. .

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
CO3	Read different genres of texts adopting various reading strategies.
CO4	Listen/view and comprehend different spoken discourses/excerpts in different accents
CO5	Identify topics and formulate questions for productive inquiry

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	3	-	-	-	-	3
CO2	-	1	-	2	-	-	-	-	-	3	-	-	-	-	-
CO3	-	2	-	3	-	-	-	-	-	2	-	-	3	-	1
CO4	-	-	-	-	-	-	-	-	2	2	-	-	1	-	2
CO5	-	2	1	1	2	-	2	-	-	3	-	-	2	-	1

MA1102	ENGINEERING MATHEMATICS – I	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	3	1	0	4

OBJECTIVES

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus.
- The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering.
- This is a foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I	MATRICES	12
Eigenvalues and Eigenvectors of a real matrix — Characteristic equation — Properties of Eigenvalues and Eigenvectors — Cayley-Hamilton theorem — Diagonalization of matrices — Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms		CO1
UNIT II	**CALCULUS OF ONE VARIABLE**	**12**
Limit of a function - Continuity - Derivatives - Differentiation rules — Interval of increasing and decreasing functions — Maxima and Minima - Intervals of concavity and convexity.		CO2
UNIT III	**CALCULUS OF SEVERAL VARIABLES**	**12**
Partial differentiation — Homogeneous functions and Euler's theorem — Total derivative — Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.		CO3
UNIT IV	**INTEGRAL CALCULUS**	**12**
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.		CO4
UNIT V	**MULTIPLE INTEGRALS**	**12**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves — Change of variables from Cartesian to polar in double integrals-Triple integrals — Volume of solids		CO5
		TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi,2015. [For Units I & III - Sections 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.2 - 7.4 and 7.8].

REFERENCE BOOKS

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. T. Veerarajan. Engineering Mathematics – I, McGraw Hill Education; First edition 2017.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Have a clear idea of matrix algebra pertaining Eigenvalues and Eigenvectors in addition dealing with quadratic forms.
CO2	Understand the concept of limit of a function and apply the same to deal with continuity and derivative of a given function. Apply differentiation to solve maxima and minima problems, which are related to real world problems.
CO3	Have the idea of extension of a function of one variable to several variables. Multivariable functions of real variables are inevitable in engineering.
CO4	Understand the concept of integration through fundamental theorem of calculus. Also acquire skills to evaluate the integrals using the techniques of substitution, partial fraction and integration by parts along with the knowledge of improper integrals.
CO5	Do double and triple integration so that they can handle integrals of higher order which are applied in engineering field.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	3	-	-	3	2	3	3	2	1	1
CO2	3	3	3	2	2	1	-	-	-	-	1	2	2	2	1
CO3	3	3	3	2	2	1	-	-	-	-	1	2	2	1	2
CO4	3	3	3	2	2	1	-	-	-	-	1	2	2	2	1
CO5	3	3	3	2	1	1	-	-	-	-	1	2	2	1	2

PH1103	ENGINEERING PHYSICS	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

To make the students conversant with

- ❖ Elastic properties of materials and various moduli of elasticity
- ❖ Principles of laser and fiber optics and its various technological applications
- ❖ Thermal conduction in solids, heat exchangers and its applications in various devices
- ❖ Quantum concepts to explain black body radiation, Compton effect and matter waves.
- ❖ Various crystal structures, Miller indices and crystal growth techniques

UNIT I	PROPERTIES OF MATTER	9
Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment — cantilever: theory and experiment — uniform and non-uniform bending: theory and experiment – Practical applications of modulus of elasticity-I-shaped girders - stress due to bending in beams.		CO1
UNIT II	**LASER AND FIBER OPTICS**	**9**
Lasers : population of energy levels, Einstein's A and B coefficients derivation — resonant cavity, optical amplification (qualitative) – Nd-YAG Laser-Semiconductor lasers: homojunction and heterojunction — Industrial and medical applications of Laser– Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) — losses associated with optical fibers — Fabrication of Optical fiber-Double crucible method-fibre optic sensors: pressure and displacement-Industrial and medical applications of optical fiber- Endoscopy-Fiber optic communication system.		CO2
UNIT III	**THERMAL PHYSICS**	**9**
Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity –Rectilinear flow of heat- Lee's disc method: theory and experiment - conduction through compound media (series and parallel)-Radial flow of heat– thermal insulation – applications: heat exchangers, refrigerators, oven, Induction furnace and solar water heaters.		CO3
UNIT IV	**QUANTUM PHYSICS**	**9**
Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification — wave particle duality — electron diffraction — concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations — particle in a one-dimensional rigid box — Electron microscope-tunnelling (qualitative) - scanning tunnelling microscope-Applications of electron microscopy.		CO4
UNIT V	**CRYSTAL PHYSICS**	**9**
Single crystalline, polycrystalline and amorphous materials — single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices — inter-planar distances coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures — Graphite structure-crystal imperfections: point defects, line defects — Burger vectors, stacking faults — growth of single crystals: solution and melt growth techniques-Epitaxial growth-Applications of Single crystal (Qualitative).		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2017.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2013.

REFERENCE BOOKS

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2019.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics‘. W.H.Freeman, 2014.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	The elastic property and stress strain diagram, determination of rigidity modulus by torsional pendulum and Young‘s modulus by various methods.
CO2	Principle of laser, Einstein‘s coefficients of laser action, semiconductor laser and its applications, optical fibers and their applications in sensors and communication system.
CO3	The heat transfer through solids and the determination of thermal conductivity in a bad conductor by Lee‘s disc method and radial flow of heat.
CO4	The quantum concepts and its use to explain black body radiation, Compton effect and wave equation for matter waves, tunnelling electron microscopy and its applications.
CO5	The importance of various crystal structures, Miller indices and various growth techniques.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	2	1	3	2	1	2	3	2	2
CO2	3	3	3	2	3	2	2	1	2	2	2	1	2	2	3
CO3	3	3	2	2	2	1	2	1	2	1	1	2	2	2	2
CO4	3	3	2	2	2	1	1	1	1	1	1	3	3	3	3
CO5	3	3	3	3	2	1	2	1	3	1	1	3	3	3	3

CY1104	ENGINEERING CHEMISTRY	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

To make the student conversant with the

- ❖ Principles of water characterization and treatment for industrial purposes
- ❖ Principles and applications of surface chemistry and catalysis
- ❖ Phase rule and various types of alloys
- ❖ Various types of fuels, applications and combustion
- ❖ Conventional and non–conventional energy sources and energy storage device

UNIT I	WATER AND ITS TREATMENT	9
Hardness of water — Types — Expression of hardness — Units — Estimation of hardness by EDTA method – Numerical problems on EDTA method – Boiler troubles (scale and sludge, caustic embrittlement , boiler corrosion, priming and foaming) – Treatment of boiler feed water — Internal treatment (carbonate, phosphate, colloidal, sodium aluminate and calgon conditioning) – External treatment – Ion exchange process, Zeolite process – Desalination of brackish water by Reverse Osmosis.		CO1

UNIT II	SURFACE CHEMISTRY AND CATALYSIS	9
Surface chemistry: Types of adsorption – Adsorption of gases on solids – Adsorption of solute from solutions — Adsorption isotherms — Freundlich's adsorption isotherm — Langmuir's adsorption isotherm — Kinetics of uni-molecular surface reactions — Adsorption in chromatography – Applications of adsorption in pollution abatement using PAC. **Catalysis**: Catalyst – Types of catalysis – Criteria – Contact theory – Catalytic poisoning and catalytic promoters – Industrial applications of catalysts – Catalytic convertor – Auto catalysis – Enzyme catalysis – Michaelis-Menten equation.		CO2

UNIT III	PHASE RULE AND ALLOYS	9
Phase rule: Introduction – Definition of terms with examples – One component system – Water system — Reduced phase rule — Thermal analysis and cooling curves — Two component systems – Lead-silver system – Pattinson process. **Alloys**: Introduction – Definition – Properties of alloys – Significance of alloying – Functions and effect of alloying elements – Nichrome, Alnico, Stainless steel (18/8) – Heat treatment of steel — Non-ferrous alloys — Brass and bronze.		CO3

UNIT IV	FUELS AND COMBUSTION	9
Fuels: Introduction – classification of fuels – Comparison of solid, liquid, gaseous fuels – Coal – Analysis of coal (proximate and ultimate). – Carbonization – Manufacture of metallurgical coke (Otto Hoffmann method) — Petroleum — Cracking — Manufacture of synthetic petrol (Bergius process, Fischer Tropsch Process) — Knocking — Octane number — Diesel oil — Cetane number – Compressed natural gas (CNG) – Liquefied petroleum gases (LPG) – Power alcohol and biodiesel. **Combustion of fuels**: Introduction — Calorific value — Higher and lower calorific values — Theoretical calculation of calorific value — Ignition temperature — Spontaneous ignition temperature – Explosive range – Flue gas analysis by Orsat Method.		CO4

UNIT V	NON–CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES	9
Nuclear energy — Fission and fusion reactions — Differences — Chain reactions — Nuclear reactors — Classification of reactors — Light water nuclear reactor for power generation — Breeder reactor — Solar energy conversion — Solar cells — Wind energy — Fuel cells — Hydrogen-oxygen fuel cell . Batteries – Types of batteries - Alkaline batteries – Lead-acid, Nickel-cadmium and Lithium batteries.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. P.C.Jain, Monica Jain, "Engineering Chemistry" 17th Ed. Dhanpat Rai Pub. Co., New Delhi,(2015).
2. S.S. Dara, S.S. Umare, "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2020).
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India (P) Ltd. New Delhi, (2018).
4. P. Kannan, A. Ravikrishnan, "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company (P) Ltd. Chennai, (2009).

REFERENCE BOOKS

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tata McGraw–Hill Pub.Co.Ltd, New Delhi (2008).
3. Prasanta Rath, "Engineering Chemistry", Cengage Learning India (P) Ltd., Delhi, (2015).
4. Shikha Agarwal, "Engineering Chemistry–Fundamentals and Applications", Cambridge University Press, Delhi, (2015).
5. A. Pahari, B. Chauhan, "Engineering Chemistry", Firewall Media., New Delhi., (2010).
6. Sheik Mideen., Engineering Chemistry, Airwalk Publications, Chennai (2018).

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Able to understand impurities in industrial water, boiler troubles, internal and external treatment methods of purifying water.
CO2	Able to understand concepts of absorption, adsorption, adsorption isotherms, application of adsorption for pollution abatement, catalysis and enzyme kinetics.
CO3	Able to recognize significance of alloying, functions of alloying elements and types of alloys, uses of alloys, phase rule, reduced phase and its applications in alloying.
CO4	Able to identify various types of fuels, properties, uses and analysis of fuels. They should be able to understand combustion of fuels, method of preparation of bio-diesel, synthetic petrol.
CO5	Able to understand conventional, non-conventional energy sources, nuclear fission and fusion, power generation by nuclear reactor, wind, solar energy and preparation, uses of various batteries.

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	2	2	2	2	2	2	2	1
CO2	3	3	2	2	2	2	2	1	1	1	1	2	2	1	1
CO3	3	3	3	3	3	2	2	1	2	2	2	2	2	2	2
CO4	3	3	3	2	2	3	3	2	2	3	2	2	3	1	2
CO5	3	2	3	3	3	3	3	2	2	2	2	2	3	2	3

GE1105	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

- To know the basics of algorithmic problem solving
- To write simple python programs
- To develop python program by using control structures and functions
- To use python predefined data structures
- To write file-based program

UNIT I	ALGORITHMIC PROBLEM SOLVING	9
Algorithms, Building blocks of algorithms: statements, state, control flow, functions, Notation: pseudo code, flow chart, programming language, Algorithmic problem solving: Basic algorithms, flowcharts and pseudocode for sequential, decision processing and iterative processing strategies, Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.		CO1
UNIT II	**INTRODUCTION TO PYTHON**	**9**
Python Introduction, Technical Strength of Python, Python interpreter and interactive mode, Introduction to colab , pycharm and jupyter idle(s) ,Values and types: int, float, boolean, string, and list; Built-in data types, variables, Literals, Constants, statements, Operators: Assignment, Arithmetic, Relational, Logical, Bitwise operators and their precedence, Expressions, tuple assignment, Accepting input from Console, printing statements, Simple Python programs.		CO2
UNIT III	**CONTROL FLOW, FUNCTIONS AND STRINGS**	**9**
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for; Loop manipulation using pass, break, continue, and else; Modules and Functions: function definition and use, flow of execution, parameters and arguments, local and global scope, return values, function composition, recursion. Strings: string slices, immutability, string functions and methods, string module; Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		CO3
UNIT IV	**LISTS, TUPLES, DICTIONARIES**	**9**
Lists: Defining list and list slicing, list operations, list slices, list methods, list loop, list Manipulation, mutability, aliasing, cloning lists, list parameters, lists as arrays. Tuples: tuple assignment, tuple as return value, tuple Manipulation; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.		CO4
UNIT V	**FILES, MODULES, PACKAGES**	**9**
Files and exception: Concept of Files, Text Files; File opening in various modes and closing of a file, Format Operators, Reading from a file, Writing onto a file, File functions- open(), close(), read(),readline(), readlines(),write(), writelines(),tell(),seek(), Command Line arguments; Errors and exceptions: handling exceptions; modules, packages; introduction to numpy, matplotlib. Illustrative programs: word count, copy a file.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist ‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016

   (http://greenteapress.com/wp/thinkpython/)

2. Guido van Rossum and Fred L. Drake Jr, “ An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press, 2019.

REFERENCE BOOKS

1. John V Guttag, “Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
5. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop algorithmic solutions to simple computational problems
CO2	Develop simple console application in python
CO3	Develop python program by applying control structure and decompose program into functions.
CO4	Represent compound data using python lists, tuples, and dictionaries.
CO5	Read and write data from/to files in Python.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

GE1106	ENGINEERING GRAPHICS	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	2	0	4	4

OBJECTIVES

- ❖ To develop graphic skills for communication of concepts, ideas and design of engineering products.
- ❖ To inculcate drawing practice in standardized form whenever technical drawing is needed.
- ❖ To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)	**1**
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	

UNIT I	**PLANE CURVES AND FREEHAND SKETCHING**	**7+12**
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloidal curves – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects (Draw without using drawing instruments)		**CO1**

UNIT II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**6+12**
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		**CO2**

UNIT III	**PROJECTION OF SOLIDS**	**5+12**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes when the solid is simply suspended by rotating object method.		**CO3**

UNIT IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OFSURFACES**	**6+12**
Sectioning of simple solids like prisms, pyramids, cylinder, and cone in a simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones - Graphically finding the shortest distance connecting two points.		**CO4**

UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+12**
Principles of isometric projection — isometric scale –Isometric projections and isometric views of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method		**CO5**
		TOTAL : 90 PERIODS

TEXT BOOKS

1. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, Twenty Ninth Edition 2017
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2011.
3. S. Ramachandran and K. Pandian, “Engineering Graphics” Airwalk Publications; 8th edition 2014.

REFERENCE BOOKS

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2018.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Comput er Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the fundamentals and standards of Engineering graphics
CO2	Perform freehand sketching of basic geometrical constructions and multiple views of objects
CO3	Understand the concept of orthographic projections of lines and plane surfaces
CO4	Draw the projections of section of solids and development of surfaces
CO5	Visualize and to project isometric and perspective sections of simple solids

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)											PROGRAM SPECIFIC OUTCOMES (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	-	-	3	3	2	3	-	1	1
CO2	3	1	2	2	1	1	-	-	3	3	2	3	-	1	1
CO3	3	1	1	3	1	1	-	-	3	3	2	3	-	1	1
CO4	3	1	1	3	1	1	-	-	3	3	2	3	-	1	1
CO5	3	1	2	3	1	1	-	-	3	3	2	3	-	1	1

GE1209	தமிழர் மரபு	L	T	P	C
		1	0	0	1

அலகு I	**மொழி மற்றும் இலக்கியம்**	3
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 பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன் மார்கள் – 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
நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை , வீணை , யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.		
அலகு III	**நாட்டுப்புறக் கலைகள் மற்றும் வீர விலையாட்டுகள்**	3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்		
அலகு IV	**தமிழர்களின் திணைக் கோட்பாடுகள்**	3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்கொப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடுகள் – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துளற முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.		
அலகு V	**இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு**	3
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.		
		TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

GE1209	HERITAGE OF TAMILS	L	T	P	C
	(Common to all Branches of B.E./ B. Tech Programmes)	1	0	0	1

UNIT I	**LANGUAGE AND LITERATURE**	3
Language Families in India – Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.		
UNIT II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
UNIT III	**FOLK AND MARTIAL ARTS**	3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT IV	**THINAI CONCEPT OF TAMILS**	3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		
	TOTAL : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

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

GE1107	PYTHON PROGRAMMING LABORATORY	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	0	0	4	2

OBJECTIVES

- ❖ To write, test, and debug simple Python programs.
- ❖ To implement Python programs with conditionals and loops.
- ❖ Use functions for structuring Python programs.
- ❖ Represent compound data using Python lists, tuples, and dictionaries.
- ❖ Read and write data from/to files in Python.

LIST OF EXPERIMENTS

1. Write an algorithm and draw flowchart illustrating mail merge concept.	**CO1**
2. Write an algorithm, draw flowchart and write pseudo code for a real life or scientific or technical problems	
3. Scientific problem-solving using decision making and looping. • Armstrong number, palindrome of a number, Perfect number.	
4. Simple programming for one dimensional and two-dimensional arrays. • Transpose, addition, multiplication, scalar, determinant of a matrix	
5. Program to explore string functions and recursive functions.	**CO2**
6. Utilizing 'Functions' in Python • Find mean, median, mode for the given set of numbers in a list. • Write a function dups to find all duplicates in the list. • Write a function unique to find all the unique elements of a list. • Write function to compute gcd, lcm of two numbers.	
7. Demonstrate the use of Dictionaries and tuples with sample programs.	
8. Implement Searching Operations: Linear and Binary Search.	
9. To sort the 'n' numbers using: Selection, Merge sort and Insertion Sort.	
10. Find the most frequent words in a text of file using command line arguments.	**CO3**
11. Demonstrate Exceptions in Python.	
12. Applications**:** Implementing GUI using turtle, pygame.	

TOTAL: 60 PERIODS

REFERENCE BOOKS

1. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press, 2019
2. Allen B. Downey , " Think Python: How to Think Like a Computer Scientist", Second Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
3. Shroff "Learning Python: Powerful Object-Oriented Programming; Fifth edition, 2013.
4. David M.Baezly "Python Essential Reference". Addison-Wesley Professional; Fourth edition, 2009.
5. David M. Baezly "Python Cookbook" O'Reilly Media; Third edition (June 1, 2013)

WEB REFERENCES
1. http://www.edx.org

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Develop simple console applications through python with control structure and functions
CO2	Use python built in data structures like lists, tuples, and dictionaries for representing compound data.
CO3	Read and write data from/to files in Python and applications of python.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

BS1108	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	0	0	4	2

OBJECTIVES

The students will be trained to perform experiments to study the following.

- ❖ The Properties of Matter
- ❖ The Optical properties, Characteristics of Lasers & Optical Fibre
- ❖ Electrical & Thermal properties of Materials
- ❖ Enable the students to enhance accuracy in experimental measurements.
- ❖ To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis
- ❖ Instrumental method of analysis such as potentiometry, conductometry and pHmetry

LIST OF EXPERIMENTS – PHYSICS

(A minimum of 5 experiments to be performed from the given list)

1. Determination of Young's modulus of the material of the given beam by Non-uniform bending method.	**CO1**
2. Determination of Young's modulus of the material of the given beam by uniform bending method.	
3. Determination of rigidity modulus of the material of the given wire using torsion pendulum.	
4. Determination of wavelength of mercury spectra using Spectrometer and grating.	**CO2**
5. Determination of dispersive power of prism using Spectrometer.	
6. (a) Determination of wavelength and particle size using a laser. (b) Determination of Numerical and acceptance angle of an optical fibre.	
7. Determination of energy band gap of the semiconductor.	
8. Determination of coefficient of thermal conductivity of the given bad conductor using Lee's disc.	

DEMONSTRATION EXPERIMENT

1. Determination of thickness of a thin sheet / wire – Air wedge method	**CO1**

LIST OF EXPERIMENTS – CHEMISTRY

(A minimum of 6 experiments to be performed from the given list)

1. Determination of chloride content of water sample by argentometric method.	**CO3**
2. Estimation of copper content of the given solution by Iodometry.	
3. Determination of strength of given hydrochloric acid using pH meter.	
4. Determination of strength of acids in a mixture of acids using conductivity meter.	**CO4**
5. Estimation of iron content of the given solution using potentiometer.	
6. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.	
7. Conductometric titration of strong acid vs strong base.	
8. Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.	**CO5**
9. Determination of total, temporary & permanent hardness of water by EDTA method.	
10. Determination of DO content of water sample by Winkler's method.	

DEMONSTRATION EXPERIMENTS	
1. Estimation of iron content of the water sample using spectrophotometer (1,10-Phenanthroline / thiocyanate method).	**CO3**
2. Estimation of sodium and potassium present in water using flame photometer.	**CO5**
	TOTAL: 60 PERIODS

REFERENCE BOOKS

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2017.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2013.
4. P.C.Jain, Monica Jain, “Engineering Chemistry” 17th Ed. Dhanpat Rai Pub. Co., New Delhi,(2015).
5. S.S. Dara, S.S. Umare, “A text book of Engineering Chemistry” S.Chand & Co.Ltd., New Delhi (2020).

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Able to understand the concept about the basic properties of matter like stress, strain and types of moduli Able to understand the concept of optics like reflection, refraction, diffraction by using spectrometer grating.
CO2	Able to understand the thermal properties of solids, specific heat and some models for specific heat calculation. Able to understand the working principle of laser components and working of different laser system. Able to understand the phenomenon of light, applications of fibre optics.
CO3	Able to understand the concept of determining the pH value by using pH meter. Able to understand the concept about the amount of chloride present in the given sample of water.
CO4	Able to understand the concept of determining the emf values by using potentiometer Able to understand the concept about the measurement of conductance of strong acid and strong base by using conductivity meter.
CO5	Able to understand the amount of dissolved oxygen present in the water. Able to understand the concept of estimation of hardness of water by EDTA method. Able to understand the concept of estimation of alkalinity in water sample.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	2	1	1	1	3	2	2	3	2	2	2
CO2	3	1	2	1	1	1	1	1	2	1	1	2	2	2	2
CO3	3	1	2	1	2	2	2	1	2	1	1	1	2	2	1
CO4	3	2	1	1	2	1	1	1	2	1	1	2	2	1	2
CO5	3	2	1	1	1	2	2	1	2	1	2	1	2	1	1

HS1201	PROFESSIONAL ENGLISH	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

- ❖ Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- ❖ Foster their ability to write convincing job applications and effective reports.
- ❖ Develop their speaking skills to make technical presentations, participate in group discussions.
- ❖ Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT I	READING AND STUDY SKILLS	9
Listening-Listening Comprehension of a discussion on a technical topic of common interest by three or four participants (real life as well as online videos). -Speaking — describing a process-Reading: Practice in chunking and speed reading - Paragraphing- Writing- interpreting charts, graphs- Vocabulary Development: Important foreign expressions in Use, homonyms, homophones, homographs- easily confused words Language Development- impersonal passive voice, numerical adjectives.		CO1

UNIT II	READING AND STUDY SKILLS	9
Listening-Listening Comprehension of a discussion on a technical topic of common interest by three or four participants (real life as well as online videos). -Speaking — describing a process-Reading: Practice in chunking and speed reading - Paragraphing- Writing- interpreting charts, graphs- Vocabulary Development: Important foreign expressions in Use, homonyms, homophones, homographs- easily confused words Language Development- impersonal passive voice, numerical adjectives.		CO2

UNIT III	TECHNICAL WRITING AND GRAMMAR	9
Listening — listening to conversation — effective use of words and their sound aspects, stress, intonation & pronunciation - Speaking – mechanics of presentations -Reading: Reading longer texts for detailed understanding. (GRE/IELTS practice tests); Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Informal vocabulary and formal substitutes-Misspelled words. Language Development- embedded sentences and Ellipsis.		CO3

UNIT IV	REPORT WRITING	9
Listening — Model debates & documentaries and making notes. Speaking — expressing agreement/disagreement, assertiveness in expressing opinions-Reading: Technical reports, advertisements and minutes of meeting - Writing- email etiquette- job application – cover letter –Résumé preparation(via email and hard copy)- analytical essays and issue based essays- - Vocabulary Development- finding suitable synonyms-paraphrasing- Language Development- clauses- if conditionals.		CO4

UNIT V	GROUP DISCUSSION AND JOB APPLICATIONS	9
Listening: Extensive Listening. (radio plays, rendering of poems, audio books and others) Speaking –participating in a group discussion - Reading: Extensive Reading (short stories, novels, poetry and others)– Writing reports- minutes of a meeting- accident and survey- Writing a letter/ sending an email to the Editor - cause and effect sentences -Vocabulary Development- verbal analogies. Language Development- reported speech.		CO5
	TOTAL : 45 PERIODS	

TEXT BOOKS

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2020.
2. Barun K Mitra, Effective Technical Communication Oxford University Press : 2006.
3. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

REFERENCE BOOKS

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning,USA: 2007.
6. Caroline Meyer & Bringi dev, Communicating for Results Oxford University Press: 2021.
7. Aruna Koneru, Professional Speaking Skills, Oxford University Press :2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
CO3	Read different genres of texts adopting various reading strategies.
CO4	Listen/view and comprehend different spoken discourses/excerpts in different accents
CO5	Identify topics and formulate questions for productive inquiry

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	2	3	-	-	-	-	3
CO2	-	1	-	2	-	-	-	-	-	3	-	-	-	-	-
CO3	-	2	-	3	-	-	-	-	1	2	-	-	3	-	1
CO4	-	-	-	-	1	-	-	-	2	2	-	-	1	-	2
CO5	-	2	1	1	2	-	2	-	-	3	-	-	2	-	1

MA1202	ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of B.E. / B. Tech Programmes - Except AI-DS & AI-ML)		3	1	0	4

OBJECTIVES

- This course is designed to cover topics such as Differential Equation, Vector Calculus, Complex Analysis and Laplace Transform.
- The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines

UNIT I	ORDINARY DIFFERENTIAL EQUATIONS	12
Higher order linear differential equations with constant coefficients - Method of variation of parameters– Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients		CO1

UNIT II	VECTOR CALCULUS	12
Gradient and directional derivative — Divergence and curl - Vector identities — Irrotational and Solenoidal vector fields — Line integral over a plane curve — Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals		CO2

UNIT III	COMPLEX VARIABLES	12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions $w = Z + C$, CZ, $1/Z$ - Bilinear transformation		CO3

UNIT IV	COMPLEX INTEGRATION	12
Cauchy's integral theorem — Cauchy's integral formula — Taylor's and Laurent's series — Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi circular contour(excluding poles on the real line)		CO4

UNIT V	LAPLACE TRANSFORMS	12
Existence conditions – Transforms of elementary functions –Basic properties – Transform of unit step function and unit impulse function - Shifting theorems - transforms of derivatives and integrals —– Inverse transforms — Convolution theorem — Transform of periodic functions — Application to solution of linear second order ordinary differential equations with constant coefficients		CO5

TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016

REFERENCE BOOKS

1. G Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., “ Advanced Engineering Mathematics, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. O’Neil, P.V. “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, “Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Apply various techniques in solving differential equations
CO2	Gradient, divergence and curl of a vector point function and related identities
CO3	Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification
CO4	Analytic functions, conformal mapping and complex integration
CO5	Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	-	-	1	1	3	3	3	3
CO2	3	3	2	3	2	2	1	-	-	-	-	2	2	2	2
CO3	3	2	2	2	2	1	1	-	-	-	-	1	2	2	2
CO4	3	3	3	2	2	2	1	-	-	-	-	1	2	2	2
CO5	3	3	3	2	2	2	1	-	-	-	-	1	2	3	3

PH1252	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C
	(Common to CSE, IT, AI-DS & AI-ML)	3	0	0	3

OBJECTIVES

- To understand the essential principles of physics of semiconductor device and Electron transport properties.
- To have the necessary understanding in optical properties of materials.
- Grasp the principles of magnetic materials and its applications.
- To understand the basics of Nano-electronic devices.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9
Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three-dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids - Electron effective mass – concept of hole- Applications of low resistive and high resistive materials.		CO1
UNIT II	**SEMICONDUCTOR PHYSICS**	**9**
Intrinsic Semiconductors — Energy band diagram — direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature — variation of Fermi level with temperature and impurity concentration — Carrier transport in Semiconductor– Hall effect and devices – Ohmic contacts – Schottky diode-Semiconducting polymers.		CO2
UNIT III	**MAGNETIC PROPERTIES OF MATERIALS**	**9**
Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification: diamagnetism — paramagnetism — ferromagnetism — antiferromagnetism — ferrimagnetism –Curie temperature — Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses-— Magnetic principle in computer data storage — Magnetic hard disc — Spintronics - GMR Sensor (Giant Magnetoresistance) – TMR (Tunnel Magnetoresistance)		CO3
UNIT IV	**OPTICAL PROPERTIES OF MATERIALS**	**9**
Classification of optical materials — carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode — solar cell - LED — Organic LED — p-i-n Photodiodes - Avalanche Photodiodes -Optical data storage techniques- Holography – applications.		CO4
UNIT V	**NANO DEVICES**	**9**
Electron density in bulk material – Size dependence of Fermi energy – Quantum confinement – Quantum structures — Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterials — Tunneling: single electron phenomena and single electron transistor – Quantum dot laser - Ballistic transport – Carbon nanotubes: Properties and applications - Material Processing by chemical vapour deposition and Laser Ablation method – Graphene: Properties and applications.		CO5
	TOTAL : 45 PERIODS	

TEXT BOOKS

1. Jasprit Singh, “Semiconductor Devices: Basic Principles, Wiley 2012.
2. Donald Neaman, Dhrubes Biswas , Semiconductor Physics and Devices (SIE), 4th Edition, 2017
3. Salivahanan,S., Rajalakshmi,A., Karthie,S., Rajesh,N.P., “Physics for Electronics Engineering and Information Science”, McGraw Hill Education (India) Private Limited, 2018.
4. Kasap, S.O. “Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
5. Kittel, C. “Introduction to Solid State Physics”. Wiley, 2005.

REFERENCE BOOKS

1. Garcia, N. & Damask, A. “Physics for Computer Science Students. Springer-Verlag, 2012.
2. Hanson, G.W. “Fundamentals of Nanoelectronics. Pearson Education, 2009.
3. Rogers, B., Adams, J. & Pennathur, S. “Nanotechnology: Understanding

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain knowledge on classical and quantum electron theories, and energy band structures.
CO2	Acquire knowledge on basics of semiconductor physics and its applications in various Devices.
CO3	Get knowledge on magnetic properties of materials and their applications in data storage.
CO4	Have the necessary understanding on the functioning of optical materials for Optoelectronics.
CO5	Understand the basics of quantum structures and their applications in carbon electronics.

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	2	1	1	1	2	1	3	2	2
CO2	3	3	1	1	3	1	1	1	2	2	2	1	2	2	3
CO3	3	3	1	1	2	2	1	1	1	1	1	2	2	2	2
CO4	3	3	3	2	2	1	1	1	2	2	1	3	3	3	3
CO5	3	3	3	2	3	1	1	1	2	1	2	3	3	3	3

GE1204	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
(Common to all branches of B.E. / B. Tech Programmes)		3	0	0	3

OBJECTIVES

- To study the inter relationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.
- To study the dynamic processes and understand the features of the earth‘s interior and surface.

UNIT I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	9
Definition, scope and importance of environment — Need for public awareness — Role of Individual in Environmental protection – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Food chains, food webs and ecological pyramids — Ecological succession — Types, characteristic features, structure and function of forest, grass land, desert and aquatic (ponds, lakes, rivers, oceans, estuaries) ecosystem. Biodiversity – Definition – Genetic, species and ecosystem diversity – Value of biodiversity – Consumptive use, productive use, social, ethical, aesthetic and option values — Biodiversity at global, national and local levels — India as a mega–diversity nation — Hot spots of biodiversity — Threats to biodiversity– Habitat loss, poaching of wild life, human-wildlife conflicts – Wildlife protection act and forest conservation act –Endangered and endemic species – Conservation of biodiversity – In-situ and ex–situ conservation of biodiversity.		**CO1**

UNIT II	ENVIRONMENTAL POLLUTION	9
Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: causes, effects and control measures of municipal solid wastes – Problems of e-waste – Role of an individual in prevention of pollution – Pollution case studies – Disaster management – Floods, earthquake, cyclone, tsunami and landslides – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.		**CO2**

UNIT III	NATURAL RESOURCES	9
Forest resources: Use and over-exploitation — Deforestation — Case studies — Timber extraction, mining, dams and their effects on forests and tribal people – Water resources – Use and overutilization of surface and ground water, floods, drought, conflicts over water – Dams: benefits and problems – Mineral resources: Use and exploitation – Environmental effects of extracting and using mineral resources – Case studies – Food resources: World food problems – Changes caused by agriculture and overgrazing – Effects of modern agriculture: fertilizer–pesticide problems, water logging, salinity – Case studies – Energy resources: Growing energy needs – Renewable and non renewable energy sources – Use of alternate energy sources – Case studies — Land resources: Land as a resource — Land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles – Field study of local area to document environmental assets – River / Forest / Grassland / Hill / Mountain.		**CO3**

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	9
From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Role of non-governmental organization – Environmental ethics – Issues and possible solutions – Climate change – Global warming – Acid rain, Ozone layer depletion –Nuclear accidents and holocaust – Case studies – Wasteland reclamation — Consumerism and waste products — Principles of Green Chemistry — Environment protection act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife protection Act – Forest conservation act – Enforcement machinery involved in environmental legislation– Central and state pollution control boards– National Green Tribunal – Public awareness.		**CO4**
UNIT V	**HUMAN POPULATION AND THE ENVIRONMENT**	**9**
Population growth — Variation among nations — Population explosion — Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – COVID 19 – Women and child welfare – Role of information technology in environment and human health – Case studies.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2014).
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, (2004).
3. Dr. A. Sheik Mideen and S.Izzat Fathima, "Environmental Science and Engineering", Airwalk Publications, Chennai, (2018).

REFERENCE BOOKS

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, (2007).
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt, Ltd, Hydrabad, (2015).
3. G. Tyler Miller,Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt.Ltd,Delhi, (2014).
4. R. Rajagopalan, 'Environmental Studies-From Crisis to Cure', Oxford University Press, (2005).
5. Anubha Kaushik , C.P. Kaushik, "Perspectives in Environmental Studies", New Age International Pvt. Ltd, New Delhi, (2004).
6. Frank R. Spellman, "Handbook of Environmental Engineering", CRC Press, (2015).

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Obtain knowledge about environment, ecosystems and biodiversity.
CO2	Take measures to control environmental pollution.
CO3	Gain knowledge about natural resources and energy sources.
CO4	Find and implement scientific, technological, economic and political solutions to environmental problems.
CO5	Understand the impact of environment on human population.

MAPPING OF COs WITH POs AND PSOs															
Cos	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3	3	3	3	3	2	2	2	3	2	1	2
CO2	3	2	3	3	2	3	3	3	3	2	2	3	2	2	2
CO3	3	3	2	2	3	3	2	2	1	2	1	3	2	2	2
CO4	3	3	3	3	1	2	3	3	2	2	2	2	2	1	2
CO5	3	2	3	2	3	3	3	2	2	2	2	3	3	2	3

BE1251	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING	L	T	P	C
	Common to CSE, IT, AI-DS & AI-ML	3	0	0	3

OBJECTIVES

- To learn the fundamental laws, network theorems and analyse the electric circuits.
- To study the basic principles of electrical machines and their performance.
- To study the fundamentals of power systems.
- To learn the characteristics of various electron devices and Op Amp integrated circuit.
- To understand the principle and operation of measuring instruments and transducers.

UNIT I	ELECTRIC CIRCUITS ANALYSIS	9
Ohms Law, Kirchhoff's Law-Instantaneous power - Series and parallel circuit: analysis of resistive, capacitive and inductive network, star delta conversion, Nodal analysis and mesh analysis. Network theorems: Thevenin's theorem, Norton's theorem, superposition theorem and maximum power transfer theorem. Three phase ac supply –Instantaneous power, Reactive power and apparent power.		CO1

UNIT II	ELECTRICAL MACHINES	9
DC and AC ROTATING MACHINES: Types, Construction, principle, EMF and torque equation, application, Speed Control. Basics of Stepper Motor and Brushless DC motors. Transformers-Introduction, types and construction, working principle of Ideal transformer, EMF equation, All day efficiency calculation.		CO2

UNIT III	FUNDAMENTALS OF POWER SYSTEM	9
Structure of power system. Sources of electrical energy — Non-renewable, Renewable-Storage systems: Batteries-Ni-Cd, Pb -Acid and Li-ion, SOC (State of Charge), DOD (Depth of Discharge) Characteristics. Utilization of electrical power - DC and AC load applications. - Electric circuit Protection-need for earthing, fuses and circuit breakers.		CO3

UNIT IV	ELECTRON DEVICES AND INTEGRATED CIRCUITS	9
PN Junction-VI Characteristics of Diode, Zener diode, Rectifiers, Zener voltage regulator. Transistor configurations — CE amplifier - RC and LC oscillators. Op Amps — Basic characteristics and its applications.		CO4

UNIT V	MEASURING INSTRUMENTS AND TRANSDUCERS	9
Characteristic of measurement-errors in measurement — Principle and working of indicting instrument- Moving Coil meter, Moving Iron meter, Energy meter and watt meter, Cathode Ray Oscilloscope —- Transducers, thermo-electric, RTD, Strain gauge, LVDT, LDR, and piezoelectric transducer.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, fourth Edition, 2019
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.

REFERENCE BOOKS

1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016
2. B.L Theraja, Fundamentals of Electrical Engineering and Electronics. S.Chand & Co, 2008.
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015
4. John Bird, "Electrical and Electronic Principles and Technology", Fourth Edition, Elsevier, sixth edition,2017.
5. Mittle,Mittal, Basic Electrical Engineering", 2nd Edition, Tata McGraw-Hill Edition, 2016.
6. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age international pvt.ltd.,2003

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Ability to learn the fundamental laws, theorems of electrical circuits and to analyze them
CO2	Ability to understand the basic construction and operating principle of dc and ac machines.
CO3	Ability to understand the electrical power generation, energy storage and utilization of electric power.
CO4	Ability to understand the characteristics of various electronic devices and Op Amp integrated circuit.
CO5	Ability to understand the principles and operation of measuring instruments and transducers.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	1	1	2	3	2	1	2	3	1	2
CO2	3	3	3	3	1	1	1	2	3	2	1	2	3	1	2
CO3	3	3	3	3	1	1	1	2	3	2	1	2	3	1	2
CO4	3	3	3	3	1	1	1	3	3	3	1	3	3	1	3
CO5	3	3	3	3	1	1	1	2	3	2	1	2	3	1	2

CS1206	PROGRAMMING IN C	L	T	P	C
	(Common to CSE, IT, AI-DS & AI-ML)	3	0	0	3

OBJECTIVES

- To develop C Programs using basic programming constructs
- To develop C programs using arrays, strings and functions
- To develop applications in C using pointers
- To develop applications in C using structures and union
- To develop applications using sequential and random-access file processing.

UNIT I	BASICS OF C PROGRAMMING	9
An overview of C: History of C; Compiler Vs. Interpreter, Structure of a C Program, Compiling a C Program; Basic data types: Modifiers, Variables: Type qualifiers, Storage class specifiers; Constants: Enumeration Constants; Keywords; Operators: Precedence and Associativity; Expressions: Order of evaluation, Type conversion in expression, Casts; Input/Output statements; Assignment statements, Selection statements; Iteration statements; Jump statements; Expression statements; Pre-processor directives: Compilation process.		**CO1**

UNIT II	ARRAYS, STRINGS AND FUNCTIONS	9
Introduction to Arrays: Declaration, Initialization, Single dimensional array, Two dimensional array, Array manipulations; String operations: length, compare, concatenate, copy; Functions: General form of a function, Function Arguments, Built-in functions, return statement, Recursion		**CO2**

UNIT III	POINTERS	9
Pointers: Declaring and defining pointers, Pointer operators, Pointer expression; Pointer assignment, Pointer conversions, Pointer arithmetic, Pointer comparisons; Pointers and Arrays: Array of pointers; Multiple indirection; Pointers to function; Problems with pointers; Parameter passing: Pass by value, Pass by reference.		**CO3**

UNIT IV	STRUCTURES AND UNIONS	9
Structure: Accessing structure members, structure assignments; Nested structures; Pointer and Structures; Array of structures; Passing structures to functions: Passing structure member to function, Passing entire structure to functions; Arrays in structures; Self-referential structures; Dynamic memory allocation; typedef statement, Union and Enumeration.		**CO4**

UNIT V	FILE PROCESSING	9
File system basics: File pointer, opening and closing a File; reading and writing character; working with String: fputs() and fgets(); rewind(); ferror(); fread() and fwrite(); Erasing files; Types of file processing: Sequential access; Random access: fprintf() and fscanf(), fseek() and ftell(); Command line arguments.		**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Herbert Schildt, C The Complete Reference, Fourth Edition, McGraw-Hill.
2. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, 'C How to Program, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, 'Programming in C, CENGAGE Learning India pvt. Ltd., 2011.
3. Pradip Dey, Manas Ghosh, 'Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, 'Computer Fundamentals and Programming in C, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop simple applications in C using basic constructs.
CO2	Design and implement applications using arrays, strings and functions.
CO3	Develop and implement applications in C using pointers.
CO4	Develop applications in C using structures and union.
CO5	Design applications using sequential and random-access file processing.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
CO2	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
CO3	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
CO4	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
CO5	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2

GE1210	Tamils and Technology	L	T	P	C
(Common to all Branches of B.E. / B. Tech Programmes)		1	0	0	1

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

TEXT-CUM-REFERENCE BOOKS

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

GE1210	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
(Common to all Branches of B.E. / B. Tech Programmes)		1	0	0	1

அலகு I	**நெசவு மற்றும் பானைத் தொழில்நுட்பம்**	3
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.		
அலகு II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**	3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை .		
அலகு III	**உற்பத்தித் தொழில்நுட்பம்**	3
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு IV	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்**	3
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.		
அலகு V	**அறிவியல் தமிழ் மற்றும் கணித்தமிழ்**	3
அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இளணயத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.		
TOTAL : 15 PERIODS		

TEXT-CUM-REFERENCE BOOKS

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

GE 1207	ENGINEERING PRACTICES LABORATORY	L	P	T	C
	(Common to all branches of B.E. / B. Tech Programmes)	0	0	4	2

OBJECTIVES

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE **13**

Buildings:

a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

b) Study of pipe connections requirements for pumps and turbines.

c) Preparation of plumbing line sketches for water supply and sewage works.

d) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

e) Demonstration of plumbing requirements of high-rise buildings.

CO1

Carpentry using Power Tools only:

a) Study of the joints in roofs, doors, windows and furniture.

b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE **18**

Welding:

a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

b) Gas welding practice

Basic Machining:

a) Simple Turning and Taper turning

b) Drilling Practice

Sheet Metal Work:

a) Forming & Bending.

b) Model making – Trays and funnels.

c) Different type of joints.

CO2

Machine assembly practice:

a) Study of centrifugal pump

b) Study of air conditioner

Demonstration on:

a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

b) Foundry operations like mould preparation for gear and step cone pulley.

c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)	
III ELECTRICAL ENGINEERING PRACTICE 13 1. Residential house wiring using switches, fuse, indicator, lamp and energy meter. 2. Fluorescent lamp wiring. 3. Stair case wiring 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.	**CO3**
5. Measurement of energy using single phase energy meter. 6. Measurement of resistance to earth of an electrical equipment.	**CO4**
IV ELECTRONICS ENGINEERING PRACTICE 16 1. Study of electronic components and equipment‘s — Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR. 2. Study of logic gates AND, OR, EX-OR and NOT. 3. Generation of Clock Signal. 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB. Measurement of ripple factor of HWR and FWR.	**CO5**
TOTAL: 60 PERIODS	

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required
	CIVIL	
1.	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 sets
2.	Carpentry vice (fitted to work bench)	15 Nos
3.	Standard woodworking tools 15 Sets.	15 Sets.
4.	Models of industrial trusses, door joints, furniture joints	5 each
5.	**Power Tools:** (a) Rotary Hammer (b) Demolition Hammer (c) Circular Saw (d) Planer (e) Hand Drilling Machine (f) Jigsaw	2 Nos
	MECHANICAL	
1.	Arc welding transformer with cables and holders.	5 Nos
2.	Welding booth with exhaust facility.	5 Nos
3.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets
4.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5.	Centre lathe.	2 Nos
6.	Hearth furnace, anvil and smithy tools.	2 Sets
7.	Moulding table, foundry tools.	2 Sets
8.	Power Tool: Angle Grinder.	2 Nos
9.	**Study-purpose items:** centrifugal pump, air-conditioner.	1 each

ELECTRICAL		
1.	Assorted electrical components for house wiring.	15 Sets
2.	Electrical measuring instruments.	10 Sets
3.	**Study purpose items:** Iron box, fan and regulator, emergency lamp.	1 each
4.	Megger (250V/500V).	1 No.
5.	**Power Tools:** (a) Range Finder (b) Digital Live-wire detector	2 Nos
ELECTRONICS		
1.	Soldering guns 10 Nos.	10 Nos.
2.	Assorted electronic components for making circuits 50 Nos.	50 Nos.
3.	Small PCBs.	10 Nos.
4.	Multimeters	10 Nos.
5.	**Study purpose items:** Telephone, FM radio, low-voltage power supply	1 each

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Fabricate carpentry components and pipe connections including plumbing works. Use welding equipment's to join the structures.
CO2	Carry out the basic machining operations Make the models using sheet metal works
CO3	Carry out basic home electrical works and appliances.
CO4	Measure the electrical quantities
CO5	Elaborate on the components, gates, soldering practices

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	-	-	3	-	-	-	-	-	3	3	3	3
CO2	3	2	3	-	-	3	-	-	-	-	-	3	3	3	3
CO3	3	1	2	-	-	2	-	-	-	-	-	3	3	3	3
CO4	3	1	3	-	-	3	-	-	-	-	-	3	3	3	3
CO5	3	2	2	-	-	2	-	-	-	-	-	3	2	2	2

CS1208	PROGRAMMING IN C LABORATORY	L	T	P	C
	Common to CSE, IT, AI-DS & AI-ML	0	0	4	2

OBJECTIVES

- ❖ To develop programs in C using basic constructs.
- ❖ To develop applications in C using strings, pointers, functions, structures.
- ❖ To develop applications in C using file processing

LIST OF EXPERIMENTS

1. C programming using simple statements and expressions.	**CO1**
2. Scientific problem-solving using decision making and looping.	
3. Generating different patterns using multiple control statements.	
4. Problems solving using one dimensional array.	
5. Mathematical problem solving using two dimensional arrays.	
6. Solving problems using string functions.	**CO2**
7. Solving problems with user defined functions.	
8. Solving problems using recursive function.	
9. Solving problems with dynamic memory allocation.	
10. Realtime application using structures and unions.	
11. Realtime problem solving using sequential and random-access file.	**CO3**
12. Solving problems with command line argument.	

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Problem Solving and Program Design in C, 4th edition, by Jeri R. Hanly and Elli B.Koffman.
2. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
3. Programming in C by Pradip Dey, Manas Ghosh 2nd edition Oxford University Press. E.Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill.
4. A first book of ANSI C by Gray J.Brosin 3rd edition Cengagedelmer Learning India P.Ltd.
5. AL Kelly, Iraphol, Programming in C, 4th edition Addison-Wesley – Professional.
6. Brain W.Kernighan & Dennis Ritchie, C Programming Language, 2nd edition, PHI.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop C programs for simple applications making use of basic constructs.
CO2	Develop C programs involving string, functions, recursion, pointers, and structures.
CO3	Design applications using sequential and random-access file processing.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
CO2	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
CO3	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2

MA1351	PROBABILITY AND STATISTICS	L	T	P	C
	Common to CSE, IT & AI-DS	4	0	0	4

OBJECTIVES

- To understand the basic concepts of probability, one- and two-dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in engineering applications.
- To acquaint the knowledge of testing of hypothesis for small and large samples, which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I	PROBABILITY AND RANDOM VARIABLES	12
Probability – The axioms of probability – Conditional probability – Baye‘s theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.		CO1
UNIT II	**TWO - DIMENSIONAL RANDOM VARIABLES**	**12**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression — Central limit theorem (for independent and identically distributed random variables).		CO2
UNIT III	**RANDOM PROCESSES**	**12**
Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.		CO3
UNIT IV	**TESTING OF HYPOTHESIS**	**12**
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) – Goodness of fit.		CO4
UNIT V	**DESIGN OF EXPERIMENTS**	**12**
One way and Two way classifications - Completely randomized design — Randomized block design –Latin square design - 2^2 factorial design.		CO5
		TOTAL : 60 PERIODS

TEXT BOOKS

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2017.
2. Ibe, O.C., “Fundamentals of Applied Probability and Random Processes", Elsevier, 2nd Indian Reprint, 2014.

REFERENCE BOOKS

1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2017.
2. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2014.
3. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2017.
4. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 4th Edition, Elsevier, 2009.
5. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2008.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Get exposure to random variables and well-founded knowledge of standard distributions which can describe real life phenomena.
CO2	Get ideas to handle situations involving more than one random variable.
CO3	Gain an understanding and characterizes phenomena which evolve with respect to time in a probabilistic manner and modelling the real-life phenomena.
CO4	Gain the knowledge on Large Samples and Small Samples. These concepts are very useful in biological, economical and social experiments and all kinds of generalizations based on information about a smaller sample and larger samples. Apply the appropriate test in the problems related with sampling.
CO5	Do design of experiments, carry them out, and analyze the data.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	1	-	-	-	-	1	1	3	2	1
CO2	3	3	2	2	2	1	-	-	-	-	1	1	3	2	1
CO3	3	2	2	1	1	1	-	-	-	-	1	1	3	2	1
CO4	3	3	2	3	3	2	1	-	-	-	2	2	3	2	1
CO5	3	3	2	3	2	2	1	-	-	-	1	2	2	1	1

CS1302	DATA STRUCTURES	L	T	P	C
	Common to CSE, IT, AI-DS, AI-ML, ECE Semester IV	3	0	0	3

OBJECTIVES

- To understand the concepts of ADTs.
- To learn linear data structures like lists, stacks, and queues.
- To learn Non-linear tree data structures.
- To apply Graph structures
- To understand sorting, searching and hashing algorithms

UNIT I	LINEAR DATA STRUCTURES – LIST	9
Abstract Data Types (ADTs) — List ADT — array-based implementation — linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).		CO1
UNIT II	**LINEAR DATA STRUCTURES – STACKS, QUEUES**	**9**
Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue — applications of queues.		CO2
UNIT III	**NON-LINEAR DATA STRUCTURES – TREES**	**9**
Tree ADT — tree traversals — Binary Tree ADT — expression trees — applications of trees — binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap.		CO3
UNIT IV	**NON-LINEAR DATA STRUCTURES – GRAPHS**	**9**
Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity –Graph Algorithms – Shortest Path Algorithms: Dijkstra's Algorithm – All pair shortest Path Algorithms: Floyds warshall Algorithm – Minimum Spanning Tree: Prim's Algorithm – Kruskal's Algorithm – Applications of Graph.		CO4
UNIT V	**SEARCHING, SORTING AND HASHING TECHNIQUES**	**9**
Searching- Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Radix sort - Merge sort – Quick sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.		CO5
	TOTAL : 45 PERIODS	

TEXT BOOKS

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition , Oxford University Press, 2011.
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley,2013.
4. Bradley N. Miller, David L. Ranum, “ Problem Solving with Algorithms and Data Structures using Python “ , Second Edition, 2013.
5. Rance D. Necaise, Data Structures and Algorithms Using Python, John Wiley & Sons, 2011.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Implement abstract data types for linear data structures.
CO2	Apply the different linear data structures to problem solutions.
CO3	Implement abstract data types for non-linear data structures.
CO4	Apply Graph data structure for the real world problems.
CO5	Critically analyze the various sorting, searching algorithms and hash functions that result in a collision free scenario for data storage and retrieval.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
CO2	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
CO3	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
CO4	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
CO5	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3

CS1303	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	2	4

OBJECTIVES

- ❖ Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP like encapsulation, Inheritance and Polymorphism
- ❖ Design an object-oriented system, GUI components and multithreaded processes as per needs and specifications
- ❖ To provide a Strong foundation for advanced programming using Object Oriented Programming Concepts.

UNIT I	JAVA FUNDAMENTALS	9
Programming Language types and paradigms – Object Oriented Programming Concepts- History of Java - Java buzzwords- JVM architecture – Java Source File Structure – Naming Convention – Data Types – Literals in Java- Scope and life time of variables – Operators in Java- Control Statements in Java - Array – String and StringBuffer		CO1
UNIT II	**OBJECT-ORIENTED PROGRAMMING, INTERFACES AND INHERITANCE**	**9**
Working with Objects - Implementing Classes - Object Construction - Static Variables and Methods — Packages - Nested Classes — Abstract Class - Interfaces — Static, Default and Private Methods – Local and Anonymous Classes – Inheritance – Extending a class - Object: The Cosmic Superclass – Wrapper classes.		CO2
UNIT III	**EXCEPTIONS, COLLECTIONS AND STREAMS**	**9**
Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.		CO3
UNIT IV	**CONCURRENT PROGRAMMING AND GUI PROGRAMMING**	**9**
Threads — Multithreaded Programming — Thread Creation — Life Cycle — Thread Priorities - Synchronization of Threads - Event Handling: Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing Components – Handling menus, Layout Manager – Layout Management types – Border, Grid, Flow, Card and Grid Bag.		CO4
UNIT V	**JAVA SERVER TECHNOLOGIES AND NETWORK PROGRAMMING**	**9**
Introduction to Servlet - Servlet Life Cycle - The Servlet API - Developing and Deploying Servlets - Exploring Deployment - Networking Basics — Exploring java.net classes and interfaces, InetAddress, TCP/IP Client and Server Sockets – Cookies and Datagrams.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Herbert schildt , “The complete reference”, 11th Edition, Tata Mc Graw Hill, New Delhi. 2018.
2. Cay S. Horstmann, “Core Java SE 9 for the Impatient”, 2nd Edition, Addison-Wesley,2017 .
3. Paul Deitel, Harvey M. Deitel, “Java How to Program”, 11th Edition, Pearson Education, 2018.

REFERENCE BOOKS

1. T. Budd, “An Introduction to Object Oriented Programming”, 3rd Edition, Pearson Education, 2009.
2. Y. Daniel Liang , “Introduction to Java programming”, 7th Edition, Pearson education, 2010.
3. C Xavier , “Java Programming – A Practical Approach”, Tata McGraw-Hill Edition, 2011.
4. K. Arnold and J. Gosling, “The Java programming language”, 3rd Edition, Pearson Education, 2000.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	understand the fundamental ideas behind the object-oriented approach to programming
CO2	To inculcate concepts of inheritance to create new classes from existing one & design the classes needed given a problem specification
CO3	Able to create the good application with proper Exception Handling Mechanisms.
CO4	A modern coverage of concurrent programming that focuses on high-level synchronization constructs and the concept of event handling used in GUI.
CO5	An in-depth exposure to the object-oriented programming paradigm, which builds upon programming experience gained in computer science classes.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	2	-	-	2	1	1	1	2	2	1
CO2	1	1	2	1	1	1	2	1	2	1	1	1	2	2	2
CO3	1	1	1	1	1	-	-	1	2	2	2	1	1	2	2
CO4	1	1	2	-	1	-	1	-	1	1	2	1	3	1	3
CO5	2	2	2	2	2	-	1	1	2	1	2	2	1	2	2

CS1304	COMPUTER ARCHITECTURE	L	P	T	C
	Common to CSE, IT & EEE (Elective)	3	0	0	3

OBJECTIVES

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating-point arithmetic unit.
- To learn the basics of pipelined execution.
- To understand parallelism and multi-core processors.
- To understand the memory hierarchies and the ways of communication with I/O devices.

UNIT I	BASIC STRUCTURE OF A COMPUTER SYSTEM	9
Eight ideas-Functional Units — Basic Operational Concepts — Performance — Instructions: Language of the Computer — Operations, Operands — Instruction representation — Logical operations – decision making – MIPS Addressing.		CO1
UNIT II	**DATA REPRESENTATION AND ARITHMETIC FOR COMPUTERS**	**9**
Signed number representation, Addition and Subtraction – Multiplication – Division – Fixed- and Floating-Point Representation – Floating Point Operations.		CO2
UNIT III	**DATA PATH AND CONTROL UNIT**	**9**
A Basic MIPS implementation — Building a Datapath — Control Implementation Scheme — Pipelining — Pipelined data path and control — Handling Data Hazards & Control Hazards — Exceptions.		CO3
UNIT IV	**PARALLELISM**	**9**
Parallel Processing challenges — Flynn‘s classification — SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading — multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.		CO4
UNIT V	**MEMORY AND PERIPHERAL DEVICES**	**9**
Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB’s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits – USB		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. M. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012

REFERENCE BOOKS

1. William Stallings, “Computer Organization and Architecture — Designing for Performance”, Tenth Edition, Pearson Education, 2016.
2. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.
3. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
4. Jim Ledin, “Modern Computer architecture and Organization”, Packt Publishing,2020.
5. Douglas Comer, “Essentials of Computer Architecture”,Taylor and Francis Group 2020

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basics structure of computers, operations and instructions.
CO2	Design arithmetic and logic unit.
CO3	Understand pipelined execution and design control unit.
CO4	Understand parallel processing architectures.
CO5	Understand the various memory systems and I/O communication

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO2	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO3	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO4	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO5	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2

CS1306	DIGITAL PRINCIPLES AND LOGIC DESIGN	L	T	P	C
		3	1	0	4

OBJECTIVES

- To learn Boolean algebra and simplification of Boolean functions.
- To learn to design and analyze different combinational circuits.
- To study the basics of synchronous sequential logic, analyze and design sequential circuits.
- To learn about basic memory devices and programmable logic devices to build simple digital systems.
- To learn to write code in Hardware Definition Language for designing larger digital systems

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES	9+3
Number Systems: Digital and Binary – Number-Base Conversions – Octal and Hexadecimal Numbers – Complements of Numbers – Signed Binary Numbers - Arithmetic Operations – Binary Codes – Binary Logic - Boolean Algebra – Axiomatic Definition of Boolean algebra - Theorems and Postulates — Boolean Functions — Canonical and Standard Forms — Simplification of Boolean Functions – Digital Logic Gates – Implementation of Universal gate		CO1
UNIT II	**COMBINATIONAL LOGIC**	**9+3**
Combinational Circuits — Analysis and Design Procedures - Binary Adders — Subtractor — Multiplier - Decimal Adder - Parity Generator and Checker – Four-bit Binary Parallel Adder - Magnitude Comparator – Decoders – Encoders –Multiplexers – Demultiplexers - Introduction to HDL – HDL Models of Combinational circuits		CO2
UNIT III	**SYNCHRONOUS SEQUENTIAL LOGIC**	**9+3**
Sequential Circuits – Storage Elements: Latches, Flip-Flops – Interconversion of Flip-Flops - Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure – Registers and Counters – HDL Models of Sequential Circuits.		CO3
UNIT IV	**ASYNCHRONOUS SEQUENTIAL LOGIC**	**9+3**
Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.		CO4
UNIT V	**SYSTEM DESIGN**	**9+3**
RAM — Memory Decoding — Error Detection and Correction — ROM — Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices – Design of Digital System using PLA and PAL		CO5
		TOTAL : 60 PERIODS

TEXT BOOKS

1. M. Morris Mano, Michael D. Ciletti, “Digital Design”, Fifth Edition, Pearson Education, 2013.
2. A. Saha and N. Manna, “Digital Principles and Logic Design”, Infinity Science Press LLC, 2007
3. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Fifth Edition, Morgan Kaufmann/Elsevier, 2013.

REFERENCE BOOKS

1. Charles H. Roth Jr., “Fundamentals of Logic Design”, Fifth Edition, Jaico Publishing House, 2003.
2. John F. Wakerly, “Digital Design Principles and Practices”, Fourth Edition, Pearson Education, 2007.
3. Donald D. Givone, “Digital Principles and Design”, Tata McGraw Hill, 2003.
4. G. K. Kharate, “Digital Electronics”, Oxford University Press, 2010.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Simplify Boolean functions using KMAP
CO2	Design and Analysis of Combinational Logic Circuits
CO3	Design and Analysis of Synchronous Sequential Logic Circuits
CO4	Design and Analysis of Asynchronous Sequential Logic Circuits
CO5	Implement designs using Programmable Logic Devices

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO2	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO3	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO4	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
CO5	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2

CS1309	AGILE SOFTWARE ENGINEERING	L	T	P	C
	Common to CSE & IT	3	0	0	3

OBJECTIVES

❖ Understand the phases of software and various different models and the basic fundamental concepts of requirement engineering

❖ Understand the fundamentals concepts of modelling and to learn various testing strategies and maintenance measures.

❖ Understand the principles and practices of various Agile methodologies like Scrum, XP, Kanban, etc.

❖Gain proficiency in the Scrum framework, including artifacts, meetings, and roles, for efficient project management.

❖ Apply Agile principles and practices to real-world projects and case studies to develop practical skills.

UNIT I	INTRODUCTION TO SOFTWARE ENGINEERING AND REQUIREMENT ENGINEERING	9
Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models: Waterfall, prototyping, spiral, incremental model Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – case study.		CO1
UNIT II	**SOFTWARE DESIGN AND TESTING**	**9**
Design process — Design Concepts-Design Model– Design Heuristic —Architectural styles, Architectural Mapping using Data Flow. Software testing fundamentals-Internal and external views of Testing-white box testing — basis path testing-control structure testing-black box testing- Regression Testing — Unit Testing — Integration Testing — Validation Testing — System Testing and Debugging.		CO2
UNIT III	**FUNDAMENTALS OF AGILE PROCESS**	**9**
Introduction and background, Agile Manifesto and Principles, Stakeholders and Challenges, Overview of Agile Development Models: Scrum, Extreme Programming, Feature Driven Development, Crystal, Kanban, and Lean Software Development.		CO3
UNIT IV	**INTRODUCTION TO SCRUM**	**9**
Agile Scrum Framework, Scrum Artifacts, Meetings, Activities and Roles, Scrum Team Simulation, Scrum Planning Principles, Product and Release Planning, Sprinting: Planning, Execution, Review and Retrospective; User story definition and Characteristics, Acceptance tests and Verifying stories, Burn down chart, Daily scrum, Scrum Case Study.		CO4
UNIT V	**INTRODUCTION TO EXTREME PROGRAMMING (XP)**	**9**
XP Lifecycle, The XP Team, XP Concepts: Refactoring, Technical Debt, Timeboxing, Stories, Velocity; Adopting XP: Pre-requisites, Challenges; Applying XP: Thinking- Pair Programming, Collaborating, Release, Planning, Development; XP Case Study.		CO5
		TOTAL : 45 PERIODS

REFERENCE BOOKS

1. James Shore and Shane Warden, The Art of Agile Development, O'Reilly Media, 2007.
2. Roger S.Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill International edition, Seventh edition, 2009.

3. Ian Sommerville, Software Engineering, 8th Edition, Pearson Education, 2008.
4. Craig Larman, “Agile and Iterative Development: A manager’s Guide, Addison-Wesley, 2004.
5. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson, 2001.
6. Cohn, Mike, Agile Estimating and Planning, Pearson Education, 2006.
7. Cohn, Mike, User Stories Applied: For Agile Software Development Addison Wisley, 2004.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain the basic knowledge on Software engineering process models and the requirement elicitation process
CO2	Acquire the knowledge with an understanding of design and modelling with testing strategies
CO3	Achieve a comprehensive understanding of Agile principles, methodologies, and frameworks, facilitating adept application in real-world software development contexts
CO4	Attain mastery of Scrum methodology, including its principles, practices, and roles, to effectively lead and manage Agile projects
CO5	Apply Agile practices such as user story definition, continuous integration, and test-driven development to enhance software quality, development efficiency, and timely project delivery.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	3	2	3	3	3	3	3	2	2
CO2	3	3	3	3	2	2	3	2	3	3	3	3	2	3	3
CO3	2	3	3	3	3	2	3	2	3	3	3	3	2	3	3
CO4	3	2	3	3	3	2	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	2	3	2	3	3	3	3	3	2	2

CS1307	DATA STRUCTURES LABORATORY USING C	L	T	P	C
	Common to CSE, IT & ECE Semester IV	0	0	4	2

OBJECTIVES

- To introduce the concepts of primitive data structures.
- To understand the process in linear and non-linear data structures.
- To introduce the concepts of sorting, searching and hashing.

LIST OF EXPERIMENTS

1. **IMPLIMENTATION OF LIST** Write C programs to a) Array implementation of Stack ADTs. b) Array implementation of Queue ADTs.	
2. **LIST ADT** Array implementation of List ADT.	**CO1**
3. **IMPLEMENTATION OF STACK AND QUEUE** Write C programs to a) Design and implement Single Linked List. b) Design and implement Stack and its operations using List. c) Design and implement Queue and its operations using List.	
4. **APPLICATIONS OF LINEAR DATA STRUCTURE** Write C programs for the following: a) Design and implement polynomial ADT using list b) Uses Stack operations to convert infix expression into postfix expression. c) Uses Stack operations for evaluating the postfix expression.	**CO2**
5. **APPLICATIONS OF TREE** a) Write a C program to Design and implement binary tree. b) Traverse the above binary tree recursively in pre-order, post-order & in-order.	
6. **IMPLEMENTATION OF TREE** Write a C program to Design and implement binary search tree.	
7. **IMPLEMENTATION OF ADVANCED TREE** a) Design and Implement AVL tree using Templates. b) Design and Implement heap tree using Templates.	**CO3**
8. **IMPLEMENTATION OF SHORTEST PATH ALGORITHMS** Write C programs for the following: a) Design and Implement Dijkstra's algorithm b) Design and Implement Floyd Warshall algorithm.	**CO3**
9. **IMPLEMENTATION OF MINIMUM SPANNING TREE** Write C programs for the following: a) Design and Implement Kruskal's algorithm. b) Design and Implement Prim's algorithm.	

10. **GRAPH TRAVERSAL & APPLICATIONS**

Write C programs to implement the following algorithms:

a) Depth first search.
b) Breadth first search.
c) Toplogical Sorting.

11. **SORTING &SEARCHING AND HASH TABLE IMPLEMENTATION**

a) Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order.
   i. Insertion sort
   ii. Selection sort
   iii. Quick sort
   iv. Merge sort
b) Write C programs for implement linear search and binary search.
c) Write C programs for implement Hashing – any two collision techniques

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition , Oxford University Press, 2011.

WEB REFERENCES

1. https://www.mygreatlearning.com/blog/data-structures-using-c/
2. https://www.faceprep.in/data-structures/data-structures-programs/

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Write functions to implement linear and non-linear data structure operations
CO2	Suggest appropriate linear / non-linear data structure operations for solving a given problem
CO3	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	-	-	2	2	2	3	3	3	3	2
CO2	3	3	3	1	1	-	-	2	2	2	3	3	3	3	2
CO3	3	3	3	1	1	-	-	2	2	2	3	3	3	3	2

CS1308	OBJECT ORIENTED PROGRAMMING LABORATORY	L	P	T	C
		0	0	4	2

OBJECTIVES

- ❖ Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic building activity.
- ❖ Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
- ❖ Identify and describe common abstract user interface components to design GUI in Java using Swing.
- ❖ Understanding the Network Programming in Java.

LIST OF EXPERIMENTS

1. Write a Java program that prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. Read in a, b, c and use the quadratic formula. If the discriminate $b^2 - 4ac$ is negative, display a message stating that there are no real solutions.	CO1
2. The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non recursive functions to print the nth value in the Fibonacci sequence	
3. Write a Java program that counts the number of objects created by using static variable	
4. Write a Java program to create a student class with following fields a) Hall ticket number b) Student Name c) Department Create 'n' number of Student objects where 'n' value is passed as input to constructor	
5. Write a java program to create an abstract class named Shape that contains an empty method named number of Sides ( ). Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides ( ) that shows the number of sides in the given geometrical figures	
6. Write a JAVA program which has a) A Interface class for Stack Operations b) A Class that implements the Stack Interface and creates a fixed length Stack. c) A Class that implements the Stack Interface and creates a Dynamic length Stack. d) A Class that uses both the above Stacks through Interface reference and does the Stack operations that demonstrates the runtime binding.	CO2
7. Complete the following: a) Create a package named shape. b) Create some classes in the package representing some common shapes like Square, Triangle, and Circle. c) Import and compile these classes in other program.	
8. Write a program in Java for String handling which performs the following: a) Checks the capacity of StringBuffer objects. b) Reverses the contents of a string given on console and converts the resultant string in upper case. c) Reads a string from console and appends it to the resultant string of ii.	

9. Write a Java program to make frequency count of words in a given text	
10. Write a Java program to implement a Queue using user defined Exception Handling (also make use of throw, throws.).	
11. Write a Java program to read copy content of one file to other by handling all file related exceptions	
12. Write a Java program that creates three threads. First thread displays “Good Morning” everyone second, the second thread displays “Hello” every two seconds and the third thread displays “Welcome” every three seconds.	
13. Write a java Program to create a window when we press a) M or m the window displays Good Morning b) A or a the window displays Good After Noon c) E or e the window displays Good Evening d) N or n the window displays Good Night	**CO3**
14. Create a GUI program in java with the following components. a) A frame with Flow layout. b) Add the following components on to the frame. i. Two Text Field ii. A button with the label display c) Allow the user to enter data into the JTextField d) When the button is clicked paint the frame by displaying the data entered in the JTextField e) Allow the user to properly close the frame	
15. Develop a program for executing the remote command using TCP Socket	
TOTAL : 60 PERIODS	

REFERENCE BOOKS

1. Herbert schildt , The complete reference, 11th edition, Tata Mc Graw Hill, New Delhi. 2018.

WEB REFERENCES

1. https://www.startertutorials.com/corejava/resources
2. https://docs.oracle.com/javase/tutorial/
3. https://wiki.c2.com/?JavaLinks

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved
CO2	To be able to make an understanding to developing Strings and exception handling, Multithreading and File Handling
CO3	Identify, Design & develop Network Programming with Sockets and Graphical user interfaces using principal Java Swing classes based on MVC architecture.

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	1	2	-	-	2	2	2	-	2	2	3	2
CO2	3	3	3	2	2	-	-	2	2	2	1	2	3	3	2
CO3	3	3	3	2	2	-	-	2	2	2	1	2	2	3	2

MA1453	DISCRETE MATHEMATICS	L	T	P	C
	Common to CSE, IT & AI-DS	3	1	0	4

OBJECTIVES

- To introduce Mathematical Logic, Inference Theory and proof methods.
- To provide fundamental principles on combinatorial counting techniques.
- To introduce graph models, their representation, connectivity and traverse ability.
- To explain the fundamental algebraic structures, groups and their algebraic properties.
- To introduce partial ordering and some functions on a set.

UNIT I	LOGIC AND PROOFS	12
Propositional Logic – Propositional Equivalences – Normal Forms - Predicates and Quantifiers — Nested Quantifiers — Rules of Inference — Introduction to Proofs — Proof Methods and Strategy.		CO1
UNIT II	**COMBINATORICS**	**12**
Mathematical Induction – Strong Induction and Well Ordering – The Basics of Counting - The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations -Generating Functions - Solving Linear Recurrence Relations Using Generating Functions– Inclusion — Exclusion – Principle and Its Applications.		CO2
UNIT III	**SETS AND FUNCTIONS**	**12**
Set -Relations on sets — Types of relations and their properties — Partitions — Equivalence relations – Partial ordering – Poset – Hasse diagram. Functions: Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.		CO3
UNIT IV	**GRAPHS**	**12**
Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.		CO4
UNIT V	**ALGEBRAIC STRUCTURES**	**12**
Groups – Subgroups – Homomorphisms – Isomorphism - Normal Subgroup and Coset – Lagrange's Theorem.		CO5

TOTAL : 60 PERIODS

TEXT BOOKS

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2012.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, Thirtieth Reprint, New Delhi, 2011.

REFERENCE BOOKS

1. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education, Fifth Edition, New Delhi, 2014
2. Seymour Lipschutz and Mark Lipson," Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi, 2013.
3. Thomas Koshy," Discrete Mathematics with Applications", Elsevier Publications, Boston, 2004.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Construct proofs by using direct proof, proof by contraposition, proof by contradiction. Construct mathematical arguments using logical connectives and quantifiers and verify the correctness of an argument using propositions. Logic helps in arriving inferences for any problem.
CO2	Solve problems on permutation and combination. Prove mathematical theorems using mathematical induction. Demonstrate basic counting principles, compute and interpret the meaning in the context of the particular application which helps to apply the combinatorial techniques in Algorithms and Data structure for analysis and design.
CO3	Understand relations on a set and functions on a set
CO4	Apply the concepts of graph theory in data structures, data mining, image segmentation and in clustering.
CO5	Familiar with algebraic systems, groups, sub groups, Lagrange's theorem and normal subgroups. In Coding algorithms and in theoretical computer science algebraic structures are applied.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1	-	-	-	1	1	2	2	2	1
CO2	3	3	2	2	1	1	-	-	-	1	1	2	2	2	1
CO3	3	3	2	2	1	1	-	-	-	1	1	2	2	2	1
CO4	3	3	2	2	1	1	-	-	-	-	1	2	2	2	1
CO5	3	3	2	2	1	1	-	-	-	-	1	2	2	1	1

CS1401	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
	(Common to CSE, IT, AI-DS & AI-ML)	3	0	0	3

OBJECTIVES

- To learn the general framework for analyzing algorithm efficiency
- To be conversant with algorithms for common problems.
- To analyse the algorithms for time/space complexity.
- To write algorithms for a given problem using different design paradigms.
- To understand computational complexity of problems

UNIT I	INTRODUCTION	9
Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – The Analysis Framework – Asymptotic Notations and Basic Efficiency Classes – Mathematical Analysis of Nonrecursive and Recursive Algorithms – Empirical Analysis of Algorithms.		CO1
UNIT II	**DECREASE AND CONQUER AND DIVIDE-AND-CONQUER**	**9**
Decrease-and-Conquer– Insertion Sort – Binary Search – Computing a Median and the Selection Problem – Divide-and-Conquer – Merge Sort – Quicksort – The Closest – Pair and Convex –Hull Problems by Divide-and-Conquer.		CO2
UNIT III	**DYMANIC PROGRAMMING AND GREEDY TECHNIQUE**	**9**
The Knapsack Problem and Memory Functions – Optimal Binary Search Trees – Warshall's Algorithm – Floyd's Algorithm – Greedy Technique – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman Trees and Codes.		CO3
UNIT IV	**ITERATIVE IMPROVEMENT**	**9**
Graphical Method – The Simplex Method – The maximum Flow Problem – Maximum Matching in Bipartite Graphs – The Stable Marriage Problem.		CO4
UNIT V	**BACKTRACKING, BRANCH-AND-BOUND AND APPROXIMATION ALGORITHMS**	**9**
P, NP, and NP- Complete Problems – Backtracking – n-Queens Problem – Hamiltonian Circuit Problem — Subset-Sum Problem — Branch-and-Bound — Assignment Problem — Knapsack Problem – Traveling Salesman Problem – Approximation Algorithms for the Traveling Salesman Problem and the Knapsack Problem.		CO5
	TOTAL : 45 PERIODS	

TEXT BOOKS

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, McGraw Hill, 2009.

REFERENCE BOOKS

1. Steven S. Skiena, “The Algorithm Design Manual”, Second Edition, Springer, 2008.
2. Robert Sedgewick, Kevin Wayne, “Algorithms”, Fourth Edition, Pearson Education, 2011.
3. Donald E. Knuth, “Art of Computer Programming, Volume I - Fundamental Algorithms”, Third Edition, Addison Wesley, 1997.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Ability to investigate an algorithm‘s efficiency with respect to running time
CO2	Design and implement problems using algorithmic design techniques such as decrease and conquer and divide and conquer
CO3	Ability to understand the design techniques such as Dynamic programming and Greedy Technique
CO4	Ability to understand the iterative design techniques
CO5	Understand the variations among tractable and intractable problems

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	3	-	2	3	3	2	2
CO2	3	3	3	3	2	-	-	-	3	-	2	3	3	2	2
CO3	3	3	3	3	2	-	-	-	3	-	2	3	3	2	2
CO4	3	3	3	3	2	-	-	-	3	-	2	3	3	2	2
CO5	3	3	3	3	2	-	-	-	3	-	2	3	3	2	2

CS1402	OPERATING SYSTEMS	L	T	P	C
	(Common to CSE, IT, AI-DS)	3	0	0	3

OBJECTIVES

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android

UNIT I	OPERATING SYSTEM OVERVIEW	9
Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.		CO1

UNIT II	PROCESS MANAGEMENT	9
Processes — Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling — Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization — The critical-section problem, Semaphores, Classical problems of synchronization, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.		CO2

UNIT III	STORAGE MANAGEMENT	9
Main Memory — Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory — Background, Demand Paging, Need for Page Replacement, Page Replacement Algorithm, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.		CO3

UNIT IV	FILE SYSTEMS AND I/O SYSTEMS	9
Mass Storage system — Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems — I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.		CO4

UNIT V	CASE STUDY	9
Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCE BOOKS

1. RamazElmasri, A. Gil Carrick, David Levine, “Operating Systems — A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. William Stallings, “Operating Systems – Internals and Design Principles”, 7 th Edition, Prentice Hall, 2011.
3. AchyutS.Godbole, AtulKahate, “Operating Systems”, McGraw Hill Education, 2016.
4. Andrew S. Tanenbaum, “Modern Operating Systems”, 4th Edition, Pearson Education, 2014.
5. D M Dhamdhere, “Operating Systems: A Concept-Based Approach”, Second Edition, Tata McGraw-Hill Education
6. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly, 2005.
7. Neil Smyth, “iPhone iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.
8. http://nptel.ac.in/.
9. William Stallings, Operating Systems: Internals and Design Principles, Pearson, 9 th Edition (2018).

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Analyze various scheduling algorithms.
CO2	Understand deadlock, prevention and avoidance algorithms.
CO3	Compare and contrast various memory management schemes.
CO4	Understand the functionality of file systems.
CO5	Perform administrative tasks on Linux Servers and Compare iOS and Android

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1403	DATABASE DESIGN AND MANAGEMENT (Lab Integrated)	L	T	P	C
	(Common to CSE, IT & AI-DS)	3	0	2	4

OBJECTIVES

- ❖ To learn the fundamentals of data models, ER diagrams and to study SQL and relational database design.
- ❖ To familiarize relational model with Relational Database design and Normal Forms.
- ❖ To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- ❖ To understand the implementation techniques by learning file organization and Query Optimization.
- ❖ To understand the concepts of distributed databases, Object Oriented databases and XML databases.

UNIT I	INTRODUCTION TO RELATIONAL DATABASES	9 + 6

Purpose of Database System – Views of data – Data Models – Database System Architecture Entity-Relationship model — E-R Diagrams — Enhanced-ER Model — ER-to-Relational Mapping– Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features

Lab Component

- Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements .Database Querying — Simple queries, Nested queries, Sub queries and Joins
- Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views, Synonyms, Sequences.
- Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)

CO1

UNIT II	RELATIONAL DATABASE DESIGN	9 + 6

Embedded SQL– Dynamic SQL - Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

Lab Component

- Simple Embedded SQL Program to demonstrate the concepts.
- Database Design using normalization and Implementation for any application.

CO2

UNIT III	TRANSACTIONS	9 + 6

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery – Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

Lab Component

- Usage of Transaction control language commands like commit, rollback and save point.
- Develop Programs using BEFORE and AFTER Triggers for INSERT, DELETE and UPDATE statements

CO3

UNIT IV	IMPLEMENTATION TECHNIQUES	9 + 6

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing. Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

Lab Component

- Implementation of B tree and B+ Tree.
- Develop programs to demonstrate hashing techniques.

CO4

UNIT V	ADVANCED TOPICS	9 + 6
Distributed Databases: Architecture, Data Storage, Data Fragmentation - Replication and Allocation Techniques for Distributed Database Design. Distributed Databases: Architecture, Data Storage, Transaction Processing — Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery. **Lab Component** • Database Connectivity with Front End Tools • Case Study using real life database applications.		**CO5**

PRACTICALS: 30 PERIODS	THEORY: 45 PERIODS	TOTAL : 75 PERIODS

TEXT BOOKS

1. Ramez Elmasri and Shamkant B. Navathe; Fundamentals of Database Systems, Pearson, Seventh Edition, Global Edition,2016
2. A Silberschatz, H Korth, S Sudarshan, “Database System and Concepts”, fifth Edition McGraw-Hill,2012.
3. Vlad Vlasceanu, Wendy A. Neu, Andy Oram, Sam Alapati, An Introduction to Cloud Databases, O'Reilly Media, Inc.,2019.

REFERENCE BOOKS

1. C.J.Date, “An Introduction to Database Systems”, Eighth Edition, Pearson Education,2004.
2. Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, McGraw-Hill College Publications, 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Map ER model to Relational model to perform database design effectively
CO2	Write queries using normalization criteria and optimize queries
CO3	Design the Query Processor and Transaction Processor
CO4	Learn different database concepts like distributed databases, spatial databases and mobile databases.
CO5	Apply security concepts to databases, review cloud databases, streaming and graph databases.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	1	-	-	2	2	2	2	3	3
CO2	3	3	3	3	2	1	1	-	-	2	2	2	2	3	3
CO3	3	3	3	3	2	1	1	-	-	2	2	2	2	3	3
CO4	3	3	3	3	2	1	1	-	-	2	2	2	2	3	3
CO5	3	3	3	3	2	1	1	-	-	2	2	2	2	3	3

CS1404	COMPUTER NETWORKS	L	T	P	C
	Common to CSE & IT	3	0	0	3

OBJECTIVES

- To understand the protocol layering and physical level communication and to analyze the performance of a network.
- To analyze the contents of Data Link layer packet, based on the layer concept.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.
- To know about different application layer protocols.

UNIT I	INTRODUCTION AND PHYSICAL LAYER	9
Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.		CO1
UNIT II	**DATA-LINK LAYER & MEDIA ACCESS**	**9**
Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.		CO2
UNIT III	**NETWORK LAYER**	**9**
Network Layer Services – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing — IPV6 Protocol.		CO3
UNIT IV	**TRANSPORT LAYER**	**9**
Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol — Transmission Control Protocol-Congestion Control Mechanisms-Streaming Control Transmission Protocol.		CO4
UNIT V	**APPLICATION LAYER**	**9**
WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP- Internet Multimedia.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2014.

REFERENCE BOOKS

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012
2. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open-Source Approach, McGraw Hill Publisher, 2011
4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basic layers, functions in computer networks and to evaluate the performance of a network.
CO2	Understand the basics of how data flows from one node to another.
CO3	Analyse and design routing algorithms.
CO4	Understand design goals of Connectionless and Connection oriented protocols.
CO5	Understand the working of various application layer protocols

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3

CS1410	FUNDAMENTALS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the use of Python libraries for data wrangling.
- To learn to describe the data inspecting and cleansing.
- To determine the relationship between data dependencies using statistics.
- To gain knowledge to construct and classify the data.
- To apply the knowledge for data handling and model evaluation metrics

UNIT I	PYTHON LIBRARIES FOR DATA WRANGLING	9
Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.		CO1
UNIT II	**INTRODUCTION TO DATA SCIENCE**	**9**
Introduction to Data Science - Overview of Data - Sources of Data - Types of Data - Small Data and Big Data - Data collection methods - Surveys - Interviews - Log and Diary data - User studies in Lab and Field - Web Scraping - Public datasets - Data cleaning - Tools for Data Science.		CO2
UNIT III	**DESCRIPTIVE DATA ANALYSIS**	**9**
Dataset Construction - Sampling of data - Stem and Leaf Plots - Frequency table - Time Series data - Central Tendency Measures of the location of data - Dispersion measures - Correlation analysis - Data reduction techniques - Principal Component analysis - Independent component analysis – Hypothesis testing – Statistical Tests.		CO3
UNIT IV	**MODEL CONSTRUCTION AND CLASSIFICATION**	**9**
Overview of machine learning concepts – Model construction using regression and Classification models - Linear regression and multiple regression models - KNN classification models - Comparison models - Training data construction - Regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean.		CO4
UNIT V	**DATA HANDLING AND MODEL EVALUATION**	**9**
Data aggregation – Data Transformation: merging datasets, reshaping data – Data enrichment: missing values - Normalization - Cross-validation techniques - Accuracy metrics for evaluation of models – Contingency table, ROC curve, Precision-recall curves - A/B testing.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Grus, Joel, “Data science from scratch: first principles with python”, O'Reilly Media, 2019.
2. Chirag Shah, “A Hands-on Introduction to Data Science”, Cambridge University Press, UK, 2020.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCE BOOKS

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
2. Aragues, A. “Visualizing Streaming Data: Interactive Analysis beyond Static Limits”, O’Reilly Media, Inc, 2018.
3. https://www.coursesidekick.com/statistics/study-guides/introstats1
4. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
5. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Use the Python Libraries for Data Wrangling
CO2	Can apply the skills of data inspecting and cleansing.
CO3	Determine the relationship between data dependencies using statistics
CO4	Gain knowledge to construct and classify the data
CO5	Can apply the knowledge for data handling and model evaluation metrics

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	1	1	2	2	3	3	3
CO2	3	2	2	2	3	2	1	1	2	1	2	3	2	3	2
CO3	3	2	3	2	3	2	1	1	2	1	2	3	2	2	3
CO4	3	2	3	2	3	2	1	1	2	2	2	3	3	3	2
CO5	3	2	3	2	3	2	1	1	2	2	2	3	3	3	2

CS1407	OPERATING SYSTEMS LABORATORY	L	T	P	C
	(Common to CSE, IT & AI-DS)	0	0	4	2

OBJECTIVES

- ❖ To learn basic Unix commands, shell programming and to implement various Process Management functions such as IPC and Scheduling.
- ❖ To implement Process Synchronization, Deadlock Detection and Avoidance and Memory Allocation methods.
- ❖ To implement Paging Techniques and File Management Techniques.

LIST OF EXPERIMENTS

1. Simulation of Unix Commands like cp, ls, grep, cd, mkdir, cat, rm etc.,	**CO1**
2. Implementation of Shell Programs.	
3. Implementation of CPU Scheduling Algorithms.	
4. Implementation of Producer Consumer problem using Semaphore.	
5. Implementation of Inter-process Communication using Shared memory.	
6. Implementation of Threading and Synchronization Applications.	**CO2**
7. Implementation of Bankers Algorithm for Deadlock Avoidance.	
8. Implementation of Deadlock Detection Algorithm.	
9. Implementation of Contiguous Memory Allocation.	
10. Implementation of Memory Management scheme using Paging.	**CO3**
11. Implementation of Page Replacement Algorithms.	
12. Implementation of Directory Structures.	
13. Implementation of File Allocation Strategies.	

TOTAL: 60 PERIODS

REFERENCE BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2012.
2. William Stallings, “Operating Systems – Internals and Design Principles”, 7 th Edition, Prentice Hall, 2011.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop simple applications with shell programming and Scheduling mechanisms.
CO2	Design and develop applications for synchronization, deadlock avoidance and detection.
CO3	Develop applications for implementing Paging and File management concepts.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	3	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	3	-	-	-	-	2	2	2	3	3	2

CS1411	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To understand the python libraries for data science
- To understand the basic Statistical and Probability measures for data science.
- To learn descriptive analytics on the benchmark data sets.
- To apply correlation and regression analytics on standard data sets.
- To present and interpret data using visualization packages in Python.

LIST OF EXPERIMENTS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.	CO1
2. Working with Numpy arrays	
3. Working with Pandas data frames	
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set	CO2
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following: a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard	
6. Deviation, Skewness and Kurtosis. a. Bivariate analysis: Linear and logistic regression modeling b. Multiple Regression analysis . c. Also compare the results of the above analysis for the two data sets.	
7. Apply and explore various plotting functions on UCI data sets. a. Normal curves b. Density and contour plots c. Correlation and scatter plots d. Histograms e. Three dimensional plotting	CO3
8. Visualizing Geographic Data with Basemap	

TOTAL: 60 PERIODS

REFERENCE BOOKS

1. https://www.analyticsvidhya.com
2. https://www.collborat.com/pima-diabetes-data-discovery-predictive-model/

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Make use of the python libraries for data science
CO2	Make use of the basic Statistical and Probability measures for data science and descriptive analytics on the benchmark data sets
CO3	Present and interpret data using visualization packages in Python

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	3	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	3	-	-	-	-	2	2	2	3	3	2

HS1310	PROFESSIONAL SKILLS LABORATORY	L	T	P	C
	Common to CSE & AI-DS	0	0	2	1

OBJECTIVES

- ❖ Enhance the Employability and Career Skills of students
- ❖ Orient the students towards grooming as a professional
- ❖ Make them Employable Graduates
- ❖ Develop their confidence and help them attend interviews successfully.

LIST OF EXPERIMENTS

UNIT I	**6**
Introduction to Soft Skills- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Making an Oral Presentation–Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language-General awareness of Current Affairs.	**CO1**
UNIT II	**6**
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic — answering questions — individual presentation practice—— Making a Power Point Presentation -- Structure and format; Covering elements of an effective presentation; Body language dynamics. Making an Oral Presentation–Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language	**CO2**
UNIT III	**6**
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- Structure and dynamics of a GD; Techniques of effective participation in group discussion; Preparing for group discussion; Accepting others‘ views / ideas; Arguing against others‘ views or ideas, etc	**CO3**
UNIT IV	**6**
Basics of public speaking; Preparing for a speech; Features of a good speech; Speaking with a microphone. (Famous speeches may be played as model speeches for learning the art of public speaking). Interview etiquette — dress code — body language — attending job interviews– telephone/skype interview -one to one interview &panel interview –Job Interviews: purpose and process; How to prepare for an interview; Language and style to be used in an interview; Types of interview questions and how to answer them.	**CO4**
UNIT V	**6**
Recognizing differences between groups and teams- managing time managing stress-networking professionally- respecting social protocols understanding career management-developing a long- term career plan making career changes	**CO5**
TOTAL : 30 PERIODS	

REFERENCE BOOKS

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
4. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010
5. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Make effective presentations
CO2	Participate confidently in Group Discussions
CO3	Attend job interviews and be successful in them.
CO4	Develop adequate Soft Skills required for the workplace
CO5	Develop their speaking skills to enable them speak fluently in real contexts

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	2	3	-	-	2	1	2
CO2	-	1	-	2	-	-	-	-	-	3	-	-	1	-	2
CO3	-	2	-	3	-	-	-	-	1	2	-	-	-	-	2
CO4	-	-	-	-	1	-	-	-	2	2	-	-	-	-	2
CO5	-	2	1	1	2	-	2	-	-	3	-	-	1	2	2

MA1501	ALGEBRA AND NUMBER THEORY	L	T	P	C
	Common to CSE & IT	3	1	0	4

OBJECTIVES

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To introduce and apply the concepts of rings, finite fields and polynomials.
- To understand the basic concepts in number theory
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject

UNIT I	ALGEBRAIC STRUCTURES	9+3
Groups - Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism		CO1
UNIT II	**POLYNOMIALS OVER FIELDS**	**9+3**
Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields		CO2
UNIT III	**DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS**	**9+3**
Division algorithm – Base - b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM		CO3
UNIT IV	**DIOPHANTINE EQUATIONS AND CONGRUENCES**	**9+3**
Linear Diophantine equations – Congruence's – Linear Congruence's - Applications: Divisibility tests - Modular exponentiation-Chinese remainder theorem — 2 x 2 linear systems		CO4
UNIT V	**CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS**	**9+3**
Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions		CO5

TOTAL : 60 PERIODS

TEXT BOOKS

1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007.
2. Koshy, T., "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2002

REFERENCE BOOKS

1. Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2nd Edition, 2006.
2. Niven, I., Zuckerman.H.S. and Montgomery, H.L., "An Introduction to Theory of Numbers, John Wiley and Sons , Singapore, 2004.
3. San Ling and Chaoping Xing, "Coding Theory — A first Course", Cambridge Publications, Cambridge, 2004

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Understand and apply the basic notions of groups, rings, fields which will then be used to solve related problems.
CO2	Explore of advanced algebraic techniques and demonstrating accurate and efficient use of the same with context to extending concept related to polynomials.
CO3	Understand the basic concepts in number theory and approach into the analysis of numbers
CO4	Apply the basic ideas of number theory to real world problems by the way of congruence and Linear Diophantine equations and Chinese remainder theorem.
CO5	Understand the three classical theorems, apply the same to solve the non - trivial problems related to the field and have strong foundation in dealing with numbers.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	2	-	-	2	2	1	-	2	3	3	2
CO2	3	3	2	-	2	-	-	2	2	1	-	2	3	3	2
CO3	3	3	3	-	2	-	-	2	2	1	-	2	3	3	2
CO4	3	3	3	-	2	-	-	2	2	1	-	2	3	3	2
CO5	3	3	3	-	2	-	-	2	2	1	-	2	3	3	2

CS1502	OBJECT ORIENTED ANALYSIS AND DESIGN	L	P	T	C
	Common to CSE & IT	3	0	0	3

OBJECTIVES

- To capture the requirements specifications of an intended software system
- To design software with static and dynamic UML diagrams
- To map the design properly to code
- To improve the software design with design patterns
- To test the software against its requirements specifications

UNIT I	INTRODUCTION	9
Introduction to OOAD with OO Basics - Unified Process – UML diagrams, Use Cases – Case study — the Next Gen Point of Sale (POS) system, Inception Use case Modelling, use case modeling - Relating Use cases — include, extend and generalization.		CO1
UNIT II	**STATIC MODELLING**	**9**
Class Diagram - Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes - Domain Modeling using class diagrams - Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition.		CO2
UNIT III	**DYNAMIC MODELLING**	**9**
Dynamic Diagrams - UML interaction diagrams - System sequence diagram — Collaboration diagram - Communication diagram - State machine diagram and Modelling — State Diagram - Activity diagram, Implementation Diagram - UML package diagram - Component and Deployment Diagrams		CO3
UNIT IV	**DESIGN PATTERNS**	**9**
GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling — High Cohesion — Controller. Design Patterns — Creational — Factory method — Structural — Bridge – Adapter – Behavioral– Strategy – Observer, Applying Gang of Four design patterns – Mapping design to code		CO4
UNIT V	**TESTING**	**9**
Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing — Develop Test Cases and Test Plans, Revisiting and consolidating all salient points and key insights based on the team projects.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Craig Larman, “Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development”, 3rd. Edition, Pearson Education, 2005.
2. Carol Britton, Jill Doake, “A Student Guide to Object-oriented Development”, Elsevier Butterworth-Heinemann, 2005

REFERENCE BOOKS

1. Martin Fowler, “UML Distilled: A Brief Guide to the Standard Object Modeling Language”, Third Edition, Addison Wesley, 2003.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, “Design Patterns: Elements of Reusable Object-Oriented Software”, Pearson, 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Identify and map basic software system requirements in UML
CO2	Express software design with UML diagrams
CO3	Design and implement software systems using OO methodology
CO4	Improve software design using design patterns
CO5	Test the software system developed against the intended requirements

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1503	ARTIFICIAL INTELLIGENCE (Lab Integrated)	L	T	P	C
		3	0	2	4

OBJECTIVES

- ❖ To impart basic knowledge about Artificial Intelligence
- ❖ To learn the methods of solving problems using Artificial Intelligence
- ❖ To learn to represent knowledge in solving AI problems
- ❖ To understand the different ways of designing intelligent agents
- ❖ To understand the application of AI namely Robotics

UNIT I	INTRODUCTION	9 + 6

Introduction–Definition — Foundation and History of AI - Future of Artificial Intelligence — Characteristics of Intelligent Agents– Agents and Environments – Nature of Environments - Structure of Agents - Typical Intelligent Agents

Lab Component:

- Demonstration of 8-Queen‘s problem
- Implementation of Water Jug Problem

CO1

UNIT II	PROBLEM SOLVING METHODS	9 + 6

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems — Constraint Propagation - Backtracking Search - Game Playing — Optimal Decisions in Games — Alpha - Beta Pruning

Lab Component:

- Path Search problem to find a path from point A to point B using A* Search Algorithm
- Usage of Hill Climbing Search Algorithm to find a solution for Travelling Salesman Problem

CO2

UNIT III	KNOWLEDGE REPRESENTATION	9 + 6

First Order Predicate Logic — Prolog Programming — Unification — Forward Chaining- Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering- Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for categories – Reasoning with Default Information.

Lab Component:

- Create a First Order Logic solver
- Develop a Forward Chaining Inference Engine.

CO3

UNIT IV	SOFTWARE AGENTS	9 + 6

Architecture for Intelligent Agents — Examples - Agent communication — Speech Acts - KQML- KIF - FIPA ACL - Argumentation among Agents – Trust and Reputation in Multi-agent systems.

Lab Component:

- Develop a Simple Agent for the Vacuum-Cleaner world problem
- Create a Tic Tac Toe Game program

CO4

UNIT V	APPLICATIONS	9 + 6
AI applications — Language Models — Information Retrieval — Information Extraction — Natural Language Processing — Machine Translation — Speech Recognition — Robot — Hardware - Perception – Planning – Moving **Lab Component:** • Simulation of Turtle moving • Simulation of Game playing		**CO5**

PRACTICALS:30 PERIODS	THEORY :45 PERIODS	TOTAL : 75 PERIODS

TEXT BOOKS

1. Russell S and Norvig P, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.
2. Gerhard Weiss, - Multi Agent Systems , Second Edition, MIT Press, 2013.

REFERENCE BOOKS

1. Tim Jones M - Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Bratko I - Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Implement basic AI Algorithms.
CO2	Use appropriate search algorithms to solve AI based problems.
CO3	Represent a problem using first order and predicate logic.
CO4	Implement Various intelligent systems.
CO5	Gain knowledge on the functions of Robots.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	-	-	1	2	2	3	3	3	3
CO2	3	3	3	3	3	2	-	-	1	2	2	3	3	3	3
CO3	3	3	3	3	3	2	-	-	1	2	2	3	3	3	3
CO4	3	3	3	3	3	1	-	-	2	2	2	3	3	3	3
CO5	3	3	3	3	3	1	-	-	2	2	2	3	3	3	3

CS1509	FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ To understand different stacks and develop web pages using HTML and CSS.
- ❖ To develop the front end for web applications
- ❖ To create single page applications using React JS.
- ❖ To create server side applications using Node JS.
- ❖ To create and deploy database driven web applications .

UNIT I	Web Development Basics	9
Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture – Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React, HTML, CSS		CO1

UNIT II	Frontend Development Framework	9
Introduction to Angular - Angular Application Architecture - Angular Components - Angular Templates - Data Binding - Types of Data Binding - Modules Component Working – Directives - Structure Directives - Template Routing - Theme Implementation in Angular Framework - Angular Forms – Services - Inject Services - Angular Server Communication with Backend Server - Working of API (GET, POST, PUT, DELETE) - Complete Web Application in Angular Framework		CO2

UNIT III	REACT JS	9
Introduction to React - React Router and Single Page Applications - React Forms, Flow Architecture and Introduction to Redux - More Redux and Client-Server Communication		CO3

UNIT IV	Backend Development Framework	9
Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers – Callbacks – Handling Data I/O – Implementing HTTP services in Node.js.		CO4

UNIT V	Database & Deployment	9
Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications - Spring JDBC Agile development principles - Deploying application in Cloud		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jon Duckett Vasan, Web Design with HTML, CSS, JavaScript and JQuery Set, Wiley publications, 2014
2. Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB.

REFERENCE BOOKS

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018
2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018
3. TomaszDyl , Kamil Przeorski , Maciej Czarnecki, Mastering Full Stack React Web Development Paperback, 2017
4. https://v17.angular.io/docs
5. https://react.dev/learn
6. https://nodejs.org/en/learn/getting-started/introduction-to-nodejs.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop web pages using HTML and CSS and gain Knowledge about the front end and back end Tools
CO2	Develop front end framework using Angular JS
CO3	Building user interface and single page applications using React JS.
CO4	Deploying server side web applications using Node JS.
CO5	Implementation of web application employing efficient database access.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	2	-	-	-	1	2	1	2	2	2
CO2	3	3	3	3	2	1	-	-	2	1	2	3	2	2	2
CO3	3	3	2	2	2	2	-	-	2	2	2	3	2	2	2
CO4	3	3	2	2	2	1	-	-	1	1	2	2	2	1	2
CO5	3	3	3	3	3	1	-	-	0	1	2	2	2	2	2

CS1508	OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY	L	P	T	C
	Common to CSE & IT	0	0	4	2

OBJECTIVES

- ❖ To capture the requirements specification for an intended software system
- ❖ To draw the UML diagrams for the given specification
- ❖ To map the design properly to code
- ❖ To test the software system thoroughly for all scenarios
- ❖ To improve the design by applying appropriate design patterns.

LIST OF EXPERIMENTS

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.	**CO1**
2. Document the Software Requirements Specification (SRS) for the identified system.	
3. Identify use cases and develop the Use Case model.	**CO2**
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.	
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams	
6. Draw relevant State Chart and Activity Diagrams for the same system.	
7. Implement the system as per the detailed design	
8. Test the software system for all the scenarios identified as per the use case diagram	**CO3**
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.	
10. Implement the modified system and test it for various scenarios	

SUGGESTED DOMAINS FOR MINI-PROJECT

- Passport automation system.
- Book bank
- Exam registration
- Stock maintenance system.
- Online course reservation system
- Airline/Railway reservation system
- Software personnel management system
- Credit card processing
- e-book management system
- Recruitment system
- Foreign trading system
- Conference management system
- BPO management system
- Library management system
- Student information system

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Martin Fowler, “UML Distilled: A Brief Guide to the Standard Object Modeling Language”, Third Edition, Addison Wesley, 2003.
2. Craig Larman, “Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development”, 3rd. Edition, Pearson Education, 2005.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the requirement of the project.
CO2	Design and implement the project
CO3	Perform testing of implemented project.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1510	FULL STACK DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To design and develop user interface screens for a given scenario
- To develop the functionalities as web components as per the requirements
- To implement the database according to the functional requirements
- To integrate the user interface with the functionalities and data storage.
- To develop full stack applications with clear understanding of user interface, business logic and data storage.

LIST OF EXPERIMENTS

1. Create a simple webpage using HTML and CSS	**CO1**
2. Build a Chat module using HTML CSS and JavaScript	
3. Develop a calculator Application using Angular JS	
4. Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items using Angular JS	**CO2**
5. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them using React JS	**CO2**
6. Create a food delivery website where users can order food from a particular restaurant listed in the website using React JS	
7. Build web application for shopping cart with registration, login, catalogue and cart pages using Node Js.	
8. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days using full stack development tools and MongoDB.	**CO3**
9. Develop a simple dashboard for project management where the status of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, In Progress or Completed using full stack development tools and MongoDB.	
10. Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions using full stack development tools and MongoDB.	

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Web Design with HTML, CSS, JavaScript and jQuery Set 1st Edition.
2. Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5 (Learning PHP, MYSQL, Javascript, CSS & HTML5).
3. Murach's PHP and MySQL (3rd Edition).
4. Learn JavaScript VISUALLY with Interactive Exercises.
5. JavaScript and JQuery: Interactive Front-End Web Development.
6. PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop web page using HTML and CSS .
CO2	Develop web page using REACTJS
CO3	Use MongoDB for backend storage.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFICOUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1601	COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement code generator.
- To understand code optimization.

UNIT I	INTRODUCTION TO COMPILERS AND LEXICAL ANALYSIS	9
Translators - Compilation and Interpretation - Language processors - Compiler Construction Tools - Structure of a compiler - Lexical Analysis - Role of Lexical Analyzer - Specification of Tokens - Recognition of Tokens - Lex - Design of Lexical Analyzer for a sample Language- Finite Automata - Regular Expressions to Automata - Minimizing DFA		CO1
UNIT II	**SYNTAX ANALYSIS**	**9**
Need and Role of Parser - Context Free Grammars - Top-Down Parsing - Recursive Descent Parser - Predictive Parser- LL(1) Parser-Shift Reduce Parser-LR Parser - LR(0) Items - Construction of SLR Parsing Table - LALR Parser - Error Handling and Recovery in Syntax Analyzer – YACC.		CO2
UNIT III	**INTERMEDIATE CODE GENERATION**	**9**
Syntax Directed Definitions - Evaluation Orders for Syntax Directed Definitions - Intermediate Languages: Syntax Tree, Three Address Code - Types and Declarations, Translation of Expressions- Type Checking		CO3
UNIT IV	**RUN-TIME ENVIRONMENT AND CODE GENERATION**	**9**
Storage Organization- Stack Allocation Space- Access to Non-local Data on the Stack- Heap Management — Basic blocks and flow graphs-Issues in Code Generation - Design of a Simple Code Generator.		CO4
UNIT V	**CODE OPTIMIZATION**	**9**
Principal Sources of Optimization - Peep-hole Optimization - DAG - Optimization of Basic Blocks -Global Data Flow Analysis - Efficient Data Flow Algorithm		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2009.

REFERENCE BOOKS

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers — Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Understand the different phases of compiler and identify the tokens using lexical analyzer.
CO2	Apply different parsing algorithms to develop the parsers for a given grammar.
CO3	Understand Syntax-directed translation and formulate the Intermediate Code.
CO4	Categorize the Intermediate Code into basic blocks and generate code
CO5	Apply various optimization techniques for dataflow analysis

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1602	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system.
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

UNIT I	INTRODUCTION	9
Introduction to Mobile Computing - Mobile Computing Vs Wireless networking - Applications of Mobile Computing - Structure of Mobile Computing Applications - Generations of Mobile Communication Technologies - MAC Protocols - Wireless MAC Issues — SDMA - TDMA- FDMA - CDMA.		CO1
UNIT II	**MOBILE TELECOMMUNICATION SYSTEM**	**9**
Introduction to Cellular Systems — GSM: Services & Architecture — Protocols — Connection Establishment — Handover — Routing — Mobility Management — Security; GPRS- UMTS — Architecture – Handover – Security.		CO2
UNIT III	**MOBILE NETWORK LAYER**	**9**
Mobile IP — Features — Key Mechanisms –Route Optimization - DHCP — AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.		CO3
UNIT IV	**MOBILE TRANSPORT AND APPLICATION LAYER**	**9**
Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML — WAP 2.0.		CO4
UNIT V	**MOBILE PLATFORMS AND APPLICATIONS**	**9**
Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, Windows Phone — M-Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Jochen Schiller, -Mobile Communications, PHI, Second Edition,2009.
2. Prasant Kumar Pattnaik, RajibMall,-Fundamentals of Mobile Computing, second Edition, PHILearning Pvt.Ltd, New Delhi –2015.

REFERENCE BOOKS

1. Dharma PrakashAgarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd,2005.
2. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing, Springer,2003.
3. William.C.Y.Lee,”Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition,Tata McGraw Hill Edition,2006.
4. Toh C K, “AdHoc Mobile Wireless Networks, First Edition, Pearson Education,2002.
5. Android Developers :http://developer.android.com/index.html.
6. Apple Developer :https://developer.apple.com.
7. Windows Phone DevCenter :http://developer.windowsphone.com.
8. BlackBerry Developer :http://developer.blackberry.com.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Understand the basics of mobile telecommunication systems.
CO2	Illustrate the generations of telecommunication systems in wireless networks.
CO3	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
CO4	Understand the functionality of Transport and Application layers.
CO5	Develop a mobile application using android/ios/Windows SDK.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	2	3	1	2	-	1	2	1	3	3	2	2
CO2	1	2	2	2	2	1	2	-	1	2	1	2	2	3	2
CO3	2	2	3	3	2	1	2	-	1	2	-	3	2	3	3
CO4	1	1	1	1	2	-	1	-	-	1	-	2	3	3	3
CO5	2	-	3	-	2	-	-	-	-	2	2	3	3	3	3

CS1604	DATA SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the fundamental concepts of data science and analytics
- To learn various techniques for mining data streams
- To learn Event Modelling for different applications
- To know about Hadoop and Map Reduce procedure

UNIT I	INTRODUCTION TO DATA SCIENCE AND BIG DATA	9
Introduction to Data Science — Applications - Data Science Process — Exploratory Data analysis – Collection of data – Graphical presentation of data – Classification of data – Storage and retrieval of data – Big data – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error		CO1
UNIT II	**DATA ANALYSIS**	**9**
Correlation – Regression – Probability – Conditional Probability – Random Variables – Analysis using Mean, Median, Mode, Standard Deviation, Skewness, Kurtosis- Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics		CO2
UNIT III	**DATA MINING TECHNIQUES**	**9**
Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods- Neuro-Fuzzy Modelling — Association rule mining – Clustering – Outlier Analysis – Sequential Pattern Mining – Temporal mining – Spatial mining – Web mining		CO3
UNIT IV	**MINING DATA STREAMS**	**9**
Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments — Counting Oneness in a Window — Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions		CO4
UNIT V	**FRAMEWORKS AND VISUALIZATION**	**9**
Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems — Visualizations - Visual Data Analysis Techniques - Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012
4. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008

REFERENCE BOOKS

1. Rachel Schutt, Cathy O'Neil, “Doing Data Science”, O'Reilly Publishers, 2013
2. Foster Provost, Tom Fawcet, “Data Science for Business”, O'Reilly Publishers, 2013
3. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2014
4. S. N. Sivanandam, S. N Deepa, “Introduction to Neural Networks Using Matlab 6.0”, Tata McGraw- Hill Education, 2006

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Work with big data platform and its analysis techniques
CO2	Design efficient algorithms for mining the data from large volumes
CO3	Model a framework for Human Activity Recognition
CO4	Development with cloud databases
CO5	Apply visualization techniques to present the data

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1609	INTRODUCTION TO QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT I	QUANTUM COMPUTING BASIC CONCEPTS	**9**
Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superpositions.		**CO1**
UNIT II	QUANTUM GATES AND CIRCUITS	**9**
Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction		**CO2**
UNIT III	QUANTUM ALGORITHMS	**9**
Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm		**CO3**
UNIT IV	QUANTUM INFORMATION THEORY	**9**
Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels		**CO4**
UNIT V	QUANTUM CRYPTOGRAPHY	**9**
Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart		**CO5**
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

REFERENCE BOOKS

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basics of quantum computing.
CO2	Understand the background of Quantum Mechanics.
CO3	Analyze the computation models.
CO4	Model the circuits using quantum computation, environments and frameworks.
CO5	Understand the quantum operations such as noise and error–correction.

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	-	2	2	1	2	2	3	2
CO2	3	2	2	2	2	-	-	-	2	2	1	1	2	3	1
CO3	3	3	3	3	2	-	-	-	3	2	1	2	3	2	2
CO4	3	3	3	3	3	-	-	-	3	2	1	1	1	3	2
CO5	3	3	2	3	3	-	-	-	2	2	1	1	1	3	3

CS1607	MOBILE APPLICATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- ❖ Know the components and structure of mobile application development frameworks for Android based mobiles.
- ❖ Understand how to work with various mobile application development frameworks.
- ❖ Learn the basic and important design concepts and issues of development of mobile applications.

LIST OF EXPERIMENTS

1.	Develop an application for changing the font, color and size of the given text that uses GUI components, Font and Colors	**CO1**
2.	Develop an application for collecting student‘s information that uses Layout Managers and event listeners.	
3.	Implement a native Calculator to perform various operations using appropriate GUI Components.	
4.	Write an application that display line, circle, rectangle and other 2D graphical primitives on the screen.	
5.	Develop an application for implementing payroll system by connecting the database where the actual data is stored and retrieved.	**CO2**
6.	Develop an application that makes use of RSS Feed.	
7.	Implement an application that implements multi-threading	
8.	Develop a native application that uses GPS location information.	
9.	Implement an application that writes data to the SD card.	**CO3**
10.	Implement an application that creates an alert upon receiving a message.	
11.	Develop an application to send an email.	
12.	Write a mobile application that creates alarm clock.	

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Erik Hellman, “Android Programming — Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O‘Reilly SPD Publishers, 2015.
3. DiMarzio J F, “Beginning Android Programming with Android Studio”, 4th Edition, Wiley India Pvt Ltd, 2016.
4. Anubhav Pradhan, Anil V Deshpande, “Composing Mobile Apps” using Android, Wiley 2014.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Create, test and debug Android application by setting up Android development environment.
CO2	Demonstrate methods for storing, sharing and retrieving data in Android applications.
CO3	Analyze the performance of android applications to understand the role of permissions and security.

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1610	Design Thinking and Innovations	L	T	P	C
		0	0	4	2

OBJECTIVES

- To apply knowledge in real time problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering /non engineering problems

Phases of design thinking

1. Introduction - Group discussion on Ideation- Users perspective - Formation of team – Thinking skills- Brain storming	**CO1**
2. Problem identification (phase I) - Selecting user requirements -Survey on various user‘s applications - Specific Problem selection to proceed with the work – Team presentation on identified problems and various possible solutions.	
3. Problem identification (Phase II)- Study of an application and its importance to end user.- Various models of an application. - Finalize the identified problem.	
4. Design ideation and various stages - Sketch design diagram. - Architecture or full diagrammatic study	**CO2**
5. Design ideation and various stages - Sketch design diagram - Architecture or full diagrammatic study.	
6. Implementation (Phase I) - Build the prototype using available resources. – Record Module diagrams.	
7. Implementation (Phase II) - Display and review of the prototype. - Record its functionality and its Usage-Technical manual	
8. Testing - To test the product design with real time environment. - Record Process-user manual	
9. IPR-Activity I - To study various IPR activities. - To prepare for IPR Process.-To file an IPR.	**CO3**
10. Start-ups Formation • To exhibit the product to public: feedback approach. • To prepare full documentation. • Start-ups registration/apply patent/publish paper/submit model/prototype/Apply for seed/submit as research proposal.	

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Mueller-Roterberg, Christian. "Handbook of Design Thinking." Hochschule Ruhr West, 2018.
2. Design Kit by IDEO.org. "The field guide to human centered design." ,2015.
3. https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy.
4. https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype.
5. https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning.
6. https://uxplanet.org/what-are-insights-aa1f2d1b3b9c.
7. https://labs.sogeti.com/using-design-thinking-to-design-business-models/.
8. https://www.northeastern.edu/graduate/blog/implementing-business-model-innovation/.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Solve real world problems by applying knowledge and develop various design products, processes or technologies for sustainable and socially relevant applications.
CO2	Establish resource utilization/budgets to Implement appropriate methodologies and execute tasks by application of engineering standards/ requirements/ design criteria, within timelines
CO3	Conduct extended investigation that results in the translation of idea to product / production of a research thesis/ developing a proof of concept and Communicate well organized technical and scientific findings effectively in written and oral forms, following ethical and professional norms.

CS1701	GRAPH THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic graph terminologies and types of graphs.
- To appreciate graph theoretic terms related to trees and cut-sets.
- To understand the geometric, combinatorial properties of graphs and basic concepts of directed graphs.
- To understand the matrix representation of graphs and the colouring, covering and partitioning of graphs.
- To solve a nontrivial practical problem with the help of high-speed electronic computers.

UNIT I	INTRODUCTION	9
Introduction - Graph Terminologies - Types of Graphs – Isomorphism- Sub Graphs – Walks, Paths and Circuits – Connected Graphs and Components - Isomorphic Graphs – Operations on Graphs - Euler graphs - Hamiltonian Graph.		CO1
UNIT II	**TREES AND CUT-SETS**	**9**
Trees -Properties- Distance and Centers - Types - Rooted Tree- Labeled Tree - Unlabeled Tree - Spanning Tree – Cut-sets - Properties - Fundamental Circuits and Cut-sets- Connectivity and Separability.		CO2
UNIT III	**PLANAR, DUAL GRAPHS AND DIRECTED GRAPHS**	**9**
Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual – Directed Graphs — Types- Properties - Euler Digraph.		CO3
UNIT IV	**MATRIX REPRESENTATIONS AND CHROMATIC NUMBER**	**9**
Matrix Representation - Incidence matrix- Circuit matrix - Cut-set matrix - Path Matrix- Adjacency Matrix-Properties - Graph Coloring - Chromatic Polynomial - Chromatic Partitioning - Matchings - Coverings.		CO4
UNIT V	**GRAPH THEORETIC ALGORITHMS AND COMPUTER PROGRAMS**	**9**
Graph Algorithms: Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.

REFERENCE BOOKS

1. Foulds L R , Graph Theory Applications, Springer ,2016.
2. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication, 2008.
3. West, D. B., Introduction to Graph Theory, Pearson Education, 2011 .
4. John Clark, Derek Allan Holton, A First Look at Graph Theory, World Scientific Publishing Company, 1991.
5. Diestel, R, Graph Theory, Springer 3rd Edition,2006.
6. Kenneth H.Rosen, Discrete Mathematics and Its Applications, Mc Graw Hill , 2007.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Gain knowledge about basic terminologies of graph, types of graph and various applications of graph theory.
CO2	Develop the system which keeps the vertices together and separates the vertices.
CO3	Understand the combinational and geometric graphs.
CO4	Demonstrate the use of matrices in studying graphs and direct consequence of proper coloring of vertices
CO5	Address the computational aspects of graph theory, including graph-theoretic algorithms and computer programs.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	2	1	1	-	-	-	-	2	2	1	1
CO2	3	3	2	3	2	1	1	-	-	-	-	2	2	1	1
CO3	3	3	2	3	2	1	1	-	-	-	-	2	2	1	1
CO4	3	3	2	3	2	1	1	-	-	-	-	2	2	1	1
CO5	3	3	2	3	2	1	1	-	-	-	-	2	2	1	1

CS1702	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concept of cloud computing.
- To learn about the concept of cloud and utility computing.
- To have knowledge on the various issues in cloud computing.
- To understand the emergence of cloud as the next generation computing paradigm.

UNIT I	INTRODUCTION	9
Introduction to Cloud Computing — Definition of Cloud — Evolution of Cloud Computing — Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Benefits and Disadvantages of Cloud Computing- Elasticity in Cloud – On-demand Provisioning		CO1
UNIT II	**CLOUD ENABLING TECHNOLOGIES**	**10**
Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish- Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization — Virtualization Structures — Tools and Mechanisms — Virtualization of CPU — Memory – I/O Devices –Virtualization Support and Disaster Recovery.		CO2
UNIT III	**CLOUD ARCHITECTURE, SERVICES AND STORAGE**	**8**
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.		CO3
UNIT IV	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD**	**10**
Inter Cloud Resource Management — Resource Provisioning and Resource Provisioning Methods — Global Exchange of Cloud Resources — Security Overview — Cloud Security Challenges — Software-as-a-Service Security — Security Governance — Virtual Machine Security — IAM — Security Standards.		CO4
UNIT V	**CLOUD ADVANCEMENT TECHNOLOGIES**	**8**
Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine —— Open Stack - Cloud Software Environments - Eucalyptus — Open Nebula.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
3. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management, And Security", CRC Press, 2017

REFERENCE BOOKS

1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.
3. https://kubernetes.io/docs/home/
4. https://docs.mongodb.com/
5. https://aws.amazon.com/documentdb/

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
CO2	Learn the key and enabling technologies that help in the development of cloud.
CO3	Understand the architecture of compute and storage cloud, service and delivery models.
CO4	Explain the core issues of cloud computing such as resource management and security.
CO5	Install and use current cloud technologies and choose the appropriate technologies, approaches for implementation.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1703	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
	(Common to CSE & IT)	3	0	0	3

OBJECTIVES

- To define security attacks, services and mechanisms.
- To review modern symmetric-key ciphers based on algebraic structures.
- To understand asymmetric-key cryptography based on some topics in number theory.
- To define cryptographic data integrity algorithms and mutual trust.
- To discuss various security practices and system security measures.

UNIT I	FUNDAMENTALS	9
Computer Security Concepts – The OSI Security Architecture - Security Attacks, Services and Mechanisms - Model for network security – Classical Encryption Techniques: Substitution Techniques, Transposition Techniques, Steganography – Legal and Ethical Aspects.		CO1
UNIT II	**SYMMETRIC CRYPTOGRAPHY**	**9**
Mathematics of Symmetric Key Cryptography: Algebraic structures — Modular arithmetic- GF (2^n Fields) –The Euclidian Algorithm- Polynomial Arithmetic - Symmetric Key Ciphers: Block Cipher and Data Encryption Standard (DES) - Advanced Encryption Standard (AES) — Block Cipher Operation – Random Bit Generation and Stream Ciphers - RC4.		CO2
UNIT III	**PUBLIC KEY CRYPTOGRAPHY**	**9**
Mathematics of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Chinese Remainder Theorem — Quadratic Congruence- Exponentiation and Logarithm - Asymmetric Key Ciphers: RSA Cryptosystem – Rabin Cryptosystem - Diffie Hellman Key Exchange - ElGamal Cryptosystem – Elliptic Curve Arithmetic - Elliptic Curve Cryptography.		CO3
UNIT IV	**CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS AND MUTUAL TRUST**	**9**
Cryptographic Hash Functions – Message Authentication Codes - Digital Signatures –Key Management and Distribution – X.509 Certificates - User Authentication- Kerberos		CO4
UNIT V	**INTERNET SECURITY AND SYSTEM SECURITY**	**9**
Electronic Mail security – PGP, S/MIME – IP security – Cloud Security- Wireless Network Security – System Security: Intruders – Malicious software – Firewalls.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 5th Edition, 2011.
2. Behrouz A.Forouzan, Introduction to Cryptography and Network Security, McGraw-Hill Ferouzan Networking Series, 2008.

REFERENCE BOOKS

1. Shyamala C K, N Harini and Dr T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd.
2. Charlie Kaufman, Radia Periman and Mike Speciner, Network Security: private Communication in a public World, Prentice Hall, ISBN 0-13-046019-2
3. William Stallings, "Network Security Essentials Applications and Standards", 2nd edition, Pearson Education, 2003.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Describe the key security requirements of confidentiality, Integrity and availability
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3	Examines of asymmetric key cryptosystem and design principles
CO4	Describe the various cryptographic data integrity algorithms and various aspects of key management and distribution.
CO5	Understand various network Security practices and System level security issues

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
CO3	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
CO4	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	1	2	2	2	3	3	3

CS1709	EDGE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ Understand general concepts of Internet of Things (IoT)
- ❖ Recognize various devices, sensors and applications
- ❖ Analyze and Apply design concept to IoT solutions
- ❖ Evaluate design issues in IoT applications
- ❖ Create IoT solutions using sensors, actuators and Devices.

UNIT I	INTRODUCTION TO IoT	9
Evolution of Internet of Things - Enabling Technologies – IoT Architectures - Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications- IoT Definition - Characteristics of .IoT- Functional Blocks. Web of Things versus Internet of Things. Core IoT functional stack – IoT data management and compute stack.		CO1
UNIT II	**SENSORS AND INTERFACING**	**9**
Introduction to sensors - Transducers, Classification - Roles of sensors in IOT - Various types of sensors - Design of sensors - sensor architecture - special requirements for IOT sensors- Role of actuators - types of actuators. Hardwire the sensors with different protocols such as – COAP – MQTT - 6LoWPAN and Zigbee.		CO2
UNIT III	**IoT PROTOCOLS**	**9**
Protocol Standardization for IoT — Efforts — M2M and WSN Protocols — SCADA and RFID Protocols — Unified Data Standards — Protocols — IEEE 802.15.4 — BACNet Protocol — Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP– Security		CO3
UNIT IV	**BUILDING IoT WITH RASPBERRY PI & ARDUINO**	**9**
Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python — IoT Physical Devices and Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.		CO4
UNIT V	**CASE STUDIES AND REAL-WORLD APPLICATIONS**	**9**
Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT — Software & Management Tools for IoT Cloud Storage Models & Communication APIs — Cloud for IoT - Amazon Web Services for IoT-Google Homes in IoT.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things — A hands-on approach”, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

REFERENCE BOOKS

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
3. Jan Ho ¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Analyze various protocols for IoT
CO2	Develop web services to access/control IoT devices.
CO3	Design a portable IoT using Raspberry Pi
CO4	Deploy an IoT application and connect to the cloud.
CO5	Analyze applications of IoT in real time scenario

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	2	3	3	2	3	-	2	2	3	3
CO2	3	2	3	2	-	2	3	3	2	3	-	2	2	3	3
CO3	3	2	3	2	-	2	3	3	2	3	-	2	2	3	3
CO4	3	2	3	2	-	2	3	3	2	3	-	2	2	3	3
CO5	3	2	3	2	-	2	3	3	2	3	-	2	2	3	3

CS1707	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To install and create virtual machines and transfer of files from one virtual machine to another.
- To develop web applications in cloud and to learn the design and development process involved in creating a cloud-based application
- To implement and use parallel programming using Hadoop

LIST OF EXPERIMENTS

1. Install Virtual box /VMware Workstation with different flavours of Linux or windows OS on top of windows7/8/10.	**CO1**
2. Install two virtual machines, VM1 with server OS and VM2 with desktop [Ubuntu/centOS], after installing display the IP address and Ping among VMs	
3. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.	
4. Create and run virtual machines on Compute Engine EC2 in Google Cloud Platform [GCP].	
5. Create and run two virtual machines VM1 with Ubuntu OS and VM2 with CentOS and transfer files from one virtual machine to another.	
6. Create hello world app or any other simple web applications using python/java and launch the web application using Google App Engine.	**CO2**
7. Simulate a cloud scenario using CloudSim and create two data centres with one host and a network topology each and run two cloudlets on them.	
8. Simulate a cloud scenario using CloudSim and to create scalable simulations.	
9. Install Hadoop and set up a single node Hadoop cluster.	**CO3**
10. Create and run simple applications like wordcount.in the single Hadoop cluster.	

TOTAL: 60 PERIODS

REFERENCE BOOKS

1. Toby Velte, Anthony Velte, Robert Elsenpeter Cloud Computing, A Practical Approach,2009
2. Ted Hunter, Steven Porter, and Legorie Pajan Building Google Cloud Platform Solutions, packt publishing Ltd,2019

WEB REFERENCES

1. http://www.cloudbus.org/cloudsim/
2. https://hadoop.apache.org/docs/r2.9.2/hadoop-project-dist/hadoop-common/SingleCluster.html

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Configure various virtualization tools such as Virtual Box, VMware workstation and deploy a web application in GCP
CO2	Simulate a cloud environment using cloud sim and install, use a generic cloud environment.
CO3	Manipulate and store large data sets in a parallel environment using Hadoop.

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	1	-	-	2	2	2	-	2	3	3	2
CO2	3	3	3	1	1	-	-	2	2	2	-	2	3	3	2
CO3	3	3	3	1	1	-	-	2	2	2	-	2	3	3	2

PROFESSIONAL ELECTIVE-I

CS1511	COMPUTER GRAPHICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the mathematical basis of computer graphics.
- To train the students to acquire knowledge in Computer Graphics modelling, animation, and rendering.
- To create graphical applications.
- To acquire knowledge about tools and technologies related to graphics.
- To create visually realistic animations.

UNIT I	INTRODUCTION TO COMPUTER GRAPHICS	9
Graphics Display Devices – Graphics Input Primitives and Devices – OpenGL Basic Graphic Primitives — Line Drawing Algorithms DDA and Bresenham — Windows and Viewports — Clipping Algorithms for Lines, Regular Polygons, Circles and Arcs – Parametric Form for a Curve – Visibility Algorithms – Review of Vectors – Representations of Key Geometric Objects – Lines and Planes		CO1
UNIT II	**MODELING AND TRANSFORMATIONS OF OBJECTS**	**9**
Introduction to Transformations — Two Dimensional Transformations — 3D Affine Transformations – Homogeneous Coordinates – Matrix Representation – Drawing 3D Scenes Interactively – Introduction to Solid Modeling with Polygonal Meshes – Mesh Approximations to Smooth Objects – Particle Systems and Physically Based Systems		CO2
UNIT III	**VIEWING AND VISUAL REALISM**	**9**
Three-Dimensional Viewing – Hidden Surface Removal – Illumination Models-Depth Cueing – Perspective Projections of 3D Objects – Introduction to Shading Models – Flat Shading and Smooth Shading — Adding Texture to Faces — Morphing — To Add Shadows of Objects — OPENGL Shading Language – Manipulating Pixmaps – Manipulating Symbolically Defined Regions – Aliasing and Anti Aliasing Techniques – Creating More Shades and Colours		CO3
UNIT IV	**SURFACE DESIGN**	**9**
Describing Curves using Polynomials – Bezier Curves – Blending Functions – The B-Spline Basis Functions – Modeling Curved Surfaces – Rational Splines and NURBS – Interpolation – Modeling Curved Surfaces — Color Theory — Overview of the Ray Tracing Process — Intersecting Rays with other Primitives – Adding Shadows for Greater Realism – Reflections and Transparency – Boolean Operations on Objects – Ray Casting		CO4
UNIT V	**ANIMATIONS**	**9**
Design of Animation Sequence – Animation Function – Raster Animation – Key Frame Systems — Motion Specification — Morphing — Tweening — Types of Animation — Fractals — Tools for Animation Creation		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. F. S. Hill, Jr., Stephen M. Kelley, Jr., "Computer graphics using OpenGL", Pearson Prentice Hall, Third Edition, 2007.
2. Donald D. Hearn, M. Pauline Baker, W. Carithers., "Computer Graphics with Open GL", Fourth Edition, Pearson Eduction, 2010.

REFERENCE BOOKS

1. Tay Vaughan., "Multimedia: Making it Work", Ninth Edition, McGraw-Hill Education, 2014.
2. Alan Watt, "3D Computer Graphics", Third Edition, Pearson Addison Wesley, 2000.
3. Ralf Steinmetz, KlaraNahrstedt, "Multimedia Systems", Springer, 2004.
4. Mark S. Drew, Zee Nian Li, "Fundamentals of multimedia", Prentice Hall, 2006**.**

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand and Implement algorithms related to graphics creation.
CO2	Design and model graphical structures.
CO3	Understand and comprehend the graphical algorithms.
CO4	Design visually realistic graphical applications.
CO5	Design and develop simple and realistic animations

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	2	2	2	3	2
CO2	3	3	3	3	3	-	-	-	-	2	2	2	2	3	2
CO3	3	3	3	3	3	-	-	-	-	2	2	2	2	3	2
CO4	3	3	3	3	3	-	-	-	-	2	2	2	2	3	2
CO5	2	2	2	2	2	-	-	-	-	2	2	2	2	3	2

CS1512	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic concepts of machine learning and probability theory.
- To appreciate supervised learning and their applications.
- To understand unsupervised learning like clustering and EM algorithms.
- To understand the theoretical and practical aspects of probabilistic graphical models.
- To learn other learning aspects such as reinforcement learning, representation learning, deep learning, neural networks and other technologies.

UNIT I	INTRODUCTION	9
Machine Learning — Types of Machine Learning — Supervised Learning — Unsupervised Learning – Basic Concepts in Machine Learning – Machine Learning Process – Weight Space – Testing Machine Learning Algorithms – A Brief Review of Probability Theory –Turning Data into Probabilities – The BiasVarianceTradeoff, FIND– S Algorithm, Candidate - Elimination Algorithm		CO1

UNIT II	SUPERVISED LEARNING	9
Linear Models for Regression — Linear Basis Function Models — The Bias-Variance Decomposition — Bayesian Linear Regression — Common Regression Algorithms — Simple Linear Regression — Multiple Linear Regression — Linear Models for Classification — Discriminant Functions – Probabilistic Generative Models – Probabilistic Discriminative Models – Laplace Approximation – Bayesian Logistic Regression – Common Classification Algorithms – k-Nearest Neighbors – Decision Trees – Random Forest model – Support Vector Machines		CO2

UNIT III	UNSUPERVISED LEARNING	9
Mixture Models and EM – K-Means Clustering – Dirichlet Process Mixture Models – Spectral Clustering – Hierarchical Clustering – The Curse of Dimensionality – Dimensionality Reduction – Principal Component Analysis – Latent Variable Models(LVM) – Latent Dirichlet Allocation (LDA)		CO3

UNIT IV	GRAPHICAL MODELS	9
Bayesian Networks – Conditional Independence – Markov Random Fields – Learning – Naive Bayes Classifiers – Markov Model – Hidden Markov Model.		CO4

UNIT V	ADVANCED LEARNING	9
Reinforcement Learning — Representation Learning — Neural Networks — Active Learning — Ensemble Learning – Bootstrap Aggregation – Boosting – Gradient Boosting Machines – Deep Learning		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, Prentice Hall of India, 2015.

REFERENCE BOOKS

1. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Stephen Marsland, “Machine Learning — An Algorithmic Perspective”, Second Edition, CRC Press, 2014.
4. Tom Mitchell, “Machine Learning”, McGraw-Hill, 2017.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, Second Edition, Springer, 2008.
6. Fabio Nelli, “Python Data Analytics with Pandas, Numpy, and Matplotlib”, Second Edition, Apress, 2018.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain knowledge about basic concepts of machine learning techniques
CO2	Develop predictive model based on both input and output data
CO3	Ability to understand the unsupervised learning algorithm and dimensionality reduction techniques
CO4	Design systems that use the appropriate graphical models of machine learning
CO5	Ability to address the problem of learning control strategies for autonomous agents

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	2	2	2	2	2	2	3	3	2
CO2	3	3	3	3	2	2	2	2	2	2	2	2	3	3	2
CO3	3	3	3	3	2	2	2	2	2	2	2	2	3	3	2
CO4	3	3	3	3	2	2	2	2	2	2	2	2	3	3	2
CO5	3	3	3	3	2	2	2	2	2	2	2	2	3	3	2

CS1513	Image Analysis and Computer Vision	L	T	P	C
		3	0	0	3

OBJECTIVES

- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand Hough, Transform and its applications to detect lines, circles, ellipses.
- To understand three-dimensional image analysis techniques and motion analysis.
- To study some applications of computer vision algorithms.

UNIT I	IMAGE PROCESSING FOUNDATIONS	9
Review of image processing techniques — classical filtering operations — thresholding techniques - edge detection techniques – corner and interest point detection – mathematical morphology — texture.		CO1
UNIT II	**SHAPES AND REGIONS**	**9**
Binary shape analysis — connectedness — object labeling and counting — size filtering — distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures — active contours — shape models and shape recognition — centroidal profiles — handling occlusion — boundary length measures — boundary descriptors — chain codes — Fourier descriptors – region descriptors – moments.		CO2
UNIT III	**HOUGH TRANSFORM**	**9**
Line detection — Hough Transform (HT) for line detection — foot-of-normal method — line localization — line fitting — RANSAC for straight line detection — HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.		CO3
UNIT IV	**3D VISION AND MOTION**	**9**
Methods for 3D vision — projection schemes — shape from shading — photometric stereo — shape from texture – shape from focus – active range finding – surface representations – point- based representation – volumetric representations – 3D object recognition – 3D reconstruction — introduction to motion — triangulation — bundle adjustment — translational alignment — parametric motion – spline-based motion – optical flow – layered motion.		CO4
UNIT V	**APPLICATIONS**	**9**
Application: Photo album — Face detection — Face recognition — Eigen faces — Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.

REFERENCE BOOKS

1. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
2. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer 2011.
5. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Implement fundamental image processing techniques required for computer vision.
CO2	Implement boundary tracking techniques and perform shape analysis
CO3	Apply Hough Transform for line, circle, and ellipse detections.
CO4	Apply 3D vision techniques and implement motion related techniques.
CO5	Develop applications using computer vision techniques.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
CO3	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
CO4	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	1	2	2	2	3	3	3

CS1514	MULTICORE ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the challenges in parallel and multi-threaded programming.
- Learn about the various parallel programming paradigms, and solutions.

UNIT I	MULTI-CORE PROCESSORS	9
Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design		CO1
UNIT II	**PARALLEL PROGRAM CHALLENGES**	**9**
Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes)		CO2
UNIT III	**SHARED MEMORY PROGRAMMING WITH OpenMP**	**9**
OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.		CO3
UNIT IV	**DISTRIBUTED MEMORY PROGRAMMING WITH MPI**	**9**
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation		CO4
UNIT V	**PARALLEL PROGRAM DEVELOPMENT**	**9**
Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kauffman/Elsevier, 2011.
2. 2. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, 2011 (unit 2)

REFERENCE BOOKS

1. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
2. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Program Parallel Processors.
CO2	Understand parallel program challenges
CO3	Develop shared memory programming with openMP
CO4	Develop distributed memory programming with MPI
CO5	Design parallel program using openMP

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2
CO2	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2
CO3	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2
CO4	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2
CO5	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2

CS1515	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
	Common to CSE & IT	3	0	0	3

OBJECTIVES

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT I	DIGITAL IMAGE FUNDAMENTALS	9
Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms — DFT, DCT.		CO1
UNIT II	**IMAGE ENHANCEMENT**	**9**
Spatial Domain: Gray level transformations — Histogram processing — Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement		CO2
UNIT III	**IMAGE RESTORATION**	**9**
Image Restoration — degradation model, Properties, Noise models — Mean Filters — Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering		CO3
UNIT IV	**IMAGE SEGMENTATION**	**9**
Edge detection, Edge linking via Hough transform — Thresholding — Region based segmentation – Region growing – Region splitting and merging – Morphological processing-erosion and dilation, Segmentation by morphological watersheds — basic concepts — Dam construction – Watershed segmentation algorithm.		CO4
UNIT V	**IMAGE COMPRESSION AND RECOGNITION**	**9**
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors — Topological feature, Texture — Patterns and Pattern classes — Recognition based on matching.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing Pearson, Third Edition, 2010.
2. Anil K. Jain, Fundamentals of Digital Image Processing Pearson, 2002.

REFERENCE BOOKS

1. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
5. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basics and fundamentals of digital image processing.
CO2	Operate on images using the techniques of smoothing, sharpening and enhancement
CO3	Understand the restoration concepts of filtering techniques
CO4	Understand segmentation concepts and feature extraction
CO5	Learn the basics of compression and recognition methods for color models

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
CO3	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
CO4	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	1	2	2	2	3	3	3

PROFESSIONAL ELECTIVE – II

CS1611	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the language hierarchy
- To construct automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language
- To understand Turing machines and their capability
- To understand undecidable problems and NP class problems.

UNIT I	AUTOMATA FUNDAMENTALS	9
Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata — Non-deterministic Finite Automata — Finite Automata with Epsilon Transitions		CO1
UNIT II	**REGULAR EXPRESSIONS AND LANGUAGES**	**9**
Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata		CO2
UNIT III	**CONTEXT FREE GRAMMAR AND LANGUAGES**	**9**
CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata		CO3
UNIT IV	**PROPERTIES OF CONTEXT FREE LANGUAGES**	**9**
Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM		CO4
UNIT V	**UNDECIDABILITY**	**9**
Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem, The Class P and NP		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2003.

REFERENCE BOOKS

1. H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation, Second Edition, PHI, 2003.
2. J.Martin, "Introduction to Languages and the Theory of Computation, Third Edition, TMH, 2003.
3. MichealSipser, "Introduction of the Theory and Computation, Thomson Brokecole, 1997.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Construct automata, regular expression for any pattern.
CO2	Write Context free grammar for any construct.
CO3	Design Turing machines for any language.
CO4	Propose computation solutions using Turing machines.
CO5	Derive whether a problem is decidable or not

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1612	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ To learn the criteria for test cases.
- ❖ To learn the design of test cases.
- ❖ To understand test management and test automation techniques.
- ❖ To apply test metrics and measurements.

UNIT I	INTRODUCTION	9
Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository		CO1

UNIT II	TEST CASE DESIGN STRATEGIES	9
Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing — Compatibility testing — user documentation testing — domain testing - Random Testing — Requirements based testing — Using White Box Approach to Test design — Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria		CO2

UNIT III	LEVELS OF TESTING	9
The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness — Running the Unit tests and Recording results — Integration tests — Designing Integration Tests — Integration Test Planning — Scenario testing — Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing — Ad-hoc testing — Alpha, Beta Tests — Testing OO systems — Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing		CO3

UNIT IV	TEST MANAGEMENT	9
People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items — test management — test process — Reporting Test Results — Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- .The Technical Training Program		CO4

UNIT V	TEST AUTOMATION	9
Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics		CO5

TOTAL: 45 PERIODS

TEXT BOOK

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing — Principles and Practices", Pearson Education, 2006.

REFERENCE BOOKS

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
2. Edward Kit, Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
3. Boris Beizer, Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Design test cases suitable for a software development for different domains.
CO2	Identify suitable tests to be carried out.
CO3	Prepare test planning based on the document.
CO4	Document test plans and test cases designed.
CO5	Use automatic testing tools and develop and validate test plan

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	2	-	-	3	2	2	3	3	3
CO2	3	3	3	3	2	3	2	-	-	3	2	2	3	3	3
CO3	3	3	3	3	2	3	2	-	-	3	2	2	3	3	3
CO4	3	3	3	3	2	3	2	-	-	3	2	2	3	3	3
CO5	3	3	3	3	2	3	2	-	-	3	2	2	3	3	3

CS1613	ADVANCED JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn advanced Java programming concepts like interface, threads, Swings etc.
- To develop network programs in Java
- To understand Concepts needed for distributed and multi-tier applications
- To understand issues in enterprise applications development.

UNIT I	JAVA GUI PROGRAMMING	9
Basics of Swings - Swing Components - Containers and Frames –Layout Manager --Menus and Toolbars - Event Handling		CO1
UNIT II	**J2EE CONCEPTS**	**9**
Java EE 5 Platform Overview- Distributed Multi-tiered Applications- Web & Business Components-Java EE Containers — services & types- Java EE Application Assembly & Deployment — Packaging Applications, Java EE modules- Getting Started with Web applications- Model View Controller (MVC)2 Architecture & Packaging — Web application deployment descriptor (web.xml file)- Web Application Archive (*.WAR file) -Ant build tool		CO2
UNIT III	**APPLICATIONS IN DISTRIBUTED ENVIRONMENT**	**9**
Remote method Invocation – activation models – RMI custom sockets – Object Serialization – RMI — IIOP implementation — CORBA — IDL technology — Naming Services — CORBA programming Models - JAR file creation		CO3
UNIT IV	**MULTI-TIER APPLICATION DEVELOPMENT**	**9**
Server side programming – servlets – Java Server Pages - Applet to Applet communication – applet to Servlet communication - JDBC – Applications on databases – Multimedia streaming applications — Java Media Framework.		CO4
UNIT V	**ENTERPRISE APPLICATIONS AND FRAMEWORK**	**9**
Server Side Component Architecture –EJB Introduction-EJB Architecture- Session Beans – Entity Beans – Persistent Entity Beans –Java Frameworks-Strut introduction-HIBERNATE		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Elliotte Rusty Harold, " Java Network Programming", O'Reilly publishers, 3rd Edition 2004 (UNIT II)
2. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 3rd edition,2006. (UNIT III and UNIT V)
3. Hortsmann& Cornell, "CORE JAVA 2 ADVANCED FEATURES, VOL II", Pearson Education, 2002. (UNIT I and UNIT IV)

REFERENCE BOOKS

1. Dustin R Callaway – "InsideServlets", 2 nd Edition, 2000.
2. Ivan Bayross "Web Enabled Commercial Application Development Using JAVA 2.0, 4." -2006
3. J.Mcgovern,R.Adatia, Y.Fain "J2EE 1.4 Bible" , 2000

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Develop the Java Basics, Platform independency and GUI Concept
CO2	Develop and derive the Swing design pattern.
CO3	Develop J2EE Server side programming concepts
CO4	Develop RMI, CORBA Chat application in Distributed Environment and web applications using Servlet, JSP and Applet
CO5	Develop the enterprise applications development and Strut, Hibernate Framework

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2
CO2	3	3	3	2	1	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2
CO5	3	3	2	2	1	-	-	-	-	1	2	2	3	3	2

CS1614	Introduction to Deep Learning	L	T	P	C
		3	0	0	3

OBJECTIVES

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

UNIT I	INTRODUCTION	9
Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates		CO1
UNIT II	**DEEP NETWORKS**	**9**
History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning		CO2
UNIT III	**DIMENSIONALITY REDUCTION AND CONVNET**	**9**
Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet – Convolution and Pooling - Architectures – LeNet, AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.		CO3
UNIT IV	**OPTIMIZATION AND GENERALIZATION**	**9**
Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.		CO4
UNIT V	**GENERATIVE MODEL AND CASE STUDY**	**9**
Generative models: Restrictive Boltzmann Machines (RBMs), Stacking RBMs, Belief nets, Learning sigmoid belief nets, Deep belief nets - Applications in vision, speech and natural language processing		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.
Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018

REFERENCE BOOKS

1. Phil Kim, “Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence”, Apress, 2017.
2. Ragav Venkatesan, Baoxin Li, “Convolutional Neural Networks in Visual Computing”, CRC Press, 2018.
3. Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.
4. Joshua F. Wiley, “R Deep Learning Essentials”, Packt Publications, 2016.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Know the importance of deep learning in machine learning applications.
CO2	Design and implement deep learning applications
CO3	Design and implement CNN and RNN.
CO4	Understand the use of different deep learning models in image processing.
CO5	Explore the applications of deep learning in various domains.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3

GE1003	PROFESSIONAL ETHICS IN ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ To enable the students to create an awareness on Engineering Ethics and Human Values,
- ❖ To install Moral and Social Values and Loyalty and to appreciate the rights of others

UNIT I	HUMAN VALUES	9
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others — Living peacefully — Caring — Sharing — Honesty — Courage — Valuing time — Cooperation — Commitment — Empathy — Self-confidence — Character — Spirituality — Introduction to Yoga and meditation for professional excellence and stress management		CO1
UNIT II	**ENGINEERING ETHICS**	**9**
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy — Kohlberg's theory — Gilligan's theory — Consensus and Controversy — Models of professional roles - Theories about right action — Self-interest — Customs and Religion – Uses of Ethical Theories		CO2
UNIT III	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9**
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law		CO3
UNIT IV	**SAFETY, RESPONSIBILITIES AND RIGHTS**	**9**
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority — Collective Bargaining — Confidentiality — Conflicts of Interest — Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination		CO4
UNIT V	**GLOBAL ISSUES**	**9**
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics — Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" McGraw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	To become familiar with human values
CO2	To get exposed engineering ethics.
CO3	To learn engineering as social experimentation
CO4	To study safety responsibilities and rights.
CO5	To become familiar with global issues

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	2	2	3	1	2	2	2	1	3	2
CO2	1	1	1	1	2	2	2	3	1	2	2	2	1	2	3
CO3	1	1	1	1	2	2	2	3	1	2	2	2	1	2	3
CO4	1	1	1	1	2	2	2	3	1	2	2	2	1	3	2
CO5	1	1	1	1	2	2	2	3	1	2	2	2	1	3	3

PROFESSIONAL ELECTIVE – III

CS1711	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization ‘s strategic goals

UNIT I	PROJECT EVALUATION AND PROJECT PLANNING	9
Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects — Setting objectives — Management Principles — Management Control — Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning		CO1
UNIT II	**PROJECT LIFE CYCLE AND EFFORT ESTIMATION**	**9**
Software process and Process Models — Choice of Process models - Rapid Application development — Agile methods — Dynamic System Development Method — Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model		CO2
UNIT III	**ACTIVITY PLANNING AND RISK MANAGEMENT**	**9**
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management — – PERT technique — Monte Carlo simulation — Resource Allocation — Creation of critical paths – Cost schedules		CO3
UNIT IV	**PROJECT MANAGEMENT AND CONTROL**	**9**
Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management		CO4
UNIT V	**STAFFING IN SOFTWARE PROJECTS**	**9**
Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012

REFERENCE BOOKS

1. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" — McGraw Hill Education (India), Fourteenth Reprint 2013

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand Project Management principles while developing software.
CO2	Gain extensive knowledge about the basic project management concepts, framework and the process models.
CO3	Obtain adequate knowledge about software process models and software effort estimation techniques. Estimate the risks involved in various project activities.
CO4	Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
CO5	Learn staff selection process and the issues related to people management

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	2	3	3	3	2	2	2	3	3	2
CO2	1	1	1	2	2	2	3	3	3	2	2	2	3	3	2
CO3	1	1	1	2	2	2	3	3	3	2	2	2	3	3	2
CO4	1	1	1	2	2	2	3	3	3	2	2	2	3	3	2
CO5	1	1	1	2	2	2	3	3	3	2	2	2	3	3	2

CS1712	VIRTUALIZATION TECHNIQUES	L	T	P	C
	Common to CSE & AI-ML	3	0	0	3

OBJECTIVES

- ❖ To understand the concept of virtualization.
- ❖ To understand the various issues in virtualization.
- ❖ To be familiar with the virtualization of various components/functionalities.
- ❖ To compare and analyze various virtual machines products.
- ❖ To work with virtualization platforms

UNIT I	INTRODUCTION	9
System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines — Taxonomy of Virtual Machines — Emulation: Basic Interpretation — Threaded Interpretation — Pre-Coded & Direct Interpretation — Binary Translation — Full and Para- Virtualization – Types of Hypervisor – Types of Virtualization		CO1
UNIT II	**SERVER VIRTUALIZATION**	**9**
Server Virtualization – Partitioning Techniques – Hardware Virtualization – Virtual Hardware – Types of Server Virtualization — Business Cases for Sever Virtualization — Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform		CO2
UNIT III	**NETWORK VIRTUALIZATION**	**9**
Design of Scalable Enterprise Networks — Virtualizing the Campus — WAN Design — WAN Architecture – WAN virtualization – Virtual Enterprise Transport Virtualization – VLANs and Scalability – Theory Network Device Virtualization Layer 2 – VLANs Layer 3 VRF Instances Layer 2 – VFIs Virtual Firewall Contexts Network Device Virtualization – Datapath Virtualization Layer 2: 802.1q – Trunking Generic Routing Encapsulation – IPSec L2TPv3 Label Switched Paths — Control-Plane Virtualization — Routing Protocols — VRF- Aware Routing — Multi- Topology Routing		CO3
UNIT IV	**STORAGE VIRTUALIZATION**	**9**
Hardware Devices — SCSI — SCSI Communication — Using SCSI Buses — Fiber Channel — Fiber Channel Cables — Fiber Channel Hardware Devices — iSCSI Architecture — Securing iSCSI SAN Backup & Recovery Techniques – RAID – Classic Storage Model – SNIA Shared Storage Model Host based Architecture — Storage based architecture — Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual Tape Libraries		CO4
UNIT V	**APPLYING VIRTUALIZATION**	**9**
Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level — Shared Kernel — Enterprise Solutions: Vmware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box – Server Virtualization: Configuring Server with Server Virtualization, Adjusting & Tuning Virtual Servers, VM Backup and Migration — Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions, Localized Virtualized Desktop — Network and Storage Virtualization: VPN, VLAN, SAN and VSAN, NAS		CO5
	TOTAL : 45 PERIODS	

TEXT BOOKS

1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress, 2005.
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

REFERENCE BOOKS

1. William von Hagen, “Professional Xen Virtualization”, Wrox Publications, January, 2008.
2. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
3. Amy Newman, Kenneth Hess, “Practical Virtualization Solutions: Virtualization from the Trenches”, Prentice Hall, October 2009

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Create a virtual machine and extend it to a virtual network.
CO2	Perform server virtualization.
CO3	Explain the concept of network virtualization.
CO4	Discuss various tasks in storage virtualization.
CO5	Compile all types of virtualization techniques and utilize them in design of virtual machines

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2
CO2	3	3	3	2	1	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2
CO5	3	3	2	2	1	-	-	-	-	1	2	2	3	3	2

CS1713	GPU ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of GPU architectures
- To write programs for massively parallel processors
- To understand the issues in mapping algorithms for GPUs
- To introduce different GPU programming models

UNIT I	GPU ARCHITECTURE	9
Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory		CO1
UNIT II	**CUDA PROGRAMMING**	**9**
Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions		CO2
UNIT III	**PROGRAMMING ISSUES**	**9**
Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors		CO3
UNIT IV	**OPENCL BASICS**	**9**
OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples		CO4
UNIT V	**ALGORITHMS ON GPU**	**9**
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Shane Cook, CUDA Programming: “A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, “Heterogeneous computing with OpenCL”, 3rd Edition, Morgan Kauffman, 2015

REFERENCE BOOKS

1. Nicholas Wilt, “CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison - Wesley, 2013.
2. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General Purpose GPU Programming”, Addison - Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors - A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
4. http://www.nvidia.com/object/cuda_home_new.html
5. http://www.openCL.org

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Describe GPU Architecture
CO2	Write programs using CUDA, identify issues and debug them
CO3	Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
CO4	Write simple programs using OpenCL
CO5	Identify efficient parallel programming patterns to solve problems

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2

CS1714	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ Be familiar with resource management techniques.
- ❖ Learn to solve problems in linear programming and Integer programming.
- ❖ Be exposed to CPM and PERT.

UNIT I	LINEAR PROGRAMMING	5
Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis		CO1
UNIT II	**DUALITY AND NETWORKS**	**8**
Definition of dual problem — Primal — Dual relationships — Dual simplex methods — Post optimality analysis – Transportation and assignment model – Shortest route problem		CO2
UNIT III	**INTEGER PROGRAMMING**	**8**
Cutting plane algorithm – Branch and bound methods, Multistage (Dynamic) programming		CO3
UNIT IV	**CLASSICAL OPTIMISATION THEORY**	**12**
Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems		CO4
UNIT V	**OBJECT SCHEDULING**	**12**
Network diagram representation – Critical path method – Time charts and resource leveling – PERT		CO5
		TOTAL : 45 PERIODS

TEXT BOOK

1. H.A. Taha, “Operation Research”, Prentice Hall of India, 2002
2. V. Sundaresan, K.S. Ganapathy Subramanian, K. Ganesan, “Resource Management Techniques”, A.R. Publications.

REFERENCE BOOKS

1. Paneer Selvam, „Operations Research‟, Prentice Hall of India, 2002
2. Anderson “Quantitative Methods for Business”, 8th Edition, Thomson Learning, 2002.
3. Winston “Operation Research”, Thomson Learning, 2003.
4. Vohra, “Quantitative Techniques in Management”, Tata McGraw Hill, 2002.
5. Anand Sarma, “Operation Research”, Himalaya Publishing House, 2003.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Solve optimization problems using simplex method.
CO2	Solve dual and primal problems
CO3	Apply integer programming and linear programming to solve real-life applications
CO4	Solve unconstrained optimization problems
CO5	Use PERT and CPM for problems in project management

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	1	1	1	2	1	1	2	3	2	2
CO2	3	3	3	3	3	1	1	1	2	1	1	2	3	2	2
CO3	3	3	3	3	3	1	1	1	2	1	1	2	3	2	2
CO4	3	3	3	3	3	1	1	1	2	1	1	2	3	2	2
CO5	3	3	3	3	3	1	1	1	2	1	1	2	3	2	2

MG1001	PRINCIPLE OF MANAGEMENT	L	T	P	C
	Common to CSE & AI-DS	3	0	0	3

OBJECTIVES

- ❖ To enable the students to study the evolution of Management
- ❖ To study the functions and principles of management
- ❖ To learn the application of the principles in an organization

UNIT I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9
Definition of Management – Science or Art – Manager vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches — Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.		CO1
UNIT II	**PLANNING**	**9**
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.		CO2
UNIT III	**ORGANISING**	**9**
Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority –77 centralization and decentralization — Job Design - Human Resource Management — HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management		CO3
UNIT IV	**DIRECTING**	**9**
Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication — process of communication — barrier in communication — effective communication –communication and IT.		CO4
UNIT V	**CONTROLLING**	**9**
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

REFERENCE BOOKS

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Familiar with Management and Organizations task
CO2	Decision Making and Planning
CO3	Know about HRM, Performance Management, HR planning.
CO4	Communication and Motivational Theories
CO5	Familiar with controlling of process and reporting

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	3	-	2	2	2
CO2	3	3	3	-	-	-	-	-	-	-	3	-	2	2	2
CO3	3	3	3	-	-	-	-	-	-	-	3	-	2	2	2
CO4	3	3	3	-	-	-	-	-	-	-	3	-	2	2	2
CO5	3	3	3	-	-	-	-	-	-	-	3	-	2	2	2

PROFESSIONAL ELECTIVE - IV

CS1721	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Get familiarized with different architectures and training algorithms of neural networks.
- Get exposed to the various neural modelling and control techniques with case study using simulation tool box.
- Gain Knowledge on fuzzy set theory and fuzzy rules.
- Able to design and implement the fuzzy logic controller with case study using simulation tool box.
- Capable of designing hybrid control schemes, selected optimization algorithms with case study using simulation tool box

UNIT I	ARTIFICIAL NEURAL NETWORK	9
Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perception — Limitation — Multi layer perception — Back propagation algorithm (BPA) — Recurrent neural network (RNN) – Adaptive resonance theory (ART) based network – Radial basis function network — online learning algorithms, BP through time — RTRL algorithms — Reinforcement learning		CO1
UNIT II	**NEURAL NETWORKS FOR MODELING AND CONTROL**	**9**
Modelling of non-linear systems using ANN — Generation of training data — Optimal architecture–Model validation – Control of non-linear systems using ANN – Direct and indirect Neuro control schemes — Adaptive Neuro controller — Familiarization with neural network toolbox		CO2
UNIT III	**FUZZY SET THEORY**	**9**
Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions		CO3
UNIT IV	**FUZZY LOGIC FOR MODELING AND CONTROL**	**9**
Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification — Knowledge base — Decision making logic — Defuzzification — Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox		CO4
UNIT V	**HYBRID CONTROL SCHEMES**	**9**
Fuzzification and rule base using ANN — Neuro fuzzy systems — ANFIS — Fuzzy neuron– Introduction to GA — Optimization of membership function and rule base using Genetic Algorithm – Introduction to support vector machine – Particle swarm optimization – Case study – Familiarization with ANFIS toolbox		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Laurence Fausett, “Fundamentals of Neural Networks”, Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc., 2000.

REFERENCE BOOKS

1. Goldberg, “Genetic Algorithm in Search, Optimization and Machine learning”, Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., “Neural Networks for Control”, MIT press, 1992.
3. EthemAlpaydin, “Introduction to Machine learning (Adaptive Computation and Machine Learning series)‘, MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, “Fuzzy Modeling and Fuzzy Control Series: Control Engineering”, 2006

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand basics of deep learning
CO2	Implement various deep learning models
CO3	Realign high dimensional data using reduction techniques
CO4	Analyze optimization and generalization in deep learning
CO5	Explore the deep learning applications

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3

CS1723	SOFTWARE ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To use architecture to address accelerating growth in requirements and system size.
- For utilizing architecture to optimize key quality attributes.
- Scale systems by discovering architecturally significant influences, using DevOps.
- To understand architecture's role in the organization, so you can deliver more value.

UNIT I	INTRODUCTION, SOFTWARE ARCHITECTURE, ITS IMPORTANCE	9
Software Architecture, Architectural Structures and Views, Software Architecture Importance: Enabling a System‘s Quality Attributes, Managing Change, Predicting System Qualities, Communication among Stakeholders, Early Design Decisions, Constraints on Implementation, Organizational Structure, Enabling Incremental Development, Cost and Schedule Estimates, Reusable Model, Architecture Allows Incorporation of Independently Developed Elements.		CO1
UNIT II	**QUALITY ATTRIBUTES, QUALITY ATTRIBUTE REQUIREMENTS, INTEGRABILITY**	**9**
Understanding Quality Attributes: Functionality, Quality Attribute Considerations, Specifying Quality Attribute Requirements: Quality Attribute Scenarios, Achieving Quality Attributes through Architectural Patterns and Tactics, Designing with Tactics, Analysing Quality Attribute Design, Integrability: Evaluating the Integrability of an Architecture, Its General Scenario, Integrability Tactics, Its Tactics-Based Questionnaire, Patterns.		CO2
UNIT III	**VIRTUALIZATION, ARCHITECTURALLY SIGNIFICANT REQUIREMENTS, DESIGNING** AN **ARCHITECTURE**	**9**
Virtualization: Shared Resources, Virtual Machines, VM Images, Containers and VMs, Container Portability, Pods, Serverless Architecture, Architecturally Significant Requirements: Gathering ASRs from Requirements Documents, Gathering ASRs by Interviewing Stakeholders and understanding the Business Goals, Capturing ASRs in a Utility Tree, Designing an Architecture: Attribute-Driven Design, The Seven Steps of ADD.		CO3
UNIT IV	**EVALUATING AN ARCHITECTURE, DOCUMENTING AN ARCHITECTURE**	**9**
Evaluating an Architecture: Evaluation as a Risk Reduction Activity, Key Evaluation Activities, Contextual Factors, The Architecture Trade-off Analysis Method, Lightweight Architecture Evaluation Documenting an Architecture: Uses and Audiences for Architecture Documentation, Notations, Views, Combining View, Documenting Behaviour, Beyond Views, Documenting the Rationale, Architecture Stakeholders.		CO4
UNIT V	**ROLE OF ARCHITECTS IN PROJECTS, ARCHITECTURE COMPETENCE**	**9**
The Role of Architects in Projects: The Architect and the Project Manager, Incremental Architecture and Stakeholders, Architecture and Agile Development, Architecture and Distributed Development Architecture Competence: Competence of Individuals: Duties, Skills, and Knowledge of Architects, Competence of a Software Architecture Organization, Become a Better Architect.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Addison-Wesley Professional, 4th Edition, 2021.

REFERENCE BOOKS

1. Richard H. Thayer, Mark J. Christensen, "Software Engineering, The Development", Volume 1, Third Edition, 2016.
2. Arthur M Langer, "Analysis and Design of Next-generation Software Architectures" , Springer Nature Switcher land, 2020.
3. Mark Richards and Neal Ford, "Software Architecture Fundamentals Workshop Part 1: From Developer to Architect", 2020.
4. Taylor et al., "Software Architecture: Foundations, Theory, and Practice" , John Wiley, 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Introduction to Software Architecture and its importance
CO2	Understanding of Quality Attributes, Quality Attribute Requirements and Integrability
CO3	The concept of Virtualization, Architecture Significant Requirements, Designing an Architecture
CO4	Evaluating an Architecture and Documenting an Architecture
CO5	The role of Architects in Projects and architecture Competence

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1724	MULTIMEDIA AND GRAPHICS PACKAGES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about multimedia system properties and data stream characteristics of continuous media
- To explore the features of different types of media like image, audio and video
- To provide knowledge about Multimedia Communication Systems
- To know about R Graphics
- To explore the concepts of Grid graphics

UNIT I	MEDIA AND DATA STREAMS	9
Multimedia: Media and Data Streams: Medium –Main properties of Multimedia System — Multimedia –Traditional Data Streams Characteristics –Data Stream characteristics of continuous Media		CO1
UNIT II	**MULTIMEDIA**	**9**
Sound / Audio: Basic Sound Concepts –Music –Speech –Images and Graphics: Basic Concepts –Computer I mage Processing –Video and Animation: Basic Concepts –Television — Computer-Based Animation		CO2
UNIT III	**MULTIMEDIA COMMUNICATION SYSTEMS**	**9**
Multimedia Communication Systems: Application Subsystem –Collaborative Computing — Session Management - Transport Subsystem –Transport Layer –Network Layer –Quality of Service and Resource Ma nagement – Ba sic Concepts – Establishment and Closing of the Multimedia Call – Managing Resources during Multimedia Transmission		CO3
UNIT IV	**INTRODUCTION TO R GRAPHICS**	**9**
R Graphics Examples: Standard Plots –Trellis Plots –The Grammar of Graphics –Specialized plots –Organization of R Graphics: Types of Graphics functions –Traditional Graphics Vs Grid Graphics		CO4
UNIT V	**GRID GRAPHICS**	**9**
Trellis Graphics: The Lattice graphics model –lattice plot types –the formula argument and multipanel conditioning — the group argument and legends –layout argument and arranging plots –scale argument a nd labeling a xes — panel argument and annotating plots		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ralf Steinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications & Applications”, Pearson Education Inc., 2011
2. Paul Murrell, “R Graphics”, CRC Press, Second Edition, 2012

REFERENCE BOOKS

1. Ze-Nian Li , Mark S. Drew and Jiangchuan Liu, Fundamentals of Multimedia , Springer International Publishing, 2014
2. Winston Chang R., Graphics Cookbook, O‘Reilly, 2013

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Understand multimedia system properties and data stream characteristics of continuous media
CO2	Analyze the features of different media
CO3	Understand the Multimedia Communication Systems
CO4	Understand the concepts of R graphics
CO5	Analyze the Grid graphics concepts

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	-	-	-	-	2	2	2	3	3	2
CO2	2	2	1	1	2	-	-	-	-	2	2	2	3	3	2
CO3	2	2	1	1	2	-	-	-	-	2	2	2	3	3	2
CO4	2	2	1	1	2	-	-	-	-	2	2	2	3	3	2
CO5	2	2	1	1	2	-	-	-	-	2	2	2	3	3	2

CS1725	HUMAN COMPUTER INTERACTION	L	T	P	C
	(Common to CSE & AI-ML)	3	0	0	3

OBJECTIVES

- To know how to analyze and consider user"s need in the interaction system
- To understand various interaction design techniques and models
- To understand the theory and framework of HCI
- Understand and analyze the cognitive aspects of human – machine interaction

UNIT I	INTRODUCTION	9
Foundation — Human — Computer — Interaction — Paradigms — What is HCI — Components — Cognitive Framework – Perception and Representation – Attention and Memory Constraint – Knowledge and Mental Model – Interface Metaphors – Input – Output		CO1
UNIT II	**DESIGN PROCESS**	**9**
Interaction Styles — Interaction Design Basics — HCI in the Software Process — Design Rules - Designing Windowing Systems - User Support and On-Line Information - Designing For Collaborative Work and Virtual Environments - Principles and User-Centered Design - Methods for User-Centered Design		CO2
UNIT III	**IMPLEMENTATION AND EVALUATION PROCESS**	**9**
Implementation issues – Implementation Support - Evaluation techniques – Universal Design – User Support		CO3
UNIT IV	**MODELS**	**9**
Cognitive models – Communication and collaboration models: Models of the system – Models of the System – Modeling Rich Interaction		CO4
UNIT V	**APPLICATIONS**	**9**
Socio — organization issues and stakeholder requirements - Ubiquitous Computing - Context — aware User Interfaces - Hypertext, multimedia and the World Wide Web		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, “Human Computer Interaction”, Third Edition, Pearson Education, 2004
2. Dix, Finlay, Abowd and Beale. “Human – Computer Interaction”, Second edition, Prentice Hall,1998

REFERENCE BOOKS

1. J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey. “Human — Computer Interaction”, Addison Wesley, 1994.
2. John M.Carrol, “Human Computer Interaction in the New Millenium”, Pearson Education, 2002.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	To develop good design for human machine interaction syste
CO2	Analyze the user"s need in interaction system
CO3	To design new interaction model to satisfy all types of customers
CO4	Evaluate the usability and effectiveness of various products
CO5	To know how to apply interaction techniques for systems

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	2	2	2	2	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	2	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	2	3	2
CO4	2	2	3	3	2	-	-	-	-	2	2	2	2	3	2
CO5	2	2	2	2	2	-	-	-	-	2	2	2	2	2	2

CS1726	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

UNIT I	INTRODUCTION TO BUSINESS ANALYTICS	9
Analytics and Data Science - Analytics Life Cycle - Types of Analytics - Business Problem Definition - Data Collection - Data Preparation - Hypothesis Generation - Modeling - Validation and Evaluation - Interpretation - Deployment and Iteration.		CO1
UNIT II	**BUSINESS INTELLIGENCE**	**9**
Data Warehouses and Data Mart - Knowledge Management - Types of Decisions - Decision Making Process - Decision Support Systems - Business Intelligence - OLAP - Analytic functions.		CO2
UNIT III	**BUSINESS FORECASTING**	**9**
Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models - Data Mining and Predictive Analysis Modelling - Machine Learning for Predictive analytics.		CO3
UNIT IV	**HR & SUPPLY CHAIN ANALYTICS**	**9**
Human Resources - Planning and Recruitment - Training and Development - Supply chain network - Planning Demand, Inventory and Supply - Logistics - Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.		CO4
UNIT V	**MARKETING & SALES ANALYTICS**	**9**
Marketing Strategy, Marketing Mix, Customer Behaviour - selling Process - Sales Planning - Analytics applications in Marketing and Sales - predictive analytics for customer's behaviour in marketing and sales.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, Operations Management -Theory and Practice, 3rd Edition, Pearson Education, 2018.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Explain the real world business problems and model with analytical solutions.
CO2	Identify the business processes for extracting Business Intelligence
CO3	Apply predictive analytics for business fore-casting
CO4	Apply analytics for supply chain and logistics management
CO5	Use analytics for marketing and sales.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	-	--	-	1	2	1	1	3	2	1
CO2	3	3	3	2	3	-	--	-	1	2	2	2	3	1	2
CO3	2	2	3	3	2	-	--	-	3	1	1	3	3	1	2
CO4	2	1	1	2	2	-	--	-	3	3	2	1	1	3	1
CO5	2	3	2	3	2	-	--	-	3	3	1	3	3	1	1

PROFESSIONAL ELECTIVE – V

CS1811	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of natural language processing
- To understand word level and syntactic analysis.
- To understand the syntax analysis and parsing
- To understand the role of semantics of sentences and pragmatics
- To get knowledge about the machine translation

UNIT I	INTRODUCTION	9
Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages - NLP Applications-Information Retrieval. Language Modeling: Various Grammar-based Language Models-Statistical Language Model.		CO1
UNIT II	**WORD LEVEL ANALYSIS**	**9**
Regular Expressions, Finite-State Automata — English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance - Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff -Words and Word classes-Part-of Speech Tagging - Issues in PoS tagging – Hidden Markov and Maximum Entropy models.		CO2
UNIT III	**SYNTACTIC ANALYSIS**	**9**
Context-Free Grammars, Grammar rules for English, Treebank, Normal Forms for grammar – Dependency Grammar — Syntactic Parsing, Ambiguity, Dynamic Programming parsing — Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.		CO3
UNIT IV	**SEMANTICS AND PRAGMATICS**	**9**
Requirements for representation, First-Order Logic, Description Logics — Syntax-Driven Semantic analysis, Semantic attachments — Word Senses, Relations between Senses, Thematic Roles, selection restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods — Word Similarity using Thesaurus and Distributional methods.		CO4
UNIT V	**NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION**	**9**
Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Second Edition, Pearson Publication, 2014
2. Christopher Manning, “Foundations of Statistical Natural Language Processing”, MIT Press, 2009
3. Nitin Indurkhya and Fred J. Damerau, “Handbook of Natural Language Processing”, Second Edition, Chapman & Hall/CRC Press, 2010.

REFERENCE BOOKS

1. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, First Edition, OReilly Media, 2009
2. Breck Baldwin, “Natural Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015.
3. Richard M Reese, “Natural Language Processing with Java”, First Edition, Packt Publishing,2015.
4. YoavGoldberg, GraemeHirst, “Neural Network Methods for Natural Language Processing - Synthesis Lectures on Human Language Technologies”, Morgan and Claypool Life Sciences, 2017.
5. Deepti Chopra, Nisheeth JoshiIti Mathur, “Mastering Natural Language Processing with Python”, First Edition, Packt Publishing Limited, 2016
6. Mohamed ZakariaKurdi “Natural Language Processing and Computational Linguistics 1: Speech, Morphology and Syntax”, First Edition, ISTE Ltd. Wiley, 2016
7. Atefeh Farzindar, DianaInkpen, “Natural Language Processing for Social Media, Second Edition, Morgan and Claypool Life Sciences, 2015

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To tag a given text with basic Language features
CO2	To design an innovative application using NLP components
CO3	To implement a rule-based system to tackle morphology/syntax of a language
CO4	To design a tag set to be used for statistical processing for real-time applications
CO5	To perform machine translation by preserving the meaning of the input text, and producing fluent text in the output language

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)										PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	3	2	1	1	2	3	3	2	3
CO2	2	2	2	1	2	2	2	1	2	2	2	3	3
CO3	2	3	2	2	3	2	1	1	2	3	3	2	3
CO4	2	3	2	1	2	1	1	1	2	2	3	3	3
CO5	2	3	2	2	2	2	2	2	2	2	3	3	3

CS1812	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the Architecture of PIC microcontroller
- To learn about Interrupts and timers
- To recognize the Peripheral devices for data communication and transfer
- To know the Functional blocks of ARM processor
- To learn about Architecture of ARM processors

UNIT I	INTRODUCTION TO PIC MICROCONTROLLER	9
Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–IC16cxx–-Pipelining - Program Memory considerations — Register File Structure - Instruction Set - Addressing modes – Simple Operations		CO1
UNIT II	**INTERRUPTS AND TIMER**	**9**
PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings		CO2
UNIT III	**PERIPHERALS AND INTERFACING**	**9**
I^2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing		CO3
UNIT IV	**INTRODUCTION TO ARM PROCESSOR**	**9**
Architecture –ARM programmer‘s model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems		CO4
UNIT V	**ARM ORGANIZATION**	**9**
3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface–Architectural support for High Level Languages — Embedded ARM Applications		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Peatman,J.B., “Design with PIC Micro Controllers”PearsonEducation,3rdEdition, 2004
2. Furber,S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000

REFERENCE BOOKS

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand and apply computing platform and software for engineering problems
CO2	Understand the concepts of Architecture of PIC microcontroller
CO3	Acquire knowledge on Interrupts and timers
CO4	Understand the importance of Peripheral devices for data communication
CO5	Acquire knowledge in Architecture of ARM processors

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	-	-	1	-	1	-	1	3	3	2
CO2	2	2	1	1	2	-	-	1	-	1	-	1	3	3	2
CO3	2	2	1	1	2	-	-	1	-	1	-	1	3	3	2
CO4	2	2	1	1	2	-	-	1	-	1	-	1	3	3	2
CO5	2	2	1	1	2	-	-	1	-	1	-	1	3	3	2

CS1813	FORENSICS AND CYBER LAW	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamentals of Forensics and Cyber Crime.
- To know about the types and categories of Cyber Crime.
- To learn about penetration, auditing and testing in Cyber Crime.
- To understand the importance of Cyber Security.
- To recognize the significance of Cyber Act.

UNIT I	INTRODUCTION TO FORENSICS AND CYBER CRIME	9
Fundamentals of computer, Internet Technology, E-Governance & E-Business ,Crime, criminology, origin, source, recent trends. Emergence of information based society, economic, administration, social, dependence of use of information, accession, threats, civil society and global society, Overview of computer forensics and Investigative Techniques, Computer forensic tools, activities of forensic investigations and testing methodology		CO1
UNIT II	**TYPES AND CATEGORIES OF CYBER CRIME**	**9**
Personal, Business, Financial, Office Security, Cyber Crime – Complete transparency, hacking/cracking, denial of service, IP piracy, phrasing, hetaerism etc. Cyber Attack — cyber attackers		CO2
UNIT III	**ROLE OF COMPUTERS AND INTERNET IN CYBER CRIME, PENETRATION TESTING AND AUDITING**	**9**
Computer as witness, evidence, act, defining evidence, computer forensics, computer storage, media of electric record for use of course of law. Customers and legal agreements, Router penetration testing, Firewalls penetration testing, Intrusion detection system penetration testing, Wireless networks penetration testing, Password cracking penetration testing, Social engineering penetration testing, Application penetration testing, Policies and controls testing. Penetration testing report and documentation writing , Policies and procedures Security Policies-checklist		CO3
UNIT IV	**CYBER SECURITY**	**9**
The concept of cyber security , meaning, scope and the frame work, basic structure development and management, Rules, Regulations, Act, Legislation - Meaning, Scope, Difference between Rules		CO4
UNIT V	**NEED FOR A CYBER ACT**	**9**
The Indian Context , Need for a Cyber Act , Information Technology Act , Scope and further Development , Information Technology Act (Amendment) , coverage of Cyber Security and Cyber Crime Indian cyber Laws vs. cyber laws of U.S.A , similarities , scope and coverage , Effectiveness. Laboratory work: consists of gathering information, evidence with tools like WinHex, Metasploit and Social Engineering toolkit		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Cyber Forensics: from Data to Digital Evidence , Albert J. Marcella Jr., Wiley,1 st Edition,2012
2. Hack I.T. - Security Through Penetration Testing, T. J. Klevinsky, Scott Laliberte and Ajay Gupta, Addison-Wesley, 1st Edition,2002

REFERENCE BOOKS

1. Computer Forensics: Cybercriminals, Laws, And Evidence , Marie-Helen Maras, Jones & Bartlett Learn ,1st Edition ,2011
2. Computer Forensics: Investigating Network Intrusions and Cyber Crime, EC Council Press Series, Cengage Learning , 2010

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the fundamentals of Forensics and Cyber Crime.
CO2	Know about the types and categories of Cyber Crime.
CO3	Identify about penetration, auditing and testing in Cyber Crime.
CO4	Know the importance of Cyber Security.
CO5	Recognize the significance of Cyber Act.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

CS1814	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Be familiar with mathematical foundations of data mining tools
- Understand and implement classical models and algorithms in data warehouses and data mining
- Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering
- Master data mining techniques in various applications like social, scientific and environmental context
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems

UNIT I	DATA WAREHOUSE	9
Introduction to Data Ware House, Differences between operational data base systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction-Transformation-Loading, Logical (MulitDimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; FactLess-Facts, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics; OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP		CO1
UNIT II	**INTRODUCTION TO DATA MINING**	**9**
Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing- Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation , Data Transformation; Measures of similarity and dissimilarity-Basics		CO2
UNIT III	**ASSOCIATION RULES**	**9**
Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation, APRIORI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set-Maximal Frequent Item Set, Closed Frequent Item Set		CO3
UNIT IV	**CLASSIFICATION**	**9**
Problem definition, General Approaches to solving a classification problem, Evaluation of Classifiers, Classification techniques, Decision trees-Decision Tree Construction, Methods for expressing attribute test conditions, Measures for Selecting the Best split, Algorithm for Decision tree Induction, Naïve-Bayes Classifier, Bayesian Belief Networks; K-nearest neighbor classification-Algorithm and characteristics		CO4
UNIT V	**CLUSTERING**	**9**
Problem Definition, Clustering overview, Evaluation of clustering algorithms, Partitioning clustering K-Means Algorithm, K-Means Additional Issues, PAM Algorithm, Hierarchical Clustering-Algorithm- Agglomerative Methods and Divisive Methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and weakness, Outlier Detection		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Jiawei Han, Micheline Kamber, Data Mining-Concepts and Techniques, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006
2. Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Introduction to Data Mining, Pearson Education

REFERENCE BOOKS

1. Arun K Pujari, Data Mining Techniques, 3rd Edition, Universities Press
2. Pualraj Ponnaiah, Data Ware Housing Fundamentals, Wiley Student Edition
3. Ralph Kimball, The Data Ware House Life Cycle Toolkit, Wiley Student Edition
4. Vikaram Pudi, P Radha Krishna, Data Mining, Oxford University

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the functionality of the various data mining and data warehousing component
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analyzing techniques of various data
CO4	Describe different methodologies used in data mining and data ware housing
CO5	Compare different approaches of data ware housing and data mining with various technologies

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	1	-	2	2	2	3	3	2
CO2	2	2	2	1	2	-	-	1	-	2	2	2	3	3	2
CO3	2	2	2	1	2	-	-	1	-	2	2	2	3	3	2
CO4	2	2	2	1	2	-	-	1	-	2	2	2	3	3	2
CO5	2	2	2	1	2	-	-	1	-	2	2	2	3	3	2

CS1815	SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the basic tenets of software quality and quality factors.
- Be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA components.
- Understand of how the SQA components can be integrated into the project life cycle.
- Be familiar with the software quality infrastructure.
- Be exposed to the management components of software quality

UNIT I	INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	9
Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives — Software quality factors- McCall"s quality model — SQA system and architecture — Software Project life cycle Components — Pre project quality components — Development and quality plans		CO1

UNIT II	SQA COMPONENTS AND PROJECT LIFE CYCLE	9
Software Development methodologies — Quality assurance activities in the development process - Verification & Validation — Reviews — Software Testing — Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components — Quality assurance tools — CASE tools for software quality — Software maintenance quality – Project Management		CO2

UNIT III	SOFTWARE QUALITY INFRASTRUCTURE	9
Procedures and work instructions - Templates - Checklists — 3S development team - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval		CO3

UNIT IV	SOFTWARE QUALITY MANAGEMENT & METRICS	9
Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics — Cost of software quality — Classical quality cost model — Extended model — Application of Cost model		CO4

UNIT V	STANDARDS, CERTIFICATIONS & ASSESSMENTS	9
Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models — CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards — IEEE st 1012 & 1028 — Organization of Quality Assurance — Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems		CO5

TOTAL : 45 PERIODS

TEXT BOOK

1. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009

REFERENCE BOOKS

1. G.James, D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,2013.
2. E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.
4. C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Utilize the concepts in software development life cycle
CO2	Demonstrate their capability to adopt quality standards.
CO3	Assess the quality of software product.
CO4	Apply the concepts in preparing the quality plan & documents
CO5	Understand certification and assessments

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	1	3	2	3	2	2	2	2	3	3	3
CO2	1	1	1	2	1	3	2	3	2	2	2	2	3	3	3
CO3	1	1	1	2	1	3	2	3	2	2	2	2	3	3	3
CO4	1	1	1	2	1	3	2	3	2	2	2	2	3	3	3
CO5	1	1	1	2	1	3	2	3	2	2	2	2	3	3	3

PROFESSIONAL ELECTIVE – VI

CS1821	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of software defined networks.
- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming.
- To study about the various applications of SDN

UNIT I	INTRODUCTION	9
History of Software Defined Networking (SDN) — Modern Data Center — Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes		CO1
UNIT II	**OPEN FLOW & SDN CONTROLLERS**	**9**
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts		**CO2**
UNIT III	**DATA CENTERS**	**9**
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network — VLANs — EVPN — VxLAN — NVGRE		**CO3**
UNIT IV	**SDN PROGRAMMING**	**9**
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs — Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications		**CO4**
UNIT V	**SDN**	**9**
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Paul Goransson and Chuck Black, “Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks, O'Reilly Media, 2013.

REFERENCE BOOKS

1. Siamak Azodolmolky, “Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, “SDN and Open Flow for Beginners”, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, “Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Analyze the evolution of software defined networks
CO2	Express the various components of SDN and their uses
CO3	Explain the use of SDN in the current networking scenario
CO4	Design and develop various applications of SDN
CO5	Understand about SDN frameworks

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	-	-	-	-	-	2	2	2	3	2	2
CO2	3	3	3	2	-	-	-	-	-	2	2	2	3	2	2
CO3	3	3	3	2	-	-	-	-	-	2	2	2	3	2	2
CO4	3	3	3	2	-	-	-	-	-	2	2	2	3	2	2
CO5	3	3	3	2	-	-	-	-	-	2	2	2	3	2	2

CS1822	iOS APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the principles of iOS app development
- To provide hands-on experience and networking with use of Swift programming language
- To understand the conceptual overview, design issues, and practical development via iOS a pp development projects
- To use iOS development tools such as Xcode, design interfaces and interactions and evaluate their usability, and integrate camera, photo, and location -information to enhance iOS apps

UNIT I	INTRODUCTION TO SWIFT PROGRAMMING	9
Swift language essentials: Arrays, Dictionaries, functions, Optionals, Control Flow, Structs Enums and Classes, Playgrounds. Elements of The Swift Foundation classes, Cocoa Touch Foundation Framework, Simple connections to the User Interface		CO1
UNIT II	**IOS APP DESIGN AND DEVELOPMENT PRINCIPLES**	**9**
Overview of iOS History, iOS Devices, iOS App Markets, iOS Design Principles, i OS Software Arc hitecture, iOS Development Tools, Xcode, iOS Programming Languages of Swift and Objective-C, Objective-C Compatibility, Foundation Frameworks, Model-View-Controller(MVC), Multiple MVCs		CO2
UNIT III	**BEST PRACTICES FOR IOS USER INTERFACE AND FUNCTIONALITY DESIGN**	**9**
UI Overview, Views, Gestures, View Controller Lifecycle, Storyboard, Autolayout, Scroll View, Multithreading, Table View, Unwind Segues, Alerts, Timers, View Animation, Dynamic Animation, Application Lifecycle, Core Motion, Core Location, Map Kit, Modal Segues, Camera, Persistence, Embed Segues, Internationalization and Settings		CO3
UNIT IV	**IOS NETWORKING AND SECURITY**	**9**
iOS Networking with MVC, Social Networking in iOS, Web API Security and Data Transport, i OS Secure Network Setting, Basic OAuth2 Functionality, Secure JSON Web APIs, Cryptographically Secured Push Notifications, Core Data, Secure Data Storage		CO4
UNIT V	**IOS APP SOFTWARE ENGINEERING**	**9**
Software Development Cycles, Requirements Capture, Automated Testing, Test-Driven Development, Debugging, Deployment to Market, Distribution of iOS App through the App Store, Monetization		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Matt Neuburg, iOS 9 Programming Fundamentals with Swift, O'Reilly, 2015
2. The Swift Programming Language, Swift Programming Series, Apple Inc., 2019

REFERENCE BOOKS

1. Jesse Feiler, "iOS App Development For Dummies," Wiley, 2014
2. Craig Grummitt, "iOS Development with Swift," Manning Publications, 2017
3. Christian Keur, Aaron Hillegass, "iOS Programming: The Big Nerd Ranch Guide," 7th Edition, O'Reilly, 2020
4. Matt Neuburg, "iOS 13 Programming Fundamentals with Swift: Swift, Xcode, and Cocoa Basics," O'Reilly, 2020

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Understand iOS development tools and Swift programming language to develop iOS Apps from scratch
CO2	Describe the principles of software requirements for the iOS app development and networking
CO3	Apply the principles of software engineering to the iOS app software development and networking
CO4	Describe the skills required to produce and maintain a high-quality iOS app
CO5	Evaluate and apply software process and software best practices

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	-	1	-	1	1	1	3	3	2
CO2	2	2	1	1	1	-	-	1	-	1	1	1	3	3	2
CO3	2	2	1	1	1	-	-	1	-	1	1	1	3	3	2
CO4	2	2	1	1	1	-	-	1	-	1	1	1	3	3	2
CO5	2	2	1	1	1	-	-	1	-	1	1	1	3	3	2

CS1823	NETWORK SIMULATION USING NS3	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the ns3 fundamentals and installation
- To become familiar with events and simulation
- To understand logging and tracing, during network simulation
- To learn the intricacies of building various network topologies
- To run network simulations in ns3 using C++ and Python scripts

UNIT I	NS3 ARCHITECTURE AND INSTALLATION	9
Introduction – Network Simulation – Network Emulation – Evolution of Network Simulators and Emulators — Testbed — ns3 Installation –Software Organization –ns2 vs ns3 – running ns3 scripts		CO1

UNIT II	RANDOM VARIABLES	9
Pseudo-Random number generation –creating random variables –Class Random Variable Stream –Base Class Public API — Types of Random Variables		CO2

UNIT III	EVENTS AND SIMULATION	9
Simulator object –Scheduler –Simulation time –Events –ns3 source code –key abstractions – Node — Packet — Channel –Net Device –Topology Helpers –ns3 Namespace – Containers — Applications –Building ns3 script		CO3

UNIT IV	LOGGING AND TRACING	9
Logging module –enabling logging –Command Line Arguments –Tracing System – ASCII tracing –parsing traces – PCAP tracing –tcpdump –Wireshark –callbacks –connect with config –dynamic trace sources – Trace sinks – gnuplot –NetAnim		CO4

UNIT V	BUILDINGTOPOLOGIES AND DATA COLLECTION	9
Bus Network topology –Wireless Network topology –Queues –Queuing models – Data collection –GNUPlotHelper –Supported Trace types - FileHelper		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jack L. Burbank, “An Introduction to Network Simulator 3”, Wiley-Blackwell, First Edition, 2016

REFERENCE BOOKS

1. Klaus Wehrle, Mesut Gunes, James Gross, “Modeling and Tools for Network Simulation”, Springer, 2017

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand ns3 software organization and installation
CO2	Generate simple events in simulation
CO3	Implement logging, tracing and Animation
CO4	Build various network topologies
CO5	Analyze wired & wireless network simulations

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	1	1	1	-	-	1	-	-	1	1	3	3	2
CO2	2	3	1	1	1	-	-	1	-	-	1	1	3	3	2
CO3	2	3	1	1	1	-	-	1	-	-	1	1	3	3	2
CO4	2	3	1	1	1	-	-	1	-	-	1	1	3	3	2
CO5	2	3	1	1	1	-	-	1	-	-	1	1	3	3	2

CS1824	BLOCKCHAIN TECHNOLOGIES	L	T	P	C
	(Common to CSE & IT)	3	0	0	3

OBJECTIVES

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work
- To securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their own projects.

UNIT I	BASICS	9
Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.		CO1
UNIT II	**BLOCKCHAIN**	**9**
Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.		CO2
UNIT III	**DISTRIBUTED CONSENSUS**	**9**
Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.		CO3
UNIT IV	**CRYPTOCURRENCY**	**9**
History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin		CO4
UNIT V	**CRYPTOCURRENCY REGULATION**	**9**
Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

REFERENCE BOOKS

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger, "Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Design principles of Bitcoin and Ethereum and Nakamoto consensus
CO2	Learn the simplified Payment Verification protocol and describe differences between proof-of-work and proof-of-stake consensus.
CO3	Interact with a blockchain system by sending and reading transactions.
CO4	Design, build, and deploy a distributed application.
CO5	Evaluate security, privacy, and efficiency of a given blockchain system.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	3	2	3	3	1	2	2	1	1	2	3	3	2
CO2	1	1	2	1	3	2	2	2	2	1	1	2	3	3	2
CO3	1	1	3	2	3	3	1	1	2	1	1	2	3	3	2
CO4	1	1	2	2	3	2	2	2	2	1	1	3	3	3	2
CO5	1	1	3	3	3	2	1	2	2	1	1	2	3	3	2

CS1825	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide the knowledge on information retrieval system capabilities.
- To introduce different computational search problems and evaluate search engines.
- To get an understanding of machine learning techniques for text classification and clustering.
- To introduce different applications of informational retrieval techniques in the internet or web environment.
- To discuss about information visualization and system evaluation.

UNIT I	INTRODUCTION	9
Information Retrieval – Early Developments – The IR Problem – The User's Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The ePublishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interface Today – Visualization in Search Interfaces.		CO1
UNIT II	**MODELING AND RETRIEVAL EVALUATION**	**9**
Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion –Explicit Relevance Feedback.		CO2
UNIT III	**TEXT CLASSIFICATION AND CLUSTERING**	**9**
A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.		CO3
UNIT IV	**WEB RETRIEVAL AND WEB CRAWLING**	**9**
The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations – Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.		CO4
UNIT V	**RECOMMENDER SYSTEM**	**9**
Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models –Neighborhood models.		CO5
		TOTAL : 45 PERIODS

TEXT BOOK

1. Kowalski, Gerald, Mark T May bury: INFORMATION RETRIEVAL SYSTEMS: Theory and Implementation, Kluwer Academic Press, 1997

REFERENCE BOOKS

1. Gerald Kowalski: INFORMATION RETRIEVAL Architecture and Algorithms.
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval data Structures and Algorithms, Prentice Hall, 1992.
3. Modern Information Retrieval by Yates Pearson Education.
4. Information Storage & Retrieval by Robert Korfhage –John Wiley & Sons.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand various functionalities and capabilities of Information Retrieval System.
CO2	Gain knowledge on cataloguing and data structure methodology for IRS.
CO3	Differentiate various clustering algorithms and indexing.
CO4	Differentiate various user search techniques and system search techniques.
CO5	Understand the concepts of information visualization and text search

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	-	-	-	2	2	2	3	2	2
CO2	3	3	3	3	2	2	-	-	-	2	2	2	3	2	2
CO3	3	3	3	3	2	2	-	-	-	2	2	2	3	2	2
CO4	3	3	3	3	2	2	-	-	-	2	2	2	3	2	2
CO5	3	3	3	3	2	2	-	-	-	2	2	2	3	2	2

OPEN ELECTIVES – I & II

OBT101	INDUSTRIAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVE

- To motivate students to excel in research and to practice the technologies in the field of Industrial biotechnology. To provide students with a solid understanding of Biotechnology fundamentals and applications required to solve real life problems. To provide students with an academic environment that is aware of professional excellence and leadership through interaction with professional bodies

UNIT I	OVERVIEW OF THE CELL	9
Cell, structure and properties, prokaryotic and eukaryotic cells, structural organization and function of intracellular organelles; Cell wall, Nucleus, Mitochondria, Golgi bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes and Chloroplast.		CO1
UNIT II	**MICROBIAL GROWTH: PURE CULTURE TECHNIQUES**	**9**
Enrichment culture techniques for isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microorganisms. The definition of growth, mathematical expression of growth, Growth curve, availability of oxygen, culture collection and maintenance of cultures. Media formulation: principles of microbial nutrition, formulation of culture medium, selective media, factors influencing the choice of various carbon and nitrogen sources, vitamins, minerals, precursors and antifoam agents. Importance of pH.		CO2
UNIT III	**MANAGEMENT OF WASTE**	**9**
Management of Contaminated land, lake sediments and Solid Waste, Anaerobic digestion, Biostimulation, Bioaugmentation, Phytoremediation, Natural attenuation, Vermicomposting		CO3
UNIT IV	**BIOREMEDIATION**	**9**
Definition, constraints and priorities of Bioremediation, Types of bioremediation, In-situ and Ex-situ bioremediation techniques, Factors affecting bioremediation. Bioremediation of Hydrocarbons. Lignocellulosic Compounds.		CO4
UNIT V	**BIOENERGY AND BIOMINING**	**9**
Bio energy: Energy and Biomass Production from wastes, biofuels, bio hydrogen and biomass. Biomining: Bioleaching, monitoring of pollutants, microbially enhanced oil recovery, microbial fuel cells.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Molecular Biology of cell, Alberts. B et al. Developmental Biology, SF Gilbert, Sinauer Associates Inc.
2. AVN Swamy, Industrial Pollution Control Engineering, 2006, Galgotia Publication,

REFERENCE BOOKS

1. Environmental Biotechnology - Allan Stagg.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Design, perform experiments, analyze and interpret data for investigating complex problems in Biotechnology, Engineering and related fields.
CO2	Decide and apply appropriate tools and techniques in biotechnological manipulation.
CO3	Justify societal, health, safety and legal issues
CO4	Understand his responsibilities in biotechnological engineering practices
CO5	Understand the need and impact of biotechnological solutions on environment and societal context keeping in view need for sustainable solution.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	1	2	2	4	2	1	1	1	2	1	1
CO2	2	1	1	2	2	1	2	1	3	4	1	2	1	1	2
CO3	3	3	2	1	1	2	4	3	1	2	4	5	1	2	2
CO4	3	3	2	4	2	1	1	1	2	1	3	2	1	2	2
CO5	2	1	4	5	2	4	3	2	1	2	3	1	1	2	2

OBT104	BIOSENSORS	L	T	P	C
		3	0	0	3

OBJECTIVE

- Understand protein based biosensors and their enzyme reactivity, stability and their application

UNIT I	PROTEIN BASED BIOSENSORS	9
Nano structure for enzyme stabilization - Single enzyme nano particles - Nanotubes microporus silica - Protein based nanocrystalline Diamond thin film for processing		CO1
UNIT II	**DNA BASED BIOSENSOR**	**9**
Heavy metal complexing with DNA and its determination water and food samples - DNA zymo biosensors		CO2
UNIT III	**ELECTRO CHEMICAL APPLICATION**	**9**
Detection in biosensors - Flurorescence - Absorption - Electrochemical. Integration of various techniques - Fibre optic biosensors		CO3
UNIT IV	**FABRICATION OF BIOSENSORS**	**9**
Techniques used for microfabrication - Microfabrication of electrodes - On chip analysis		CO4
UNIT V	**BIOSENSORS IN RESEARCH**	**9**
Future direction in biosensor research - Designed protein pores-as components of biosensors - Molecular design -Bionanotechnology for cellular biosensing - Biosensors for drug discovery - Nanoscale biosensors		CO5

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004
2. Nanomaterials for Biosensors, Cs. Kumar, Willey - VCH, 2007
3. Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	The students will able to understand protein based biosensors and their enzyme reactivity, stability and their application in protein based nano crystalline thin film processing
CO2	The students will able to describe DNA based biosensors to study the presence of heavy metals in the food products
CO3	The students will able to understand fluorescence, UV-Vis and electrochemical applications of biosensors
CO4	The students will able to study about the fabrication of biosensors and its application as nanochipanalyzer
CO5	To understand the Future direction in biosensor research

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	3	2	1	2	2	4	2	1	1	1	2	1	1
CO2	3	2	1	2	2	1	2	1	3	4	1	2	1	1	2
CO3	1	2	4	3	1	2	4	3	1	2	4	5	1	2	2
CO4	1	2	2	4	2	1	1	1	2	1	3	2	1	2	2
CO5	2	1	3	1	2	4	3	2	1	2	3	1	1	2	2

OBT105	INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVE

- Understand the principles of processing, manufacturing and characterization of nanomaterials and nanostructures.

UNIT I	BASICS OF NANOTECHNOLOGY	9
Introduction - Time and length scale in structures -Definition of a nanosystem -Dimensionality and size dependent phenomena -Surface to volume ratio -Fraction of surface atoms - Surface energy and surface stress- surface defects-Effect of nanoscale on various properties - Structural, thermal, mechanical, magnetic, optical and electronic properties.		CO1
UNIT II	**DIFFERENT CLASSES OF NANOMATERIALS**	**9**
Classification based on dimensionality-Quantum Dots,Wells and Wires - Carbon based nano materials (buckyballs, nanotubes, grapheme) - Metal based nanomaterials (nanogold, nanosilver and metal oxides) - Nanocomposites-Nanopolymers - Nano ceramics -Biological nanomaterials.		CO2
UNIT III	**SYNTHESIS OF NANOMATERIALS**	**9**
Chemical Methods: Metal Nanocrystals by Reduction -Sol - gel processing - Solvothermal Synthesis - Photochemical Synthesis - Chemical Vapor Deposition(CVD) - Metal Oxide - Chemical Vapor Deposition (MOCVD).Physical Methods: Ball Milling - Electrodeposition - Spray Pyrolysis - DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE).		CO3
UNIT IV	**CHARACTERIZATION OF NANOSTRUCTURES**	**9**
Introduction, structural characterization, X-ray diffraction (XRD-Powder/Single crystal), Small angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM) - Energy Dispersive X-ray analysis (EDAX)- Transmission Electron Microscope (TEM) - Scanning Tunneling Microscope (STM)-Atomic Force Microscopy (AFM), UV-vis spectroscopy (liquid and solid state) - Raman Spectroscopy -X-ray Photoelectron Spectroscopy (XPS) - Auger Electron spectroscopy (AES).		CO4
UNIT V	**APPLICATIONS**	**9**
Solar energy conversion and catalysis - Molecular electronics and printed electronics - Nanoelectronics -Polymers with a special architecture - Liquid crystalline systems - Applications in displays and other devices -Nanomaterials for data storage -Photonics, Plasmonics- Chemical and biosensors -Nanomedicine and Nanobiotechnology		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Nano Technology: Basic Science and Emerging Technologies, Mick Wilson, Kamali Kannargare., Geoff Smith Overseas Press (2005)
2. A Textbook of Nanoscience and Nanotechnology,Pradeep T., Tata McGrawHill Education Pvt. Ltd., 2012.
3. Nanostructured Materials and Nanotechnology,Hari Singh Nalwa,Academic Press, 2002.
4. Introduction to Nanotechnology, Charles P.Poole, FrankJ.Owens, Wiley Interscience (2003)
5. Textbook of Nanoscience and Nanotechnology, B.S. Murty, P. Shankar, Baldev Raj, B BRath, James Murday, Springer Science & Business Media, 2013.

REFERENCE BOOKS

1. Nanotechnology: A gentle introduction to the next Big idea, Mark A.Ratner, Daniel Ratner, Mark Ratne, Prentice Hall P7R:1st Edition (2002)
2. Fundamental properties of nanostructed materials Ed D. Fioran, G.Sberveglier, World Scientific 1994
3. Nanoscience: Nanotechnologies and Nanophysics, Dupas C., Houdy P., Lahmani M., Springer-Verlag Berlin Heidelberg, 2007

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Demonstrate the understanding of length scales concepts, nanostructures and nanotechnology
CO2	Understand the different classes of nanomaterials.
CO3	Identify the CVD, MOCVD
CO4	Outline the applications of nanotechnology and
CO5	Develop an ability to critically evaluate the promise of a nanotechnology device.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	2	1	2	2	4	2	1	1	1	2	1	1
CO2	3	2	1	2	2	1	2	1	3	4	1	2	1	1	2
CO3	1	2	4	3	1	2	4	3	1	2	4	5	1	2	2
CO4	1	2	2	4	2	1	1	1	2	1	3	2	1	2	2
CO5	2	1	3	1	2	4	3	2	1	2	3	1	1	2	1

OCE102	INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEM	L	P	T	C
		3	0	0	3

OBJECTIVES

- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data models.
- To know the details of data input and topology
- To know the knowledge on data management and output processes
- To know the data quality and standards

UNIT I	FUNDAMENTALS OF GIS	9
Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open-source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.		CO1
UNIT II	**SPATIAL DATA MODELS**	**9**
Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models — Raster Data Structures — Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.		CO2
UNIT III	**DATA INPUT AND TOPOLOGY**	**9**
Scanner - Raster Data Input — Raster Data File Formats — Georeferencing — Vector Data Input –Digitiser – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration		CO3
UNIT IV	**DATA QUALITY AND STANDARDS**	**9**
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage — Metadata — GIS Standards — Interoperability - OGC - Spatial Data Infrastructure		CO4
UNIT V	**DATA MANAGEMENT AND OUTPUT**	**9**
Import/Export — Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS- distributed GIS.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition,2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver,Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2ndEdition,2007.

REFERENCE BOOKS

1. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers,2006

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Have basic idea about the fundamentals of GIS.
CO2	Understand the types of data models.
CO3	Get knowledge about data input and topology.
CO4	Gain knowledge on data quality and standards.
CO5	Understand data management functions and data output

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	-	1	-	-	-	-	2	2	2	1
CO2	2	2	1	1	2	-	1	-	-	-	-	2	2	2	2
CO3	2	2	1	1	2	-	1	-	-	-	-	2	2	2	1
CO4	2	2	1	1	2	-	1	-	-	-	-	2	2	2	1
CO5	2	2	1	1	2	-	1	-	-	-	-	2	2	2	2

OCH101	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamentals of hospital administration and management.
- To know the market related research process and its HRM
- To understand the recruitment and training processes in hospitals
- To explore various information management systems and relative supportive services.
- To learn the quality and safety aspects in hospital.

UNIT I	OVERVIEW OF HOSPITAL ADMINISTRATION	9
Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning		CO1
UNIT II	**HUMAN RESOURCE MANAGEMENT IN HOSPITAL**	**9**
Principles of HRM – Functions of HRM – Profile of HRD Manager –Human Resource Inventory — Manpower Planning.		CO2
UNIT III	**RECRUITMENT AND TRAINING**	**9**
Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer.		CO3
UNIT IV	**SUPPORTIVE SERVICES**	**9**
Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services.		CO4
UNIT V	**COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL**	**9**
Purposes – Planning of Communication, Modes of Communication – Telephone, ISDN, Public Address and Piped Music – CCTV.Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. R.C.Goyal, “Hospital Administration and Human Resource Management”, PHI – Fourth Edition, 2006.
2. G.D.Kunders, “Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

REFERENCE BOOKS

1. Cesar A.Caceres and Albert Zara, “The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger, “Handbook of Health Care Human Resources Management”, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3. Peter Berman “Health Sector Reform in Developing Countries” - Harvard University Press, 1995.
4. William A. Reinke “Health Planning For Effective Management” - Oxford University Press.1988
5. Blane, David, Brunner, “Health and SOCIAL Organization: Towards a Health Policy for the 21st Century”, Eric Calrendon Press 2002.
6. Arnold D. Kalcizony & Stephen M. Shortell, “Health Care Management”, 6th Edition Cengage Learning, 2011.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Explain the principles of Hospital administration.
CO2	Identify the importance of Human resource management.
CO3	List various marketing research techniques.
CO4	Identify Information management systems and issues in supporting departments of hospitals
CO5	Understand safety procedures followed in hospitals

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	1	1	1
CO2	3	3	3	3	2	-	-	-	-	2	2	2	1	1	1
CO3	3	3	3	3	2	-	-	-	-	2	2	2	1	1	1
CO4	3	3	3	3	2	-	-	-	-	2	2	2	1	1	1
CO5	3	3	3	3	2	-	-	-	-	2	2	2	1	1	1

OEC103	BASICS OF EMBEDDED SYSTEMS AND IoT	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor
- Be exposed to the basic concepts of embedded programming
- Learn the concepts of IoT

UNIT I	INTRODUCTION TO EMBEDDED SYSTEM	9
Complex systems and microprocessors– Embedded system design process - Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques–Design example: Model train controller.		CO1
UNIT II	**BASICS OF ARM ARCHITECTURE AND PERIPHERAL INTERFACING**	**9**
ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3 MCU		CO2
UNIT III	**EMBEDDED PROGRAMMING CONCEPTS**	**9**
Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis — Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing		CO3
UNIT IV	**INTRODUCTION TO IoT**	**9**
Functional blocks of an IoT system - Basics of Physical and logical design of IoT - IoT enabled domains - Difference between IoT - Passive and active sensors - Different applications of sensors - IoT front-end hardware Case Studies — Smart Parking, Air Pollution Monitoring.		CO4
UNIT V	**COMMUNICATION PROTOCOLS FOR EMBEDDED AND IoT**	**9**
Embedded Networking: Introduction-Serial/Parallel Communication - Serial communication protocols- RS485 - Synchronous Serial Protocols - Serial Peripheral Interface (SPI) - Inter Integrated Circuits (I2C). IoT Infrastructure - 6LowPAN - IPv6 - Wi-Fi, Bluetooth, ZigBee.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT I, II, III, IV)
2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things, A Hands-on-Approach”, 1st Edition, Universities press Pvt. Ltd., India, 2015.
3. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6, 1st Edition, John Wiley & Sons”, Inc, USA, 2013

REFERENCE BOOKS

1. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, 1st Edition, John Wiley & Sons Ltd, UK, 2014
2. Peter Waher, “Learning Internet of Things”, 1st Edition, Packt Publishing Ltd, UK, 2015.
3. Charles Bell, “Beginning Sensor Networks with Arduino and Raspberry Pi” , 1st Edition, Apress Publishers, USA, 2013.
4. Raj Kamal, Internet of Things, Architecture and Design Principles, McGraw-Hill, 2017

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Understand the Embedded System Design Process
CO2	Describe the architecture and programming of ARM processor
CO3	Outline the concepts of embedded system programming
CO4	Explain the basic concepts of IOT
CO5	Model Networked systems with basic protocols

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	-	2	1	2	-	1	2	2	3	3	2
CO2	3	3	2	3	-	3	1	2	-	1	2	2	3	3	2
CO3	3	3	2	3	3	3	1	2	1	1	2	2	3	3	2
CO4	3	3	3	3	-	2	1	2	-	1	2	2	3	3	2
CO5	3	3	3	3	2	3	1	2	1	1	2	2	3	3	2

OEE101	BASIC CIRCUIT THEORY	L	P	T	C
		3	0	0	3

OBJECTIVES

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I	BASIC CIRCUITS ANALYSIS	9
Resistive elements - Resistors in series and parallel circuits; Ohm's Law; Kirchoffs laws — methods of analysis-Mesh current and node voltage.		CO1
UNIT II	**NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS**	**9**
Network reduction- voltage and current division, source transformation, star delta conversion; Network theorems- Thevenins and Norton Theorems, Superposition Theorem, Maximum power transfer theorem, Reciprocity Theorem, Millman's theorem.		CO2
UNIT III	**ANALYSIS OF AC CIRCUITS**	**9**
Introduction to AC circuits- Inductive reactance, Capacitive reactance, Phasor diagrams, real power, reactive power, apparent power, power factor; RL, RC , RLC networks; Network reductions- voltage and current division, source transformation; Mesh and node analysis; Network theorems- Thevenins and Norton Theorems, Superposition Theorem , Maximum power transfer theorem, Reciprocity Theorem, Millman's theorem.		CO3
UNIT IV	**THREE PHASE CIRCUITS**	**9**
A.C. circuits — Average and RMS value, Phasor Diagram, Power, Power Factor and Energy; Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced; phasor diagram of voltages and currents; power measurement in three phase circuits.		CO4
UNIT V	**RESONANCE AND COUPLED CIRCUITS**	**9**
Series and parallel resonance – frequency response, Quality factor and Bandwidth; Self and mutual inductance; Coefficient of coupling; Tuned circuits — Single tuned circuits.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits",Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCE BOOKS

1. Chakrabarti A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum‘s series, McGraw- Hill, New Delhi, 2010.
4. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
5. Mahadevan, K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd.,New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, “Introduction to Electric Circuits”, 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”,McGraw Hill, 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Ability to introduce electric circuits and its analysis
CO2	Ability to impart knowledge on solving circuit equations using network theorems
CO3	Ability to introduce the phenomenon of resonance in coupled circuits.
CO4	Ability to introduce Phasor diagrams and analysis of three phase circuits
CO5	Ability to impart knowledge on resonance and coupled circuits

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	3	3	3	1	1	1	3	1	1	1
CO2	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	1	2	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	1	2	3	3	3	3

OEE103	INTRODUCTION TO RENEWABLE ENERGY SYSTEMS	L	P	T	C
		3	0	0	3

OBJECTIVES

- About the stand alone and grid connected renewable energy systems.
- Design of power converters for renewable energy applications.
- Wind electrical generators and solar energy systems.
- Power converters used for renewable energy systems.

UNIT I	INTRODUCTION	9
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.		CO1
UNIT II	**ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION**	**9**
Reference theory fundamentals-principle of operation and analysis: IG and PMSG		CO2
UNIT III	**POWER CONVERTERS**	**9**
Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers		CO3
UNIT IV	**ANALYSIS OF WIND AND PV SYSTEMS**	**9**
Standalone operation of fixed and variability speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system		CO4
UNIT V	**HYBRID RENEWABLE ENERGY SYSTEMS**	**9**
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005.
2. B.H.Khan, “Non-conventional Energy Sources”, Tata McGraw-hill Publishing Company, New Delhi, 2017.

REFERENCE BOOKS

1. Muhammad H. Rashid, “Power Electronics Hand Book”, Third Edition, Butterworth-Heinemann, 2015.
2. Ion Boldea, “Variability Speed Generators”, Second Edition, CRC Press, 2015.
3. Rai. G.D, “Non- conventional Energy Sources”, Khanna Publishers, 2004.
4. Gray, L. Johnson, “Wind Energy Systems”, Prentice Hall, 2006.
5. Andrzej M. Trzynnadlowski, “Introduction to Modern Power Electronics”, Third Edition, Wiley India Pvt. Ltd, 2016.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Ability to understand and analyze power system operation, stability, control and protection.
CO2	Ability to handle the engineering aspects of electrical energy generation and utilization.
CO3	Ability to understand the stand alone and grid connected renewable energy systems.
CO4	Ability to design of power converters for renewable energy applications.
CO5	Ability to acquire knowledge on wind electrical generators and solar energy systems.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	3	3	3	1	1	1	3	1	1	1
CO2	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	1	2	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	1	2	3	3	3	3

OEI102	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVE

- ❖ To understand the functions of the basic components of a Robot.
- ❖ To study the use of various types of End of Effectors and Sensors
- ❖ To impart knowledge in Robot Kinematics and Programming
- ❖ To learn Robot safety issues and economics.

UNIT I	FUNDAMENTALSOF ROBOT	9
Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load-Robot Parts and their Functions-Need for Robots-Different Applications.		CO1

UNIT II	ROBOT DRIVE SYSTEMS ANDEND EFFECTORS	9
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.		CO2

UNIT III	SENSORS AND MACHINEVISION	9
Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.		CO3

UNIT IV	ROBOT KINEMATICS AND ROBOTPROGRAMMING	9
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.		CO4

UNIT V	IMPLEMENTATION ANDROBOTECONOMICS	9
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.
2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill,2001.

REFERENCE BOOKS

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education,2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co.,1994.
3. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co.,1992.
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
5. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill,1995.
6. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company,2008.
7. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and IBH Publishing Co. Pvt. Ltd.,1991.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the functions of the basic components of a Robot.
CO2	Study the use of various types of End of Effectors and Sensors
CO3	Understand Sensors and Machine Vision of Robot
CO4	Understand Robot Kinematics and Robot Programming
CO5	Understand the Implementation of Robots in Industries

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	-	-	-	-	2	2	3	2	1	2
CO2	3	3	1	2	2	-	-	-	-	2	2	3	3	2	2
CO3	3	3	1	2	2	-	-	-	-	2	2	3	3	2	2
CO4	3	2	1	2	2	-	-	-	-	2	2	3	3	2	2
CO5	2	2	1	2	2	-	-	-	-	2	2	3	2	2	2

OMB101	TOTAL QUALITY MANAGEMENT	L	T	P	C
	(Common to CSE, ADS,AML & IT)	3	0	0	3

OBJECTIVES

- To learn the quality philosophies and tools in the managerial perspective.

UNIT I	INTRODUCTION	9
Quality — vision, mission and policy statements. Customer Focus — customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.		CO1
UNIT II	**PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT**	**9**
Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques — introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology		CO2
UNIT III	**STATISTICAL PROCESS CONTROL**	**9**
Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed. Process capability — meaning, significance and measurement — Six sigma - concepts of process capability. Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve.Total productive maintenance (TMP), Terotechnology. Business process Improvement (BPI) – principles, applications, reengineering process, benefits and limitations.		CO3
UNIT IV	**TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT**	**9**
Quality functions development (QFD) — Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven Tools (old & new). Bench marking and POKA YOKE.		CO4
UNIT V	**QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION**	**9**
Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements. Quality Audits. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward - TQM framework, benefits, awareness and obstacles.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Dale H.Besterfield, Carol Besterfield – Michna, Glen H. Besterfield, Mary Besterfield – Sacre Hermant – Urdhwareshe, Rashmi Urdhwareshe, Total Quality Management, Revised Third edition, Pearson Education, 2011
2. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.

REFERENCE BOOKS

1. Douglas C. Montgomory, Introduction to Statistical Quality Control, Wiley Student Edition, 4th Edition, Wiley India Pvt Limited, 2008.
2. James R. Evans and William M. Lindsay, The Management and Control of Quality, Sixth Edition, Thomson, 2005.
3. Poornima M.Charantimath, Total Quality Management, Pearson Education, First Indian Reprint 2003.
4. Indian standard – quality management systems – Guidelines for performance improvement (Fifth Revision), Bureau of Indian standards, New Delhi.

COURSE OUTCOMES

At the end of the course, the student should be able:

CO1	To apply quality philosophies and tools to facilitate continuous improvement and ensure customer delight.
CO2	To understand the principles of business process improvement
CO3	To understand and apply the concepts of statistical process control
CO4	To apply the tools and techniques used for quality management
CO5	To understand the methods in organizing and implementation of quality systems

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	-	-	-	-	2	2	2	1	1	1
CO2	3	3	3	3	2	-	-	-	-	2	2	2	1	1	1
CO3	3	3	2	3	3	-	-	-	-	2	2	2	1	1	1
CO4	2	3	3	3	2	-	-	-	-	2	2	2	1	1	1
CO5	3	3	2	3	2	-	-	-	-	2	2	2	1	1	1

OME104	INDUSTRIAL SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide exposure to the students about safety and health provisions related to hazardous processes as laid out in Factories act 1948
- To familiarize students with powers of inspectorate of factories
- To help students to learn about Environment act 1986 and rules framed under the act.
- To provide wide exposure to the students about various legislations applicable to an industrial unit.
- To prepare onsite and offsite emergency plan.

UNIT I	FACTORIES ACT – 1948	9
Statutory authorities — inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons — special provisions — penalties and procedures-Tamil Nadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948		CO1
UNIT II	**ENVIRONMENT ACT – 1986**	**9**
General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001-No Objection certificate from statutory authorities like pollution control board. Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards — prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.		CO2
UNIT III	**MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989**	**9**
Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets.		CO3
UNIT IV	**OTHER ACTS AND RULES**	**9**
Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules — electricity act and rules — hazardous wastes (management and handling) rules, 1989, with amendments in 2000- the building and other construction workers act 1996., Petroleum rules, Gas cyclinder rules-Explosives Act 1983-Pesticides Act		CO4
UNIT V	**INTERNATIONAL ACTS AND STANDARDS**	**9**
Occupational Safety and Health act of USA (The Williames - Steiger Act of 1970) – Health and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI).		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
3. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd., New Delhi.

REFERENCE BOOKS

1. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
2. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
3. The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To list out important legislations related to health, Safety and Environment.
CO2	To list out requirements mentioned in factories act for the prevention of accidents.
CO3	To understand the health and welfare provisions given in factories act.
CO4	To understand the statutory requirements for an Industry on registration, license and its renewal.
CO5	To prepare onsite and offsite emergency plan.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	1	2	2	2	2	1	2	2	1	1	1
CO2	2	1	-	-	1	2	2	2	2	1	2	2	1	1	1
CO3	2	1	-	-	1	2	2	2	2	1	2	2	1	1	1
CO4	2	1	-	-	1	2	2	2	2	1	2	2	1	1	1
CO5	2	2	-	-	1	2	2	2	2	2	2	2	1	1	1

OTHER COURSES OFFERED BY CSE

CS1406	FUNDAMENTALS OF DATA STRUCTURES IN C (LAB INTEGRATED)	L	T	P	C
	Common to EEE and EIE	3	0	2	4

OBJECTIVES

- ❖ To learn the basics of C Programming
- ❖ To learn the advanced features of C Programming
- ❖ To explore the applications of linear data structures
- ❖ To learn about how to represent and implement non-linear data structure
- ❖ To learn about the basics of sorting, searching and Hash Table.

UNIT I	C PROGRAMMING BASICS	9 + 6

Structure of C program — Data Types —– Storage classes — Variables— Constants —– Keywords —– Operators — Input/Output statements, Assignment statements —– Decision making statements — Switch statement — Looping statements —– Introduction to Arrays: Declaration, Initialization — One dimensional array — Two dimensional arrays.

Lab Component

- Implementation of basic c programs
  a. Find greatest of three numbers
  b. Create a simple Calculator
- Implementation of array
  a. Computing Mean, Median and Mode
  b. Matrix Addition

CO1

UNIT II	FUNCTIONS, POINTERS AND STRUCTURES	9 + 6

Introduction to functions: Function prototype, function definition, function call, Recursion — Pointers —– Pointer operators —– Pointer arithmetic —– Array of pointers —– Parameter passing: Pass by value, Pass by reference. Structure – Nested structures — Pointer and Structures —– Array of structures —– Self-referential structures —– Dynamic memory allocation.

Lab Component

- Implementation of user defined data types
  a. Computation of Sine series.
  b. Swapping of two numbers and changing the value of a variable using pass by reference

CO2

UNIT III	LINEAR DATA STRUCTURES	9 + 6

List — Singly Linked lists — Application of List - Polynomial addition - Linked list implementation of Stacks — Applications of Stack - Evaluating arithmetic expressions - Linked list implementation of Queues – Application of Queue.

Lab Component

- Implementation of linear data structure
  a. List implementation of List, Stack, Queue.
  b. Implement polynomial addition using list.
  c. Evaluate arithmetic expression.

CO3

UNIT IV	NON-LINEAR DATA STRUCTURES	9 + 6
Trees — Binary Trees — Binary tree representation and traversals –Binary Search Trees — Applications of trees. Graph and its representations – Graph Traversals – Topological Sort – Applications of graphs. **Lab Component** • Implementation of tree a. Construct binary search tree. b. Traverse the binary tree recursively in pre-order, post-order and in-order. • Graph traversal a. Depth first search b. Breadth first search.		**CO4**
UNIT V	**SEARCHING, SORTING AND HASH TABLE**	**9 + 6**
Linear Search — Binary Search. Bubble Sort — Insertion sort — Merge sort — Quick sort — Hashing functions - Hash tables – Introduction to Overflow handling. **Lab Component** • Sorting & Searching a. Insertion sort b. Merge sort c. Linear Search d. Binary Search		**CO5**

THEORY : 45 PERIODS **PRACTICAL : 30 PERIODS** **TOTAL : 75 PERIODS**

TEXT BOOKS

1. Reema Thareja, “Data Structures Using C, Second Edition, Oxford University Press, 2014.

REFERENCE BOOKS

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Fourth Edition, Pearson Education, 2013.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Implement basics of C
CO2	Implement advanced features of C
CO3	Apply the different linear data structures to problem solutions.
CO4	Implement Tree and Graph data structure.
CO5	Analyse the various sorting, searching algorithms and hash table.

MAPPING OF COs WITH POs AND PSOs															
COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO2	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO3	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO4	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO5	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2

CS1516	VISUAL PROGRAMMING	L	T	P	C
	Common to EEE and EIE	3	0	0	3

OBJECTIVES

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variability's, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB

UNIT I	FUNDAMENTALS OF WINDOWS AND MFC	9
Messages : Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy — Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines — Curves — Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus – Keystroke messages - Virtual key codes - Character & dead key messages.		**CO1**

UNIT II	RESOURCES AND CONTROLS	9
Creating a menu — Loading and displaying a menu — Responding to menu commands — Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus. The C button class – C list box class — C static class - The font view application — C edit class — C combo box class — C scrollbar class. Model dialog boxes – Modeless dialog boxes.		**CO2**

UNIT III	DOCUMENT / VIEW ARCHITECTURE	9
The in existence function revisited – Document object – View object – Frame window object Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document — Mid squares application — Supporting multiple document types — Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in app wizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializability classes.		**CO3**

UNIT IV	FUNDAMENTALS OF VISUAL BASIC	9
Menu bar — Tool bar — Project explorer — Toolbox — Properties window — Form designer — Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming. Variabilitys: Declaration – Types – Converting variability types – User defined data types - Lifetime of a variability. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.		**CO4**

UNIT V	DATABASE PROGRAMMING WITH VB	9
Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager — Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Tability def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements–Cursortypes and locking mechanism–Manipulating the record set object – Simple record editing and updating.		**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted,2002.
2. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications,2002.

REFERENCE BOOKS

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, McGraw Hill, reprinted,2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', McGraw Hill, Reprinted,2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Tech media Pub,1999.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand study about the concepts of windows programming models.
CO2	Understand the concepts of Menu basics, menu magic and classic controls.
CO3	Understand the concept of Document/View Architecture with single & multiple document interface.
CO4	Understand the integrated development programming event driven document interface.
CO5	Understand the database and the database management system programming.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	1	1	1	1	2	1	1	3	2	2
CO2	3	2	1	1	1	1	1	1	1	2	1	2	3	2	2
CO3	2	2	1	1	1	1	1	1	1	1	1	2	3	2	2
CO4	2	1	1	1	1	1	1	1	1	1	1	2	3	2	2
CO5	2	2	1	1	1	1	1	1	1	1	1	2	3	2	2

OPEN ELECTIVE COURSES OFFERED BY CSE

OCS101	INTRODUCTION TO C PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic concepts in C Programming Language.
- To understand Input and Output Statements.
- To enhance analyzing and problem solving skills and use the same for writing programs in C.
- To familiarize the basic syntax in arrays and pointers
- To provide exposure to problem-solving through programming

UNIT I	INTRODUCTORY CONCEPTS & C FUNDAMENTALS	9
Introduction to Computers - Computer Characteristics - Modes of Operation - Types of Programming Languages - Introduction to C - Some Simple C Programs - Desirable Program Characteristics - The C Character Set - Identifiers and Keywords - Data Types - Constants - Variables and Arrays - Declarations - Expressions - Statements - Symbolic Constants.		**CO1**
UNIT II	**OPERATORS, EXPRESSIONS, DATA INPUT & OUTPUT AND CONTROL STATEMENTS**	**9**
Arithmetic Operators - Unary Operators - Relational and Logical Operators - Assignment Operators - The Conditional Operator - Library Functions - getchar, putchar, scanf, printf, gets and puts Functions - Preliminaries - Branching: The if else Statement - Looping: The while Statement - do while Statement - for Statement - Nested Control Structures - The switch Statement - The break Statement - The continue Statement - The Comma Operator - The goto Statement		**CO2**
UNIT III	**FUNCTIONS & PROGRAM STRUCTURE**	**9**
Defining a Function - Accessing a Function - Function Prototypes - Passing Arguments to a Function — Recursion - Storage Classes - Automatic Variables - External (Global) Variables - Static Variables - Multifile Programs - More About Library Functions		**CO3**
UNIT IV	**ARRAYS & POINTERS**	**9**
Defining an Array - Processing an Array - Passing Arrays to Functions - Multidimensional Arrays - Arrays and Strings - Fundamentals - Pointer Declarations - Passing Pointers to Functions - Pointers and One-Dimensional Arrays - Dynamic Memory Allocation - Operations on Pointers - Pointers and Multidimensional Arrays - Arrays of Pointers - Passing Functions to Other Functions		**CO4**
UNIT V	**STRUCTURES, UNIONS & DATA FILES**	**9**
Defining a Structure - Processing a Structure - User-Defined Data Types (typedef) - Structures and Pointers - Passing Structures to Functions - Self-Referential Structures — Unions - Opening and Closing a Data File - Creating a Data File - Processing a Data File - Unformatted Data Files		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Byron Gottfried - Schaum's Outline of Programming with C, 2nd Edition, McGraw-Hill, 1996.

REFERENCE BOOKS

1. The C Programming Language by Brian Kernighan and Dennis Ritchie 2nd Edition.
2. Let Us C Yashavant kanetkar, BPB

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Identify situations where computational methods and computers would be useful.
CO2	Demonstrate the use of operators, input and output statements and control statements
CO3	Identify solution to a problem and apply control structures and user defined functions for solving the problem
CO4	Demonstrate the use of numeric arrays and pointers
CO5	Demonstrate the ability to design creative solutions to real life problems faced by the industry.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO2	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO3	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO4	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO5	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2

OCS102	PROGRAMMING AND DATA STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the basics of C Programming
- To learn the advanced features of C Programming
- To explore the applications of linear data structures
- To learn about how to represent and implement non-linear data structure
- To learn about the basics of sorting, searching and Hash Table

UNIT I	C PROGRAMMING BASICS	9
Structure of C program — Data Types —– Storage classes — Variables— Constants —– Keywords —– Operators — Input/Output statements, Assignment statements —– Decision making statements — Switch statement — Looping statements —– Introduction to Arrays: Declaration, Initialization — One dimensional array — Two dimensional arrays.		CO1
UNIT II	**FUNCTIONS, POINTERS AND STRUCTURES**	**9**
Introduction to functions: Function prototype, function definition, function call, Recursion — Pointers —– Pointer operators —– Pointer arithmetic —– Array of pointers —– Parameter passing: Pass by value, Pass by reference. Structure – Nested structures — Pointer and Structures —– Array of structures —– Self-referential structures —– Dynamic memory allocation.		CO2
UNIT III	**LINEAR DATA STRUCTURES**	**9**
List — Singly Linked lists — Application of List - Polynomial addition - Linked list implementation of Stacks — Applications of Stack - Evaluating arithmetic expressions - Linked list implementation of Queues – Application of Queue..		CO3
UNIT IV	**NON-LINEAR DATA STRUCTURES**	**9**
Trees – Binary Trees – Binary tree representation and traversals –Binary Search Trees — Applications of trees. Graph and its representations – Graph Traversals – Topological Sort – Applications of graphs.		CO4
UNIT V	**SEARCHING, SORTING AND HASH TABLE**	**9**
Linear Search — Binary Search. Bubble Sort — Insertion sort — Merge sort — Quick sort — Hashing functions - Hash tables – Introduction to Overflow handling.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Reema Thareja, “Data Structures Using C, Second Edition, Oxford University Press, 2014.

REFERENCE BOOKS

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Fourth Edition, Pearson Education, 2013.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Implement basics of C
CO2	Implement advanced features of C
CO3	Apply the different linear data structures to problem solutions.
CO4	Implement Tree and Graph data structure.
CO5	Analyse the various sorting, searching algorithms and hash table.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO2	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO3	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO4	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
CO5	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2

OCS103	INTRODUCTION TO CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To have the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability, benefits, as well as current and future challenges
- To have knowledge on the various virtualization techniques that serve in computation and storage services on the cloud
- To understand the technologies, architecture and applications of cloud computing
- To understand the key security and compliance challenges of cloud computing

UNIT I	INTRODUCTION	9
Introduction to Cloud Computing — Roots of Cloud Computing- Parallel and Distributed Computing, Mainframe and Grid Computing, Desired Features and benefits of Cloud Computing — Challenges and Risks of Cloud Computing		CO1
UNIT II	**VIRTUALIZATION**	**9**
Introduction to Virtualization Technology — Load Balancing and Virtualization — Understanding Hypervisor and its types, Types of Virtualizations – Hardware, OS, Memory, Application Virtualization, Levels of Virtualization		CO2
UNIT III	**CLOUD ARCHITECTURE, SERVICES AND STORAGE**	**9**
NIST Cloud Computing Reference Architecture, Layered Cloud Architecture, Architectural Design Challenges — Deployment models of cloud, Services of cloud — Cloud Storage.		CO3
UNIT IV	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD**	**9**
Inter Cloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Architecture-Cloud Security Challenges – Data Security –Application Security — Virtual Machine Security.		CO4
UNIT V	**CASE STUDIES**	**9**
Google App Engine (GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services (AWS) – GAE Applications – Cloud Software Environments – Bio-data Platform & Bio Cloud		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, First Edition, John Wiley & Sons, 2011.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management, And Security”, CRC Press, 2017.

REFERENCE BOOKS

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach”, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)”, O'Reilly, 2009.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
CO2	Understanding of fundamentals and technological aspects of virtualization along with various terminologies used in Cloud Computing
CO3	Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
CO4	Enlighten the core issues of cloud computing such as security, privacy, and interoperability.
CO5	Be familiarization with areas of cloud technologies and working experience in several of them

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	-	-	-	1	-	-	-	-	-	-	2	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
CO4	1	-	-	-	-	-	2	1	-	-	-	2	-	-	1
CO5	2	1	1	-	2	2	-	-	2	-	-	3	2	2	2

OCS104	FUNDAMENTALS OF DATABASE DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study the database design and SQL
- To make the students to understand the fundamentals of Transaction Processing and concurrency
- To have an basic knowledge about the Storage implementation and query processing
- To understand database security concepts and database programming

UNIT I	INTRODUCTION	9
Purpose of Database System — Views of data — Data Models — Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – DDL-DML-DCL-TCL- Advanced SQL features - Embedded SQL-Static Vs Dynamic SQL		CO1
UNIT II	**DATABASE DESIGN**	**9**
Entity-Relationship model — E-R Diagrams — Enhanced-ER Model — ER-to-Relational Mapping — Functional Dependencies — Non-loss Decomposition — First, Second, Third Normal Forms, Dependency Preservation — Boyce/Codd Normal Form — Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form		CO2
UNIT III	**TRANSACTION CONCEPTS AND CONCURRENCY CONTROL**	**9**
Introduction-Properties of Transaction- Serializability- Concurrency Control — Locking Mechanisms- Two Phase Locking -Two Phase Commit Protocol-Dead lock- SQL Facilities for Concurrency and Recovery		CO3
UNIT IV	**IMPLEMENTATION TECHNIQUES**	**9**
RAID — File Organization — Organization of Records in Files — Indexing and Hashing — Ordered Indices — B+ tree Index Files — B tree Index Files — Static Hashing — Dynamic Hashing — Query Processing Overview –Query optimization using Heuristics and Cost Estimation		CO4
UNIT V	**ADVANCED TOPICS AND DATABASE PROGRAMMING**	**9**
Database security issues — Discretionary access control — role based access — Encryption and public key infrastructures — challenges. Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems. Implementing functions, views, and triggers in MySQL / Oracle. ODBC/JDBC connectivity with front end tools		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition , Pearson.
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill.

REFERENCE BOOKS

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education.
2. Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, McGraw-Hill College Publications.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To understand relational data model, evolve conceptual model of a given problem and SQL
CO2	To understand Relational model and normalization to perform database design effectively
CO3	Apply and relate the concept of transaction, concurrency control and recovery in database
CO4	To understand the implementation technique and query processing
CO5	To understand the concepts of database security and database programming

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	1	2	-	1	1	-	1	-	1	1	-	1
CO2	2	-	1	1	1	-	1	1	-	-	-	1	1	-	1
CO3	1	-	1	1	1	1	-	1	-	-	-	1	1	-	1
CO4	2	-	2	1	1	1	-	1	-	-	-	1	1	-	1
CO5	1	-	2	1	2	1	-	1	1	-	-	1	1	-	1

OCS105	DATA ANALYTICS WITH R PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Students will learn R. Programming language, data analytics, data visualization and statistical model for data analytics
- By completion of this course, students will be able to become data analyst

UNIT I	INTRODUCTION TO DATA ANALYSIS	9
Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics		CO1
UNIT II	**R PROGRAMMING BASICS**	**9**
Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages		CO2
UNIT III	**DATA VISUALIZATION USING R**	**9**
Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files. **Working with R Charts and Graphs:** Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts		CO3
UNIT IV	**STATISTICS WITH R**	**9**
Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression		CO4
UNIT V	**PRESCRIPTIVE ANALYTICS**	**9**
Creating data for analytics through designed experiments, Creating data for analytics through active learning, Creating data for analytics through reinforcement learning		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team.
   URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf

REFERENCE BOOKS

1. Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education, 2013 Dunlop, Dorothy D., and Ajit C. Tamhane. Statistics and data analysis: from elementary to intermediate. Prentice Hall, 2000.
2. G Casella and R.L. Berger, Statistical Inference, Thomson Learning 2002.
3. P. Dalgaard. Introductory Statistics with R, 2nd Edition. (Springer 2008)
4. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
5. Hastie, Trevor, et al.The elements of statistical learning.Vol. 2. No. 1. New York: springer, 2009.
6. Montgomery, Douglas C., and George C. Runger. Applied Statistics and Probability for Engineers. John Wiley &Sons, 2010
7. Joseph F Hair, William C Black etal , "Multivariate Data Analysis" , Pearson Education, 7th edition, 2013.
8. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
9. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basics of data analytics
CO2	Understand and apply the R-Programming concepts
CO3	Apply R-Programming for data visualization
CO4	Implement various classification techniques using R
CO5	Apply R programming to perform perspective analytics on data

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	1	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	1	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	1	2
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	1	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	1	2

OCS106	DATA COMMUNICATIONS AND NETWORKING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the protocol layering and physical level communication and to analyze the performance of a network.
- To analyze the contents of Data Link layer packet, based on the layer concept.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.
- To know about different application layer protocols

UNIT I	INTRODUCTION AND PHYSICAL LAYER	9
Networks — Network Types — Protocol Layering — TCP/IP Protocol suite — OSI Model — Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks — Packet Switching.		CO1
UNIT II	**DATA-LINK LAYER & MEDIA ACCESS**	**9**
Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.		CO2
UNIT III	**NETWORK LAYER**	**9**
Network Layer Services — IPV4 Addresses — Forwarding of IP Packets — Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing — IPV6 Protocol.		CO3
UNIT IV	**TRANSPORT LAYER**	**9**
Introduction — Transport Layer Protocols — Services — Port Numbers — User Datagram Protocol – Transmission Control Protocol-Congestion Control Mechanisms-Streaming Control Transmission Protocol.		CO4
UNIT V	**APPLICATION LAYER**	**9**
WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP- Internet Multimedia.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2014.

REFERENCE BOOKS

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012
2. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011
4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Understand the basic layers, functions in computer networks and to evaluate the performance of a network.
CO2	Understand the basics of how data flows from one node to another.
CO3	Analyse and design routing algorithms.
CO4	Understand design goals of Connectionless and Connection oriented protocols.
CO5	Understand the working of various application layer protocols.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	1	1	1
CO2	3	3	3	-	-	-	-	-	-	-	-	-	1	1	1
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	1	1
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	1	1
CO5	3	3	3	-	-	-	-	-	-	-	-	-	1	1	1

OCS107	MACHINE LEARNING FOR INTELLIGENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce basic machine learning techniques such as regression, classification
- To learn about introduction of clustering, types and segmentation methods
- To learn about fuzzy logic, fuzzification and defuzzification
- To learn about basics of neural networks and neuro fuzzy networks.
- To learn about Recurrent neural networks and Reinforcement learning.

UNIT - I	INTRODUCTION TO MACHINE LEARNING	9
Philosophy of learning in computers, Overview of different forms of learning, Classifications vs. Regression, Evaluation metrics and loss functions in Classification, Evaluation metrics and loss functions in Regression, Applications of AI in Robotics.		CO1

UNIT - II	CLUSTERING AND SEGMENTATION METHODS	9
Introduction to clustering, Types of Clustering, Agglomerative clustering, K-means clustering, Mean Shift clustering, K-means clustering application study, Introduction to recognition, K-nearest neighbor algorithm, KNN Application case study, Principal component analysis (PCA), PCA Application case study in Feature Selection for Robot Guidance.		CO2

UNIT - III	FUZZY LOGIC	9
Introduction to Fuzzy Sets, Classical and Fuzzy Sets, Overview of Classical Sets, Membership Function, Fuzzy rule generation, Fuzzy rule generation, Operations on Fuzzy Sets, Numerical examples, Fuzzy Arithmetic, Numerical examples, Fuzzy Logic, Fuzzification, Fuzzy Sets, Defuzzification, Application Case Study of Fuzzy Logic for Robotics Application		CO3

UNIT - IV	NEURAL NETWORKS	9
Mathematical Models of Neurons, ANN architecture, Learning rules, Multi-layer Perceptrons, Back propagation, Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, Application Case Study of Neural Networks in Robotics		CO4

UNIT - V	RNN AND REINFORCEMENT LEARNING	9
Unfolding Computational Graphs, Recurrent neural networks, Application Case Study of recurrent networks in Robotics, Reinforcement learning, Examples for reinforcement learning, Markov decision process, Major components of RL, Q-learning. Application Case Study of reinforcement learning in Robotics		CO5

	TOTAL PERIODS:	45

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Understand basic machine learning techniques such as regression, classification
CO2	Understand about clustering and segmentation
CO3	Model a fuzzy logic system with fuzzification and defuzzification
CO4	Understand the concepts of neural networks and neuro fuzzy networks.
CO5	Gain knowledge on Reinforcement learning.

TEXT BOOKS:

1. Micheal Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, 3rd Edition, Addision Wesley, England, 2011

REFERENCE BOOKS:

1. Bruno Siciliano, Oussama Khatib, “Handbook of Robotics”, 2016 2nd Edition, Springer
2. Simon Haykin, “Neural Networks and Learning Machines: A Comprehensive Foundation”, Third Edition, Pearson, delhi 2016.
3. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, 4th Edition, Chichester, 2011, Sussex Wiley.

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
CO2	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
CO3	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
CO4	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
CO5	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3

OCS109	Fundamentals of Database Management Systems	L	T	P	C
		3	0	0	3

Objectives

- To learn the fundamentals of data models
- To learn conceptual modeling using ER diagrams.
- To study SQL queries and database programming
- To learn proper designing of relational database.
- To understand database security concepts
- To understand Information retrieval techniques

UNIT - I	DBMS AND CONCEPTUALDATAMODELING	9
Purpose of Database System – Data independence - Data Models – Database System Architecture – Conceptual Data modeling: ER models - Enhanced-ER Model. Introduction to relational databases – Relational Model – Keys – ER-to-Relational Mapping. Modeling of a library management system.		CO1

UNIT - II	DATABASE QUERYING	9
Relational Algebra – SQL: fundamentals – DDL – Specifying integrity constraints - DML – Basic retrieval queries in SQL - Complex SQL retrieval queries – nested queries – correlated queries –joins aggregate functions. Creating a table, populating data, adding integrity constraints, querying tables with simple and complex queries.		CO2

UNIT – III	DATABASE PROGRAMMING	9
Database programming with function calls, stored procedures - views – triggers. Embedded SQL. ODBC connectivity with front end tools. Implementation using ODBC/JDBC and SQL/PSM, implementing functions, views, and triggers in MySQL / Oracle		CO3

UNIT – IV	DATABASE DESIGN	9
Functional Dependencies – Design guidelines – Normal Forms: first, second, third – Boyce/Codd Normal Form – Normalization algorithms. Design of a banking database system/ university database system.		CO4

UNIT – V	ADVANCED TOPICS	9
Database security issues – Discretionary access control – role based access – Encryption and public key infrastructures – challenges. Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.		CO5

Total Periods:	**45**

Text Books:

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition , Pearson,2011.
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill,2011

Reference Books:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education,2006.
2. Raghu Ramakrishnan, ¯Database Management Systems, Fourth Edition, McGraw-Hill College Publications,2015.

Course Outcomes (CO)

CO1	Ability to understand relational data model, evolve conceptual model of a given problem.
CO2	Understand query the relational database and write programs with database connectivity
CO3	Ability to understand the DBMS programming
CO4	Ability to understand the DBMS Design
CO5	Ability to understand the database security and information retrieval concepts

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	1	1	1	3	3	1	1	3	2	2
CO2	3	3	3	1	1	1	1	1	3	3	1	1	3	3	2
CO3	3	3	3	1	1	1	1	2	3	3	1	1	3	3	2
CO4	3	3	3	1	1	2	1	2	3	3	1	1	3	3	2
CO5	3	3	3	1	1	1	1	2	3	3	1	1	3	2	2

AUDIT COURSES

AD1001	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

OBJECTIVES

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I	INTRODUCTION	6
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features		CO1
UNIT II	**CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES**	**6**
Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties		CO2
UNIT III	**ORGANS OF GOVERNANCE**	**6**
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions		CO3
UNIT IV	**EMERGENCY PROVISIONS**	**6**
Emergency Provisions - National Emergency, President Rule, Financial Emergency		CO4
UNIT V	**LOCAL ADMINISTRATION**	**6**
District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO Zila Pachayat- Position and role-Block level Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy		CO5
		TOTAL : 30 PERIODS

TEXT BOOKS

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.
3. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Able to understand history and philosophy of Indian Constitution.
CO2	Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3	Able to understand powers and functions of Indian government.
CO4	Able to understand emergency rule.
CO5	Able to understand structure and functions of local administration.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO2	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO3	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-

AD1002	VALUE EDUCATION	L	T	P	C
		2	0	0	0

OBJECTIVES

- ❖ Develop knowledge of self-development
- ❖ Explain the importance of Human values
- ❖ Develop the overall personality through value education
- ❖ Overcome the self destructive habits with value education
- ❖ Interpret social empowerment with value education

UNIT I	INTRODUCTION TO VALUE EDUCATION	6
Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgments		CO1
UNIT II	**IMPORTANCE OF VALUES**	**6**
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline		CO2
UNIT III	**INFLUENCE OF VALUE EDUCATION**	**6**
Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrityand discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering,love for truth.		CO3
UNIT IV	**REINCARNATION THROUGH VALUE EDUCATION**	**6**
Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation		CO4
UNIT V	**VALUE EDUCATION IN SOCIAL EMPOWERMENT**	**6**
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively		CO5

TOTAL : 30 PERIODS

REFERENCE BOOKS

1. Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain knowledge of self-development
CO2	Learn the importance of Human values
CO3	Develop the overall personality through value education
CO4	Overcome the self destructive habits with value education
CO5	Interpret social empowerment with value education

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO2	-	-	-	-	-	-	1	1	1	-	-	1	-	-	-
CO3	-	-	-	-	-	-	1	1	1	-	-	1	-	-	-
CO4	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO5	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-

AD1003	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

OBJECTIVES

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I	INTRODUCTION AND METHODOLOGY	6
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions — Overview of methodology and Searching.		CO1
UNIT II	**THEMATIC OVERVIEW**	**6**
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.		CO2
UNIT III	**EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES**	**6**
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.		CO3
UNIT IV	**PROFESSIONAL DEVELOPMENT**	**6**
Professional development: alignment with classroom practices and follow up support — Peer support - Support from the head teacher and the community - Curriculum and assessment — Barriers to learning: limited resources and large class sizes		CO4
UNIT V	**RESEARCH GAPS AND FUTURE DIRECTIONS**	**6**
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.		CO5

TOTAL : 30 PERIODS

REFERENCE BOOKS

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Understand the methodology of pedagogy
CO2	Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
CO3	Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
CO4	Know the factors necessary for professional development.
CO5	Identify the Research gaps in pedagogy.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-

AD1004	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

OBJECTIVES

- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do‘s and Don‘t‘s in life through Yam
- Categorize Do‘s and Don‘t‘s in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I	INTRODUCTION TO YOGA	6
Definitions of Eight parts of yog.(Ashtanga)		CO1
UNIT II	**YAM**	**6**
Do`s and Don‘t‘s in life.Shaucha, santosh, tapa, swadhyay, ishwarpranidhan		CO2
UNIT III	**NIYAM**	**6**
Do`s and Don‘t‘s in life. Ahinsa, satya, astheya, bramhacharya and aparigraha		CO3
UNIT IV	**ASAN**	**6**
Various yog poses and their benefits for mind & body		CO4
UNIT V	**PRANAYAM**	**6**
Regularization of breathing techniques and its effects-Types of pranayam		CO5

TOTAL : 30 PERIODS

REFERENCE BOOKS

1. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. ‘Yogic Asanas for Group Tarining-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2	Learn Do‘s and Don‘t‘s in life through Yam
CO3	Learn Do‘s and Don‘t‘s in life through Niyam
CO4	Develop a healthy mind and body through Yog Asans
CO5	Learn breathing techniques through Pranayam

MAPPING OF COs WITH POs AND PSOs															
COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO2	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO3	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO5	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-

AD1005	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

OBJECTIVES

- ❖ Develop basic personality skills holistically
- ❖ Develop deep personality skills holistically to achieve happy goals
- ❖ Rewrite the responsibilities
- ❖ Reframe a person with stable mind

UNIT I	NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I	6
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) — Verses- 26,28,63,65 (virtue)		CO1
UNIT II	**NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II**	**6**
Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)		CO2
UNIT III	**ORGANS OF GOVERNANCE**	**6**
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48		CO3
UNIT IV	**EMERGENCY PROVISIONS**	**6**
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter12 -Verses 13, 14, 15, 16,17, 18		CO4
UNIT V	**LOCAL ADMINISTRATION**	**6**
Chapter 2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter 18 – Verses 37,38,63		CO5
		TOTAL : 30 PERIODS

REFERENCE BOOKS

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari's ThreeSatakam , Niti-sringarvairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To develop basic personality skills holistically
CO2	To develop deep personality skills holistically to achieve happy goals
CO3	To rewrite the responsibilities
CO4	To reframe a person with stable mind, pleasing personality and determination
CO5	To awaken wisdom in students

MAPPING OF COs WITH POs AND PSOs															
COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO2	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO3	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-

AD1006	UNNAT BHARAT ABHIYAN	L	T	P	C
		2	0	0	0

OBJECTIVES

- To engage the students in understanding rural realities
- To identify and select existing innovative technologies, enable customization of technologies, or devise implementation method for innovative solutions, as per the local needs.
- To leverage the knowledge base of the institutions to devise processes for effective implementation of various government programmes
- To understand causes for rural distress and poverty and explore solutions for the same
- To apply classroom knowledge of courses to field realities and thereby improve quality of learning

UNIT I	QUALITY OF RURAL LIFE IN VILLAGES AND UNNAT BHARAT ABHIYAN	6
Introduction to Unnat Bharat Abhiyan - concept, scope and objectives, rural life, rural society, cast and gender relations, rural values with respect to community, nature and resources, elaboration of “Soul of India lies in villages” — (Gandhi Ji), Rural infrastructure, problems in rural area. **Assignment:** Prepare a map (Physical, visual and digital) of the village you visited and write an essay about inter-family relation in that village.		**CO1**
UNIT II	**RURAL ECONOMY AND LIVELIHOOD**	**6**
Agriculture, farming, land ownership pattern, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural market. **Assignment:** Describe your analysis of rural household economy, it‘s challenges and possible pathways to address them. Group discussion in class- (4) Field visit 3.		**CO2**
UNIT III	**RURAL INSTITUTIONS**	**6**
History of Rural Development, Traditional rural organizations, Self Help Groups, Gram Swaraj and 3- Tier Panchayat Raj Institutions (Gram Sabha, Gram Panchayat, Standing Committee), local civil society, local administration. Introduction to Constitution, Constitutional Amendments in Panchayati Raj — Fundamental Rights and Directive Principles. **Assignment:** Panchayati Raj institutions in villages? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual). Field Visit — 4.		**CO3**
UNIT IV	**RURAL DEVELOPMENT PROGRAMMES**	**6**
National programmes - Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awass Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc. **Written Assignment:** Describe the benefits received and challenges faced in the delivery of one of these programmes in the rural community, give suggestions about improving implementation of the programme for the rural poor.		**CO4**

UNIT V	FIELD WORK	6
Each student selects one programme for field visit Field based practical activities: ❖ Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities ❖ Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the work site ❖ Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures ❖ Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan(GPDP) ❖ Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization ❖ Visit Rural Schools I mid-day meal centres, study Academic and infrastructural resources and gaps ❖ Participate in Gram Sabha meetings, and study community participation ❖ Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries ❖ Attend Parent Teacher Association meetings, and interview school drop outs ❖ Visit local Anganwadi Centre and observe the services being provided ❖ Visit local NGOs, civil society organisations and interact with their staff and beneficiaries. ❖ Organize awareness programmes, health camps, Disability camps and cleanliness camps o Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys ❖ Raise understanding of people's impacts of climate change, building up community's disaster preparedness ❖ Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants ❖ Formation of committees for common property resource management, village pond maintenance and fishing.		**CO5**
		TOTAL : 30 PERIODS

TEXT BOOKS

1. Singh, Katar, Rural Development Principles, Policies and Management, Sage Publications, New Delhi, 2015
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002
3. United Nations, Sustainable Development Goals, 2015 un.org/sdgs

REFERENCE BOOKS

1. M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers
2. Unnat Bharat Abhiyan Website : www.unnatbharatabhiyan.gov.in

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Understand of rural life, culture and social realities
CO2	Understand the concept of measurement by comparison or balance of parameters.
CO3	Develop a sense of empathy and bonds of mutuality with local community
CO4	Appreciate significant contributions of local communities to Indian society and economy
CO5	Value the local knowledge and wisdom of the community

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

AD1007	ESSENCE OF INDIAN KNOWLEDGE TRADITION	L	T	P	C
		2	0	0	2

OBJECTIVES

- Get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I	INTRODUCTION TO CULTURE	6
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India		CO1
UNIT II	**INDIAN LANGUAGES AND LITERATURE**	**6**
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature		CO2
UNIT III	**RELIGION AND PHILOSOPHY**	**6**
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)		CO3
UNIT IV	**FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING)**	**6**
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India		CO4
UNIT V	**EDUCATION SYSTEM IN INDIA**	**6**
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India		CO5

TOTAL : 30 PERIODS

REFERENCE BOOKS

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978-8120810990, 2014

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Understand philosophy of Indian culture.
CO2	Distinguish the Indian languages and literature.
CO3	Learn the philosophy of ancient, medieval and modern India.
CO4	Acquire the information about the fine arts in India.
CO5	Understand education systems in India

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-

AD1008	SANGA TAMIL LITERATURE APPRECIATION	L	T	P	C
		2	0	0	0

OBJECTIVES

- Introduction to Sanga Tamil Literature.
- 'Agathinai' and'Purathinai' in SangaTamil Literature.
- 'Attruppadai' in SangaTamil Literature.
- 'Puranaanuru' in SangaTamil Literature.
- 'Pathitrupaththu' in SangaTamil Literature.

UNIT I	SANGA TAMIL LITERATURE – AN INTRODUCTION	6
Introduction to Tamil Sangam–History of Tamil Three Sangams–Introduction to Tamil SangamLiterature–Special Branches in Tamil Sangam Literature- Tamil Sangam Literature's GrammarTamil Sangam Literature's parables.		CO1
UNIT II	**'AGATHINAI'AND'PURATHINAI'**	**6**
Tholkappiyar's Meaningful Verses–Three literature materials–Agathinai's message- History ofCulturefrom Agathinai– Purathinai–Classification–Mesaage to Society from Purathinai.		CO2
UNIT III	**'ATTRUPPADAI'**	**6**
Attruppadai Literature – Attruppadaiin 'Puranaanuru' – Attruppadaiin 'Pathitrupaththu'- Attruppadaiin 'Paththupaattu'.		CO3
UNIT IV	**'PURANAANURU'**	**6**
Puranaanuru on Good Administration, Ruler and Subjects–Emotion & its Effect in Puranaanuru.		CO4
UNIT V	**'PATHITRUPATHTHU'**	**6**
Pathitrupaththuin 'Ettuthogai' — Pathitrupaththu's Parables –Tamildynasty: Valor, Administration, Charity in Pathitrupaththu - Mesaage to Society from Pathitrupaththu.		CO5

TOTAL : 30 PERIODS

REFERENCE BOOKS

1. Sivaraja Pillai, The Chronology oftheEarlyTamils,SagwanPress,2018.
2. HankHeifetz andGeorgeL. Hart, The Purananuru,Penguin Books,2002.
3. Kamil Zvelebil, The Smile of Murugan: OnTamil Literature of South India, Brill Academic Pub,1997.
4. GeorgeL. Hart, Poetsof theTamil Anthologies: AncientPoemsofLove andWar, Princeton University Press,2015.
5. XavierS.Thani Nayagam, Landscape and poetry:a study of nature in classical Tamil poetry,Asia Pub.House, 1967.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Appreciate and apply the messages in Sanga Tamil Literature in their life.
CO2	Differentiate ‘Agathinai‘ and ‘Purathinai‘in their personal and societal life.
CO3	Appreciate and apply the messages in’ Attruppadai‘ in their personal and societal life.
CO4	Appreciate and apply the messages in’ Puranaanuru‘ in their personal and societal life.
CO5	Appreciate and apply the messages in’ Pathitrupaththu‘ in their personal and societal life.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-

Value Added Courses

VAC001	INDUSTRIAL INTERNET OF THINGS	L	T	P	C
		1	0	2	2

OBJECTIVES

- ❖ The main learning objective of this course is to make the students an appreciation for:
- ❖ To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.
- ❖ Knowledge for the design and analysis of Industry 4.0Systems for Electronics Engineering students

UNIT I	INTRODUCTION TO INDUSTRIAL IOT (IIOT) SYSTEMS	9
The Various Industrial Revolutions – Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry – Industry 4.0 revolutions – Support System for Industry 4.0 – Smart Factories.		CO1
UNIT II	**IMPLEMENTATION SYSTEMS FOR IIOT**	**9**
Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.		CO2
UNIT III	**IIOT DATA MONITORING & CONTROL**	**9**
IoT Gate way – IoT Edge Systems and It's Programming – Cloud computing – Real Time Dashboard for Data Monitoring – Data Analytics and Predictive Maintenance with IIoT technology		CO3
UNIT IV	**IIOT Sensors & Networks**	**9**
Next Generation Sensors – Collaborative Platform and Product Lifecycle Management – Industrial IoT- Layers – Software Defined Networks: IIoT Analytics – Security and Fog Computing – Fog Computing in IIoT – Emerging descriptive data standards for IIoT – Cloud data base.		CO4
UNIT V	**INDUSTRIAL IOT- APPLICATIONS**	**9**
Healthcare Power Plants – Inventory Management & Quality Control – Plant Safety and Security Oil – Chemical and Pharmaceutical industry – Applications of UAVs in Industries.		CO5
		TOTAL : 45 PERIODS

REFERENCE:

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: Apress.

2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.

3. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.

4. Dr. OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers.

COURSE OUTCOMES	
Upon completion of the course, students will be able to	
CO1	Students can develop a comprehensive understanding of Internet of Things (IoT) technologies, including sensors, communication protocols, cloud computing, and data analytics.
CO2	The program can provide students with hands-on experience in designing, implementing, and managing IoT-based solutions for industrial applications.
CO3	The program can provide students with an understanding of IoT security and privacy issues, including data encryption, access control, and device authentication.
CO4	The program can help students develop effective communication and teamwork skills through group projects and case studies, which are essential for working in cross-functional teams in industrial IoT settings.
CO5	Graduates of the program can be better equipped to take on roles in IoT-based industrial applications and other areas of technology, due to their in-depth knowledge of IoT technologies and their practical experience in designing and implementing industrial IoT solutions.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO 3**
CO1	2	2	1	1	2	2	-	-	-	2	2	2	2	2	3
CO2	1	1	1	1	2	2	-	-	1	2	2	2	1	2	2
CO3	3	2	2	2	2	2	-	-	1	1	1	1	2	2	2
CO4	1	1	2	1	2	2	-	-	3	2	2	1	1	2	2
CO5	1	1	1	2	1	2	1	1	2	2	2	2	2	2	2

VAC002	AUGMENTED REALITY & VIRTUAL REALITY	L	T	P	C
		1	0	2	2

OBJECTIVES

The main learning objective of this course is to make the students an appreciation for:

1. To provide students with good depth of knowledge of Augmented Reality and Virtual Reality
2. Knowledge on Tools and Applications of Augmented Reality and Virtual Reality

UNIT I	**Introduction to Augmented Reality and Virtual Reality (VR)**	**9**
History of AR - Augmented reality characteristics– Difference between Augmented Reality and Virtual Reality– AR technological components– Technologies used in AR– Feature Extraction – Hardware components – AR devices – Importance of AR - Real world uses of AR – AR types – Software tools available for AR.		**CO1**
UNIT II	**Computer Graphics and Geometric Modeling**	**9**
The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms, Geometrical Transformations: Introduction, Frames of reference.		**CO2**
UNIT III	**Need of technologies for Augmented Reality & Virtual Reality**	**9**
Hardware technology– virtual scenes – 3D objects– AR & VR components Display – HMD – Eyeglasses– Contact Lenses – significance of AR – AR powered devices – Motion tracking –Virtual environment - VR technology, AR & VR application development drawbacks – Compatibility Performance.		**CO3**
UNIT IV	**Tools and Applications of Augmented Reality & Virtual Reality**	**9**
Tools available for Augmented Reality and Recognition - Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems - Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML.		**CO4**
UNIT V	**Augmented Realities and Virtual Reality for Micro Learning**	**9**
Micro learning techniques – Utilizing VR for learning – VR for Practical online assessment – VR info graphics – Virtual case considerations - Utilizing AR for learning – Accessible learning – sensible data – elevated learner engagement - Engineering, Entertainment, Science, Training, Game Development		**CO5**

TOTAL : 45 PERIODS

REFERENCE:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018

2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016

COURSE OUTCOMES	
Upon completion of the course, students will be able to	
CO1	Understand the importance of augmented reality in Industry 4.0 with real-time examples
CO2	To describe the history and recent developments of AR
CO3	To provide the need on emerging technologies AR and VR
CO4	To discuss the revolution and impact of AR
CO5	To understand the applications of AR and VR

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	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	2	1	1	1	1	-	-	-	2	1	1	1	2	3
CO2	2	2	2	1	1	1	-	-	-	-	1	1	1	2	2
CO3	2	2	2	1	1	1	-	-	-	-	1	1	2	2	2
CO4	2	2	2	1	1	2	-	-	-	-	1	1	2	2	3
CO5	2	2	2	1	1	2	1	1	1	2	1	1	2	2	3

VAC003	ETHICAL HACKING - CYBER SECURITY	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To learn the fundamentals of Cyber Security and Ethical Hacking
- To learn the Foot printing & Reconnaissance and Scanning Networks
- To understand Enumeration and Vulnerability Analysis
- To understand Exploitation on Network
- To learn the Web Attacks and Report Writing

UNIT I	FUNDAMENTALS OF CYBER SECURITY AND ETHICAL HACKING	9
Introduction to Cyber Security - Cyber Security & Ethical Hacking - Domains of Cyber Security - Principles of Cybersecurity (CIA Triad, Security Models, Principles of Privileges) - Offensive & Defensive Security - Cyber Kill Chain - Types of Security Teams (Red Team, Blue Team, Purple Team) - Cyber Security Frameworks (NIST, MITRE, ISO/IEC) Phases & Methodologies in Ethical Hacking - Introduction to Malware - Types of Malware		**CO1**

UNIT II	FOOTPRINTING RECONNAISSANCE AND SCANNING NETWORKS	9
Introduction to Foot printing Reconnaissance - Types of Reconnaissance (Passive & Active) - Active Reconnaissance (Ping, Traceroute, Telnet, Whatweb, Wappalyzer, Netcraft) - Passive Reconnaissance (nslookup, whois, dig, DNSDumpster, Shodan) - Introduction to OSINT (OSINT Framework, OSRFRAMEWORK, Social Searcher,) - Introduction to Scanning Networks - Types of Network Scanning (Port Scan, Service Scan, Vulnerability Scan) - Scanning Techniques - Port Scanning (TCP, UDP) - Host Discovery (ICMP, ARP) - Introduction to Wireshark - Capturing Data Packets - Packet Analysis.		**CO2**

UNIT III	ENUMERATION AND VULNERABILITY ANALYSIS	9
Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.		**CO3**

UNIT IV	EXPLOITATION ON NETWORK	9
Introduction to Exploitation - What is Shell - Types of Linux Shells (Bash, Csh/Tcsh, Ksh, Zsh, Fish) - What is Gaining Access & Maintaining Access - Reverse Shell & Bind Shell - Introduction to Metasploit Framework - Metasploit Modules - Staged Payload & Non-Staged Payload - Using Metasploit Framework Gaining the User Shell Acess - Gaining Root Shell Acess in Metasploit Framework - Introduction to Manual Exploitation - Gaining User Shell in Manual Exploitation - What is Privilege Escalation - Linux & Windows Privilege Escalation - Using Linpeass Script Finding Non-Privilege Path on Linux System - Using Winpeass Script Finding Non-Privilege Path on Windows System - Hands-on Windows & Linux Privilege Escalation - Introduction to Post Exploitation.		**CO4**

UNIT V	WEB ATTACKS AND REPORT DOCUMENTATION	9
Introduction to OWAP TOP 10 and SANS TOP 25 - Web Server & Web Application Attack Methodology - Indirect Object Reference (IDOR) - SQL Injection - Cross Site Scripting - XML Injection or XML External Internal - Account Hijacking - Sensitive Data Exposure - Server Side Forgery - Race Condition - Generate Proper Vulnerability Assessment Penetration Testing Report Document.		**CO5**

TOTAL : 45 PERIODS

REFERENCE:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.

2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.

3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the importance of fundamentals of cyber security and ethical hacking
CO2	To gain understanding on different foot printing, reconnaissance and scanning methods.
CO3	To demonstrate the enumeration and vulnerability analysis methods
CO4	To acquire knowledge on the options for network protection.
CO5	To gain knowledge on hacking options available in Web applications.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1	1	1	-	-	-	2	1	1	1	2	3
CO2	2	2	2	1	1	1	-	-	-	-	1	1	1	2	2
CO3	2	2	2	1	1	1	-	-	-	-	1	1	2	2	2
CO4	2	2	2	1	1	2	-	-	-	-	1	1	2	2	3
CO5	2	2	2	1	1	2	1	1	1	2	1	1	2	2	3

VAC004	BLOCKCHAIN AND CRYPTO CURRENCIES	L	T	P	C
		1	0	2	2

OBJECTIVES

1. To understand Blockchain's fundamental components, and examine decentralization using blockchain.
2. To understand Cryptocurrency and its background concepts.
3. To learn smart contract programing language solidity.
4. To understand public blockchain application development platform and develop distributed applications.
5. To understand enterprise blockchain application development platform and develop distributed enterprise applications

UNIT I	Introduction	9
Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash function, consensus, byzantine fault-tolerant, distributed computing, 51% attack, digital cash etc.		CO1
UNIT II	**Cryptocurrency Basics**	**9**
Bitcoin blockchain, Challenges and solutions, Crypto mining, mining types, mining hardware, proof of work, Proof of stake, alternatives to Bitcoin consensus, other crypto currencies like Ethereum, Tether, BNB etc		CO2
UNIT III	**Solidity Walkthrough**	**9**
Introduction to Ethereum blockchain – Ethereum Virtual Machine – remix IDE - MetaMask wallet – running simple smart contract – voting application – Lottery application – File sharing application		CO3
UNIT IV	**Public Blockchain Application Development**	**9**
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file		CO4
UNIT V	**Enterprise Blockchain Application Development**	**9**
Introduction to Hyperledger – Hyperledger Fabric architecture– language supports for hyperledger fabric – setting up hyprledger fabric - Building application in hyperledger fabric.		CO5

TOTAL : 45 PERIODS

REFERENCES:

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.
2. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
3. Alex Leverington, “Ethereum Programming” Packt Publishing, 2017.
4. https://hyperledger-fabric.readthedocs.io/en/latest/tutorials.html

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand Blockchain’s fundamental components, and examine decentralization using blockchain.
CO2	Understand Cryptocurrency and its background concepts
CO3	Write smart contract using programing language solidity.
CO4	Develop distributed applications using public blockchain application development platform Ethereum.
CO5	Develop distributed applications using enterprise blockchain application development platform Hyperledger

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	-	-	-	-	1	-	1	-	-	1
CO2	-	-	-	1	1	-	-	-	-	-	-	1	-	1	1
CO3	-	-	-	-	1	-	-	-	-	1	-	1	-	-	1
CO4	-	-	-	1	1	-	-	-	-	-	-	1	-	1	1
CO5	-	-	-	-	1	-	-	-	-	1	-	1	-	1	1

VAC005	INDUSTRIAL PRACTICES WITH DEVOPS	L	T	P	C
		1	0	2	2

OBJECTIVES

1. To introduce DevOps terminology, definition & concepts
2. To understand the Maven, Profiles and Plugins
3. To understand the concepts of Continuous Integration/ Continuous Testing/ ContinuousDeployment using Jenkins
4. To understand to leverage Cloud-based DevOps tools using Azure DevOps
5. Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems

UNIT I	**INTRODUCTION TO DEVOPS**	**9**
Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github		**CO1**
UNIT II	**COMPILE AND BUILD USING MAVEN & GRADLE**	**9**
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, understand build using Gradle		**CO2**
UNIT III	**CONTINUOUS INTEGRATION USING JENKINS**	**9**
Install & Configure Jenkins, Jenkins Architecture Overview, creating a Jenkins Job, configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace		**CO3**
UNIT IV	**BUILDING DEVOPS PIPELINES USING AZURE**	**9**
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file		**CO4**
UNIT V	**DEVOPS PRACTICALS**	**9**
Create Maven Build pipeline in Azure - Run regression tests using Maven Build pipeline in Azure - Install Jenkins in Cloud - Create CI pipeline using Jenkins - Create a CD pipeline in Jenkins and deploy in Cloud		**CO5**
		TOTAL : 45 PERIODS

REFERENCES:

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Mitesh Soni, Hands-On Azure Devops: CICD Implementation for Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for .DevOps and Microsoft Azure (English Edition) , 2020
3. Mariot Tsitoara, “ Beginning Git and GitHub: A Comprehensive Guide to Version Control Management, and Teamwork for the New Developer”, Second Edition, 2019.
4. https://www.jenkins.io/user-handbook.pdf
5. https://maven.apache.org/guides/getting-started

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand different actions performed through Version control tools like Git.
CO2	Compile and Build using Maven & Gradle applications
CO3	Ability to Perform Continuous Integration using Jenkins.
CO4	Understand to leverage Cloud-based DevOps tools using Azure DevOps
CO5	Develop various Devops applications

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2

VAC006	APPLIED MACHINE LEARNING WITH PYTHON	L	T	P	C
		1	0	2	2

OBJECTIVES

- To provide a basic understanding of data manipulation.
- To understand scikit learn for model evaluation.
- To provide a comprehensive understanding of neural networks and computer vision.

UNIT I	DATA MANIPULATION WITH PYTHON LIBRARIES	9
Overview of Data Manipulation with Python-Introduction to Pandas and NumPy-Data Cleaning and Preprocessing-Handling Missing Data-Data Exploration and Analysis		CO1
UNIT II	**MACHINE LEARNING BASICS WITH SCIKIT-LEARN**	**9**
Introduction to Machine Learning-Types of Machine Learning Algorithms-Overview of Decision Trees and Random Forests-Hands-on Implementation with Scikit-Learn-Model Evaluation and Validation.		CO2
UNIT III	**LINEAR REGRESSION AND BEYOND**	**9**
Linear Regression Fundamentals-Implementing Linear Regression from Scratch-Logistic Regression for Classification-Introduction to Support Vector Machines (SVM)-Hands-on Exercises with Scikit-Learn.		CO3
UNIT IV	**ADVANCED MACHINE LEARNING TECHNIQUES**	**9**
Introduction to Gradient Boosting-Implementation of Gradient Boosting with XGBoost-Neural Networks Basics with PyTorch-Deep Learning Fundamentals-Applications of Neural Networks.		CO4
UNIT V	**COMPUTER VISION AND TRANSFER LEARNING**	**9**
Image Classification with Convolutional Neural Networks (CNN)-Transfer Learning Concepts and Applications-Hands-on Image Classification with PyTorch-Fine-tuning Pre-trained Models-Building Custom Models for Specific Tasks.		CO5
		TOTAL : 45 PERIODS

REFERENCE:

1. “ Data Wrangling with Pandas" by Kevin Markham - A practical guide that delves into data cleaning, preprocessing, handling missing data, and exploratory data analysis using Pandas.
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron - A comprehensive guide that covers a wide range of machine learning topics, including decision trees, random forests, and model evaluation with scikit-learn.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To understand a predictive models that can classify or regress on data by recursively partitioning.
CO2	To develop a foundational understanding of the underlying algorithms, optimizing model parameters
CO3	To build a robust and high-performance ensemble model for regression or classification tasks.
CO4	To understand the automatic learning of hierarchical representations from data for tasks such as classification, regression, and feature extraction.
CO5	To incorporating transfer learning are to leverage pre-trained models to efficiently learn and classify features in images, facilitating accurate predictions.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	-	-	-	-	1	-	-	-	-	1	-	1	-	-	1
CO2	-	-	-	1	1	-	-	-	-	-	-	1	-	1	1
CO3	-	-	-	-	1	-	-	-	-	1	-	1	-	-	1
CO4	-	-	-	1	1	-	-	-	-	-	-	1	-	1	1
CO5	-	-	-	-	1	-	-	-	-	1	-	1	-	1	1

You Choose, We Do It
St. JOSEPH'S COLLEGE OF ENGINEERING
(An Autonomous Institution)
St. Joseph's Group of Institutions
OMR, Chennai - 119

FACULTY OF COMPUTER SCIENCE AND ENGINEERING AND INFORMATION TECHNOLOGY

Minutes of the Fourth Meeting of the Board of Studies

The Fourth meeting of the Board of Studies for the Faculty of Computer Science and Engineering and Information Technology was held virtually on 23.05.24 (Thursday), at 10 A.M

***The following Members were present for the meeting*:**

1.	**Chairman**	**Dr. A. Chandra Sekar**, Dean-Research & Faculty Head Faculty of Computer Science and Engineering and Information Technology, St. Joseph's College of Engineering, OMR, Chennai – 600 119.
2.	**University Nominee**	**Dr. J. C. Miraclin Joyce Pamila**, Professor and Head, Department of Computer Science and Engineering Government College of Technology Coimbatore – 641 013.
3.	**Subject Expert**	**Dr. Krishna Moorthy Sivalingam**, Professor, Department of Computer Science and Engineering, Indian Institute of Technology (IIT) Madras, Chennai – 600 036.
4.	**Subject Expert**	**Dr. G. Zayaraz**, Professor & Head, Department of Computer Science and Engineering, Puducherry Technological University Puducherry – 605 014.

5.	**Industrial Expert**	**Mr. Abdul Muthalif**, Director Cognizant, Chennai.
6.	**Post Graduate Meritorious Alumnus**	**Ms. S.Ram Lakshmi**, Specialist Programmer Infosys, Techno Park, SEZ, Mahindra World City, Paranur, Chennai.
7.	**Dr.Muthu Lakshmi V** ,Professor & Head, Department of Computer Science and Engineering, St. Joseph's College of Engineering, OMR, Chennai – 119.	
8.	**Ms Latha Selvi G ,** Professor & Head, Department of Information Technology , St.Joseph's College of Engineering, OMR, Chennai – 119.	
9.	**Dr. Pugalenthi R,** Professor & Head, Department of Artificial Intelligence and Data Science, St. Joseph's College of Engineering, OMR, Chennai – 119.	
10.	**Dr. Lilly Raamesh,** Professor & Head, Department of Artificial Intelligence and Machine Learning, St. Joseph's College of Engineering, OMR, Chennai – 119.	
11.	**Faculty Members of** **Computer Science and Engineering,** **Information Technology,** **Artificial Intelligence and Data Science and** **Artificial Intelligence and Machine Learning**	
Special Invitees		
12.	**Principal,** St. Joseph's College of Engineering, OMR, Chennai – 119.	
13.	**Dean Academics,** St. Joseph's College of Engineering, OMR, Chennai – 119.	
14.	**Dean Student Affairs,** St. Joseph's College of Engineering, OMR, Chennai – 119.	
15.	**Dean Industrial Collaborations & IQAC ,** St. Joseph's College of Engineering, OMR, Chennai – 119.	
16.	**The Controller of Examinations,** St. Joseph's College of Engineering, OMR, Chennai – 119.	

Minutes of 4th Meeting of Board of Studies

Minutes:

BOS 04. 01 WELCOME ADDRESS AND BRIEF INTRODUCTION OF THE MEMBERS OF BOARD OF STUDIES

The Fourth meeting of Board of studies of Faculty of Computer Science and Engineering and Information Technology was commenced with welcome address by the Faculty Head. It was followed by a brief introduction of members of Board of studies such as University Representative, Subject Experts, Industrial Expert and Alumnus and Internal Faculty Members.

BOS 04. 02 BRIEF REPORT ON THE PROGRESS OF THE DEPARTMENT

The Faculty Head has made a brief presentation to the members of the Board of Studies, highlighting the current intake, the Academic Progress and Achievements of the Departments

BOS 04. 03 TO CONSIDER AND APPROVE THE NEW CURRICULA AND SYLLABI OF B.E COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY) OF THE FIRST TO EIGHT SEMESTERS

RESOLVED TO APPROVE the curricula and syllabi of B.E Computer Science and Engineering (Cyber Security) of the FIRST to EIGHT semesters for the programmes with the Choice Based Credit System (CBCS) under R-2021 with effect from the Academic Year 2024-2025 onwards

BOS 04. 04 **TO CONSIDER AND APPROVE THE REVISIONS IN THE CURRICULUM FOR THE INTRODUCTION OF EMPLOYABILITY ENHANCEMENT SKILL BASED COURSES (As per the directions of Anna University)**

RESOLVED TO APPROVE Introduction of Employability Skill Based Courses to be followed as per the following guidelines

- Skill based experiential learning courses will be offered in two categories as purely Laboratory Based Courses and Theory Integrated Laboratory Courses. One such course will be offered in every semester from V to VII.
- A student may accumulate up to 6 credits through such courses, and such credits will be considered in lieu of the Professional Elective and/or Open Elective Courses.

BOS 04. 05 **TO CONSIDER AND APPROVE THE CHANGES IN THE SYLLABUS OF B.E / B.TECH PROGRAMMES OFFERED UNDER FACULTY OF COMPUTER SCIENCE ENGINEERING AND INFORMATION TECHNOLOGY**

RESOLVED TO APPROVE the changes in the syllabi of B.E / B.TECH Programmes under the faculty of Computer Science and Engineering and Information Technology for the academic year 2024-2025 onwards in accordance with the Choice Based Credit System (CBCS) under R-2021.

Minutes of 4th Meeting of Board of Studies

Common to all branches

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	**Theory/ Lab**	**Sub. Code**	**Subject Name**	**Year/ Sem**	**Theory/ Lab**	**Sub. Code**	**Subject Name**
I / I	Theory	GE1105	Problem Solving and Python Programming	I / I	Theory	GE1109	Problem Solving and Programming in C
I / I	Lab	GE1107	Python Programming Laboratory	I / I	Lab	GE1110	Programming in C Laboratory

Artificial Intelligence and Machine Learning

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/ Lab**	**Sub. Code**	**Subject Name**	**Year/Sem**	**Theory/ Lab**	**Sub. Code**	**Subject Name**
I / II	Theory	CS1206	Programming in C	I / II	Theory	DS1209	Python Programming
I / II	Lab	CS1208	Programming in C Laboratory	I / II	Lab	DS1210	Python Programming Laboratory
II / III	Theory	DS1303	Introduction to Artificial Intelligence	II / III	Theory	ML1304	Foundations of Artificial Intelligence and Machine Learning
II / III	Theory	ML1301	Data Foundation	II / III	Theory	ML1305	Computer Networks and Security
II / III	Lab	DS1308	Artificial Intelligence Laboratory	II / III	Lab	ML1306	Artificial Intelligence and Machine Learning Laboratory
II / IV	Theory	CS1402	Operating Systems	II / IV	Theory	ML1403	Data Analytics Tools and Techniques
II / IV	Theory	ML1401	Foundations of Machine Learning	II / IV	Theory	ML1404	Principles of Operating Systems
II / IV	Theory	CS1403	Database Design and Management (Lab Integrated)	II / IV	Theory	ML1405	Database Design and Security (Lab Integrated)

Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/ Lab**	**Sub. Code**	**Subject Name**	**Year/Sem**	**Theory/ Lab**	**Sub. Code**	**Subject Name**
II / IV	Theory	ML1402	Statistics for Machine Learning	II / IV	Theory	ML1402	Statistical Learning
II / IV	Lab	ML1408	Machine Learning Laboratory	II / IV	Lab	ML1409	Data Analytics Laboratory
II / IV	Lab	CS1407	Operating Systems Laboratory	II / IV	Lab	ML1410	Statistical Learning Laboratory
III / V	Theory	DS1502	Advanced Artificial Intelligence	III / V	Theory	ML1504	Applied Deep Learning
III / V	Theory	ML1502	Nature Inspired Computing Techniques	III / V	Theory	ML1505	Foundations of IoT: Sensors, Networks, and Applications
III / V	Lab	ML1507	Applied Reinforcement Laboratory	III / V	Lab	ML1508	IoT Laboratory
III / V	Lab	DS1508	Advanced Artificial Intelligence Laboratory	III / V	Lab	ML1509	Deep RL Laboratory
III / VI	Theory	ML1602	Autonomous Mobile Robot	III / VI	Theory	ML1605	Intelligent Robots and Drone Technology
III / VI	Theory	ML1601	Deep Learning	III / VI	Theory	ML1606	Theory of Automata and Formal Languages
III / VI	Theory	ML1604	Big Data Analytics	III / VI	Theory	ML1607	Cloud and Big Data Architecture
III / VI	Lab	ML1607	Deep Learning Laboratory	III / VI	Lab	ML1609	Intelligent Robots and Drone Technology Laboratory
IV / VII	Theory	ML1702	Formal Languages and Automata Theory	IV / VII	Theory	ML1704	Edge AI

Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory /Lab**	**Sub. Code**	**Subject Name**	**Year/Sem**	**Theory/ Lab**	**Sub. Code**	**Subject Name**
IV / VII	Theory	ML1704	Machine intelligence for network sciences	IV / VII	Theory	ML1705	Generative AI
IV / VII	Lab	ML1707	NLP Laboratory	IV / VII	Lab	ML1709	Industrial AI Applications Laboratory
				IV / VII	Lab	CT1701	Credit Course on Advanced Data Management and Machine Intelligence by Cognizant

Information Technology

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/Lab**	**Sub. Code**	**Subject Name**	**Year/Sem**	**Theory/Lab**	**Sub. Code**	**Subject Name**
I / II	Theory	CS1206	Programming in C **(Common to CSE & IT, AI-DS & AI-ML)**	I / II	Theory	IT1201	Object Oriented Programming Admitted in 2024
I / II	Lab	CS1208	Programming in C Laboratory **(Common to CSE & IT, AI-DS & AI-ML)**	I / II	Lab	IT1207	Object Oriented Programming Laboratory Admitted in 2024
II / III	Theory	CS1301	Digital Principles and Logic Design (Lab Integrated) **(Common to CSE & IT)**	II / III	Theory	IT1303	Digital Principles and Computer Architecture Admitted in 2023onwards
II / III	Theory	CS1304	Computer Architecture **(Common to CSE & IT)**	II / III	Theory	IT1302	Data Exploration and Visualization (Lab Integrated) Admitted in 2023 onwards

Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/Lab**	**Year/ Sem**	**Theory/Lab**	**Year/ Sem**	**Theory/ Lab**	**Year/ Sem**	**Theory/Lab**
II / III	Theory	CS1305	Software Engineering **(Common to CSE & IT)**	II / III	Theory	CS1309	Agile Software Engineering **(Common to CSE & IT)** Admitted in 2023 onwards
II / IV	Theory	IT1401	Computer Communication	II / IV	Theory	CS1404	Computer Networks **(Common to CSE & IT)** Admitted in 2023 onwards
II / IV	Theory	ML1401	Foundations of Machine Learning **(Common to IT, AI-DS & AI-ML)**	II / IV	Theory	IT1402	Fundamentals of Data Science and Analytics Admitted in 2023 onwards
II / IV	Lab	ML1408	Machine Learning Laboratory **(Common to IT, AI-DS & AI-ML)**	II / IV	Lab	IT1408	Fundamentals of Data Science and Analytics Laboratory Admitted in 2023 onwards
III / V	Theory	IT1502	Computational Intelligence (Lab Integrated)	III / V	Theory	IT1503	Artificial Intelligence and Machine Learning (Lab Integrated) Admitted in 2023 onwards
III / VI	Theory	IT1604	Data Science and Big Data Analytics	III / VI	Theory	IT1605	Big Data Analytics Admitted in 2023 onwards

Minutes of 4th Meeting of Board of Studies

Artificial Intelligence and Data Science

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/Lab**	**Sub.Code**	**Sub. Name**	**Year/ Sem**	**Theory/ Lab**	**Sub. Code**	**Sub. Name**
I / II	Theory	CS1206	Programming in C	I / II	Theory	CS1209	Problem Solving and Python Programming
I / II	Lab	CS1208	Programming in C Laboratory	I / II	Lab	CS1210	Python Programming Laboratory
II / III	Theory	DS1302	Object Oriented Programming(Lab Integrated)	II / III	Theory	CS1309	Java Programming
II / III	Lab	DS1307	Data Structures Laboratory using Python	II / III	Lab	CS1307	Data Structures Laboratory using C
II / III	-	-	-	II / III	Lab	CS1310	Java Programming Laboratory
II / IV	Theory	DS1401	Python Programming for Data Science	II / IV	Theory	DS1401	Fundamentals of Digital Image Processing
II / IV	Lab	DS1407	Data Science Laboratory using Python	II / IV	Lab	DS1407	Digital Image Processing Laboratory
III / V	Theory	DS1501	Optimization in Data Analysis	III / V	Theory	DS1501	Deep Learning
III / V	Lab	DS1507	Data Preparation and Analysis Laboratory	III / V	Lab	DS1507	Deep Learning Laboratory
III / VI	Theory	DS1603	Data Visualization	III / VI	Theory	DS1603	Data Visualization using Tableau

Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/Lab**	**Sub. Code**	**Sub. Name**	**Year/ Sem**	**Theory/ Lab**	**Sub. Code**	**Sub. Name**
III / VI	Theory	DS1604	Data Analytics	III / VI	Theory	DS1604	Data Analytics using R
III / VI	Lab	DS1607	Data Visualization Laboratory	III / VI	Lab	DS1607	Data Visualization using Tableau Laboratory
III / VI	Lab	-	-	III / VI	Lab	DS1608	Data Analytics using R Laboratory
III / VI	Lab	DS1608	Mini Project - I	III / VI	Lab	DS1609	Mini Project - I

Computer Science and Engineering

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	**Theory/Lab**	**Sub. Code**	**Subject Name**	**Year/ Sem**	**Theory/ Lab**	**Sub. Code**	**Subject Name**
I / II	Theory	CS1206	Programming in C (Common to CSE & IT)	I / II	Theory	CS1209	Object Oriented Java Programming Admitted in 2024 only
I / II	Lab	CS1208	Programming in C Laboratory (Common to CSE & IT)	I / II	Lab	CS1210	Object Oriented Java Programming Laboratory Admitted in 2024 only
II / III	Theory	CS1301	Digital Principles and Logic Design (Lab Integrated)	II / III	Theory	CS1306	Digital Principles and Logic Design Admitted from 2023 onwards

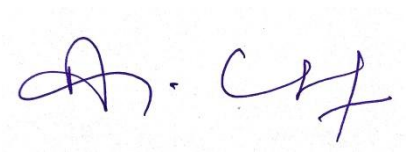
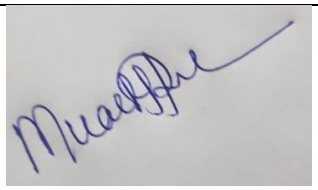
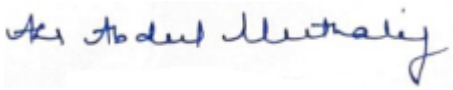
Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/Lab**	**Sub. Code**	**Subject Name**	**Year/ Sem**	**Theory/ Lab**	**Sub. Code**	**Subject Name**
II / III	Theory	CS1305	Software Engineering (Common to CSE & IT)	II / III	Theory	CS1309	Agile Software Engineering (Common to CSE & IT) Admitted from 2023 onwards
II / III	Theory	CS1303	Object Oriented Programming (Common to CSE & IT)	II / III	Theory	CS1310	Advanced Java Programming Admitted in 2024
II / III	Lab	CS1307	Data Structures Laboratory using C (Common to CSE & IT)	II / III	Lab	CS1311	Data Structures Laboratory Admitted from 2024 onwards
II / III	Lab	CS1308	Object Oriented Programming Laboratory (Common to CSE & IT)	II / III	Lab	CS1312	Advanced Java Programming Laboratory Admitted in 2024
II /I V	Theory	EC1601	Microprocessors and Microcontrollers (Common to CSE and ECE Semester VI)	II/IV	Theory	CS1410	Fundamentals of Data Science Admitted from 2023 onwards
II /I V	Lab	CS1408	Networks Laboratory	II/IV	Lab	CS1411	Data Science Laboratory Admitted from 2023 onwards
III / V	Theory	CS1501	Internet Programming	III / V	Theory	CS1509	Full Stack Development Admitted from 2023 onwards
III / V	Lab	CS1507	Internet Programming Laboratory	III / V	Lab	CS1510	Full Stack Development Laboratory Admitted from 2023 onwards

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	**Theory/Lab**	**Sub. Code**	**Theory/Lab**	**Year/ Sem**	**Theory/ Lab**	**Sub. Code**	**Theory/Lab**
III / VI	Theory	CS1603	Distributed Systems	III / VI	Theory	CS1609	Introduction to Quantum Computing Admitted from 2023 onwards
III / VI	Lab	CS1608	Mini Project I	III / V	Lab	CS1610	Design Thinking and Innovations Admitted from 2022 onwards
III/VI	Professional Elective-II	CS1613	Advanced Java Programming	III/VI	Professiona l Elective-II	CS1615	Generative AI for Software Development Admitted from 2024 onwards
IV/VII	Professional Elective-IV	CS1722	Quantum Computing	IV/VII	Professional Elective-IV	CS1726	Business Analytics Admitted from 2023 onwards

BOS 04. 06 **VOTE OF THANKS**

The meeting came to end, with the Vote of Thanks proposed by the Faculty Head to all the external and internal members for having spared their time and participated in the Third Board of Studies of Faculty of Computer Science and Engineering and Information Technology, St. Joseph's College of Engineering, Chennai - 119.

 **Chairman** **Dr. A.Chandra Sekar**, Dean Research & Faculty Head, Faculty of Computer Science and Engineering, and Information Technology, St. Joseph's College of Engineering, OMR, Chennai – 119.	 **University Nominee** **Dr. J. C. Miraclin Joyce Pamila**, Professor and Head, Department of Computer Science and Engineering, Government College of Technology, Coimbatore - 641013.	- **Subject Expert** **Dr. Krishna Moorthy Sivalingam**, Professor, Department of Computer Science and Engineering, Indian Institute of Technology (IIT) Madras, Chennai – 600036.
 **Subject Expert** **Dr. G. Zayaraz**, Professor & Head, Department of Computer Science and Engineering, Puducherry Technological University Puducherry – 605 014.	 **Industrial Expert** **Mr. Abdul Muthalif**, Director Cognizant, Chennai.	 **Post Graduate Meritorious Alumnus** **Ms. S.Ram Lakshmi**, Specialist Programmer Infosys, Techno Park, SEZ, Mahindra World City, Paranur, Chennai.