You Choose, We Do It
St. JOSEPH'S COLLEGE OF ENGINEERING
(An Autonomous Institution)
St. Joseph's Group of Institutions
Jeppiaar Educational Trust
OMR, Chennai - 119.

B.Tech   INFORMATION TECHNOLOGY
REGULATION – 2021
CHOICE BASED CREDIT SYSTEM
I - VIII SEMESTERS CURRICULA AND SYLLABI

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PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: To ensure graduates will be capable of applying the basic knowledge of physical sciences, mathematics and Information Technology for the applications pertinent to different fields of Engineering and Technology.

PEO 2: To enhance graduates with the core capabilities important for applying information on computers and telecommunication systems, gear to send, store, recover, control and investigate information with regards to business undertaking.

PEO 3: To enable graduates to think sensibly, pursue lifelong learning and will have the ability to comprehend technical issues related to computing systems and to come up with best possible solutions.

PEO 4: To empower graduates to create equipment and programming frameworks by comprehending the values of social, business and ecological necessities in the human setting.

PEO 5: To enable graduates to get placed in leading companies and develop themselves as professionals by applying their technological skills to real-world problems and meeting the diverse needs of business, education, and science.

COMPUTER COMMUNICATION 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 modelling 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 OBJECTIVES (PSOs):

PSO1: To analyse and design an efficient information management system which uses the concepts of Information technology to deliver technological solutions and to analyse its impact in the societal and human context.

PSO2: To identify the resources needed for building complex IT projects with an understanding of risk management processes, operational and policy implications considering human, financial and ecological factors.

PSO3: To develop and test software projects by applying IT tools and techniques for the development of computational systems to serve the needs of the community at large.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

Abroad relation between the Programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMMEOUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	3										
2	1		1		2							
3												3
4						2	1	3	2			
5			1	2	1					2	1	

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

Abroad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAM SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	2			3				2	2		
2				3			3	3			3	
3	1		2		3	2						

Contribution 1: Reasonable   **2: Significant**   **3: Strong**

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

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 Python Programming	√	√	√										√	√	√
	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 Practice Laboratory	√	√	√	√	√	√		√	√	√		√	√	√	√
	Programming in C Laboratory	√	√	√					√	√	√		√	√	√	√
III	Probability and Statistics	√	√	√						√				√	√	√

Sem	Course	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Java Programming	√	√	√										√	√	√
	Digital Principles & Logic Design (Lab Integrate)	√	√	√										√	√	√
	Data Structures	√	√	√	√	√	√							√	√	√
	Computer Architecture	√	√	√										√	√	√
	Software Engineering	√	√	√					√	√	√		√	√	√	√
	Data Structures Laboratory using C	√	√	√					√	√	√		√	√	√	√
	Java Programming Laboratory	√	√	√			√		√	√	√		√	√	√	√
	Professional Skills Laboratory					√	√	√	√	√	√	√	√	√	√	√
IV	Discrete Mathematics	√	√	√					√	√		√		√	√	√
	Design and Analysis of Algorithm	√	√	√	√	√				√		√		√	√	√
	Operating Systems	√	√	√	√	√					√	√	√	√	√	√
	Database Design and Management (Lab Integrated)	√	√	√	√	√					√	√	√	√	√	√
	Computer Communication	√	√	√										√	√	√
	Foundations of Machine Learning	√	√	√	√	√	√	√			√	√	√	√	√	√
	Operating Systems Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Machine Learning Laboratory	√	√	√	√	√			√		√	√	√	√	√	√
V	Algebra and Number Theory	√	√	√							√			√	√	√
	Object Oriented Analysis and Design	√	√	√										√	√	√
	Web Technology	√	√	√		√				√		√		√	√	√
	Computational Intelligence (Lab Integrated)	√	√	√			√							√	√	√
	Web Technology Laboratory	√	√	√			√	√	√	√	√		√	√	√	√
	Object Oriented Analysis and Design Laboratory	√	√	√		√	√		√	√	√		√	√	√	√
VI	Theory of Computation and Compiler Design	√	√	√					√	√	√		√	√	√	√
	Mobile Networks And Application Development	√	√	√										√	√	√

Sem	Course Title	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
	Computer Graphics and Applications	√	√	√	√	√					√	√	√	√	√	√
	Data Science and Big Data Analytics	√	√	√	√	√	√	√			√	√	√	√	√	√
	Mobile Networks And Application Development Laboratory	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Mini Project	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
VII	Advanced Neural Network	√	√	√	√	√			√			√	√	√	√	√
	Principles of Cloud Technologies	√	√	√										√	√	√
	Cryptography Algorithms and Applications	√	√	√										√	√	√
	Management Concepts and Organizational Behavior	√	√	√					√	√	√		√	√	√	√
	Cloud Application and development Lab	√	√	√					√	√	√		√	√	√	√
	Project Phase- I	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
VIII	Project Phase- II	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

PROFESSIONAL ELECTIVE COURSES (PEC)

Sem	Course Title	Program Outcomes (POs)												PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
V	Optimization Techniques	√	√	√	√	√					√	√	√	√	√	√
	Introduction to Digital Currencies	√	√	√	√	√					√	√	√	√	√	√
	Information Storage and Management	√	√	√	√	√				√	√	√	√	√	√	√
	Software Reliability	√	√	√	√	√					√	√	√	√	√	√
	Fundamentals of Digital Image Processing	√	√	√					√					√	√	√
VI	Fuzzy Logic and Artifical Neural Network	√	√	√	√	√					√	√	√	√	√	√
	Software Testing and Quality Assurance	√	√	√	√	√						√	√	√	√	√
	Natural Language Processing Tools And Applications	√	√	√	√	√		√	√	√			√	√	√	√

Sem	Course															
	Knowledge Engineering	√	√	√	√	√			√	√	√	√	√	√	√	√
	Engineering Ethics and Human Values	√	√	√		√			√				√	√	√	√
VII	Web Development Frameworks				√		√	√	√	√	√	√		√	√	√
	Information Management	√	√	√	√	√				√	√	√	√	√	√	√
	Cyber Forensics				√		√	√	√	√	√	√		√	√	√
	Parallel Algorithms	√	√	√	√	√					√	√	√	√	√	√
	Augmented and Virtual Reality	√	√	√	√				√	√	√	√	√	√	√	√
VII	Storage Area Networks	√	√	√		√			√				√	√	√	√
	NoSQL Database	√	√	√					√				√	√	√	√
	Software Agents	√	√	√	√	√					√	√	√	√	√	√
	Quantum Computing	√	√	√		√			√				√	√	√	√
	Disaster Management	√	√	√		√			√	√	√			√	√	√
VIII	Information Theory and Coding	√	√	√		√							√	√	√	√
	Electronic Commerce	√	√	√		√			√				√	√	√	√
	Affective Computing	√	√	√					√		√	√	√	√	√	√
	Social Media Mining	√	√	√	√	√			√				√	√	√	√
	Secure Coding	√	√	√	√	√					√	√	√	√	√	√
VIII	Iot Platform For Smart City Planning	√	√	√										√	√	√
	Trust Networks	√	√	√	√	√	√				√	√	√	√	√	√
	Artificial Intelligence and Robotics	√	√	√	√	√				√	√		√	√	√	√
	Software Defined Networks	√	√	√	√	√			√		√	√	√	√	√	√
	Business Analytics	√	√	√					√				√	√	√	√

SEMESTER – I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS1101	Communicative English **(Common for all branches of B.E. /B. Tech Programmes)**	HSMC	3	3	0	0	3
2.	MA1102	Engineering Mathematics – I **(Common for all branches of B.E. /B. Tech Programmes)**	BSC	4	4	0	0	4
3.	PH1103	Engineering Physics **(Common for all branches of B.E. /B. Tech Programmes)**	BSC	3	3	0	0	3
4.	CY1104	Engineering Chemistry **(Common for all branches of B.E. /B. Tech Programmes)**	BSC	3	3	0	0	3
5.	GE1105	Problem Solving and Python Programming **(Common for all branches of B.E. /B. Tech Programmes)**	ESC	4	3	1	0	3
6.	GE1106	Engineering Graphics **(Common for all branches of B.E. /B. Tech Programmes)**	ESC	5	1	0	4	4
7	GE1209	தமிழர் மரபு / **Heritage of Tamils**	HSMC	1	1	0	0	1
PRACTICALS								
8.	GE1107	Python Programming Laboratory **(Common for all branches of B.E. /B. Tech Programmes)**	ESC	4	0	0	4	2
9.	BS1108	Physics and Chemistry Laboratory **(Common for all branches of B.E. /B. Tech Programmes)**	BSC	4	0	0	4	2
		TOTAL		31	18	1	12	25

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
		THEORY						
1.	HS1201	Professional English **(Common for all branches of B.E. /B. Tech Programmes)**	HSMC	3	3	0	0	3
2.	MA1202	Engineering Mathematics- II **(Common for all branches of B.E. /B. Tech Programmes Except AI-DS & AI-ML)**	BSC	4	4	0	0	4
3.	PH1252	Physics for Information Science **(Common to CSE, AI-DS & AI-ML)**	BSC	3	3	0	0	3
4.	GE1204	Environmental Science and Engineering **(Common for all branches of B.E. /B. Tech Programmes)**	HSMC	3	3	0	0	3
5.	BE1251	Basic Electrical Electronics and Measurement Engineering **(Common to CSE, AI-DS & AI-ML)**	ESC	3	3	0	0	3
6.	CS1206	Programming in C **(Common to CSE, AI-DS & AI-ML)**	PCC	4	3	1	0	3
7	GE1210	தமிழரும் தொழில்நுட்பமும் / **Tamils and Technology**	HSMC	1	1	0	0	1
		PRACTICALS						
8.	GE1207	Engineering Practices Laboratory **(Common for all branches of B.E. /B. Tech Programmes)**	ESC	4	0	0	4	2
9.	CS1208	Programming in C Laboratory **(Common to CSE, AI-DS & AI-ML)**	PCC	4	0	0	4	2
		TOTAL		**29**	**20**	**1**	**8**	**24**

SEMESTER – III

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1351	Probability and Statistics **(Common to CSE & AI-DS)**	BSC	4	4	0	0	4
2	IT1301	Java Programming	PCC	3	3	0	0	3
3	CS1301	Digital Principles & Logic Design(Lab Integrated) **(Common to CSE)**	ESC	5	3	0	2	4
4	CS1302	Data Structures **(Common to CSE, AI-DS & AI-ML)**	PCC	3	3	0	0	3
5	CS1304	Computer Architecture **(Common to CSE)**	PCC	4	3	1	0	3
6	CS1305	Software Engineering **(Common to CSE)**	PCC	3	3	0	0	3
PRACTICALS								
7	CS1307	Data Structures Laboratory using C **(Common to CSE)**	PCC	4	0	0	4	2
8	IT1308	Java Programming Laboratory	PCC	4	0	0	4	2
9.	HS1310	Professional Skills Laboratory **(Common to AI-ML)**	HSMC	2	0	0	2	1
Total				32	19	1	12	25

SEMESTER – IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1453	Discrete Mathematics **(Common to CSE & AI-DS)**	BSC	4	4	0	0	4
2	CS1401	Design and Analysis of Algorithm **(Common to CSE, AI-DS & AI-ML)**	PCC	3	3	0	0	3
3	CS1402	Operating Systems **(Common to CSE, AI-DS & AI-ML)**	PCC	3	3	0	0	3
4	CS1403	Database Design and Management (Lab Integrated) **(Common to CSE, AI-DS & AI-ML)**	PCC	5	3	0	2	4
5	IT1401	Computer Communication	PCC	3	3	0	0	3
6	ML1401	Foundations of Machine Learning **(Common to AI-ML & AI-DS)**	PCC	3	3	0	0	3
PRACTICALS								
7	CS1407	Operating Systems Laboratory **(Common to CSE & AI-ML)**	PCC	4	0	0	4	2
8	ML1408	Machine Learning Laboratory **(Common to AI-ML & AI-DS)**	PCC	4	0	0	4	2
Total				29	19	0	10	24

SEMESTER – V

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1501	Algebra and Number Theory **(Common to CSE)**	BSC	4	4	0	0	4
2	CS1502	Object Oriented Analysis and Design **(Common to CSE)**	PCC	3	3	0	0	3
3	IT1501	Web Technology	PCC	4	3	1	0	3
4	IT1502	Computational Intelligence (Lab Integrated)	PCC	5	3	0	2	4
5		Open Elective-I	OEC	3	3	0	0	3
6		Professional Elective-1	PEC	3	3	0	0	3
PRACTICALS								
7	IT1507	Web Technology Laboratory	PCC	4	0	0	4	2
8	CS1508	Object Oriented Analysis and Design Laboratory **(Common to CSE)**	PCC	4	0	0	4	2
Total				30	19	1	10	24

SEMESTER – VI

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	IT1601	Theory of Computation and Compiler Design	PCC	4	3	1	0	3
2	IT1602	Mobile Networks And Application Development	PCC	4	3	1	0	3
3	IT1603	Computer Graphics and Applications	PCC	4	3	1	0	3
4	IT1604	Data Science and Big Data Analytics	PCC	4	3	1	0	3
5		Open Elective-II	OEC	3	3	0	0	3
6		Professional Elective-II	PEC	3	3	0	0	3
7		Audit Course	AC	2	2	0	0	0
PRACTICAL								
7	IT1607	Mobile Networks And Application Development Laboratory	PCC	4	0	0	4	2
8	IT1608	Mini Project	EEC	4	0	0	4	2
Total				30	18	4	8	22
9		Value Added Course/Internship	EEC	Two Weeks		1		

SEMESTER – VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	IT1701	Advanced Neural Network	PCC	4	3	1	0	3
2	IT1702	Principles of Cloud Technologies	PCC	4	3	1	0	3
3	IT1703	Cryptography Algorithms and Applications	PCC	4	3	1	0	3
4	MB1101	Management Concepts and Organizational Behavior **(Common to MBA)**	PCC	4	3	1	0	3
5		Professional Elective-III	PEC	3	3	0	0	3
6		Professional Elective-IV	PEC	3	3	0	0	3
PRACTICALS								
7	IT1707	Cloud application and Development Laboratory	PCC	4	0	0	4	2
8	IT1708	Project Phase-I	EEC	4	0	0	4	2
Total				30	18	4	8	22

SEMESTER – VIII

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Professional Elective-V	PEC	3	3	0	0	3
2		Professional Elective-VI	PEC	3	3	0	0	3
PRACTICALS								
3	IT1807	Project Phase-II	EEC	20	0	0	20	10
Total				26	6	0	20	16

* Audit Course is optional
* Students will undergo Industrial Training / Internship during vacation

Total Credits: 182

HUMANITICS SCIENCE AND MANAGEMENT COURSES (HSMC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS1101	Communicative English	HSMC	3	3	0	0	3
2	HS1201	Professional English	HSMC	3	3	0	0	3
3	GE1204	Environmental Science and Engineering	HSMC	3	3	0	0	3
4	HS1309	Professional Skills Laboratory	HSMC	2	0	0	2	1
5	GE1209	தமிழர் மரபு / Heritage of Tamils	HSMC	1	1	0	0	1
6	GE1210	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HSMC	1	1	0	0	1

BASIC SCIENCE COURSES (BSC)

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

ENGINEERING SCIENCE COURSES (ESC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	GE1105	Problem Solving and Python Programming	ESC	4	3	1	0	3
2	GE1106	Engineering Graphics	ESC	5	1	0	4	4
3	GE1107	Python Programming Laboratory	ESC	4	0	0	4	2

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
4	BE1251	Basic Electrical and Electronics Engineering	ESC	3	3	0	0	3
5	GE1207	Engineering Practice Laboratory	ESC	4	0	0	4	2
6	CS1301	Digital Principles & Logic Design(Lab Integrated)	ESC	5	3	0	2	4

PROFESSIONAL CORE COURSES (PCC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CS1206	Programming in C	PCC	4	3	1	0	3
2	CS1208	Programming in C Laboratory	PCC	4	0	0	0	2
3	IT1301	Java Programming	PCC	3	3	0	0	3
4	CS1302	Data Structure	PCC	3	3	0	0	3
5	CS1304	Computer Architecture	PCC	4	3	1	0	3
6	CS1305	Software Engineering	PCC	3	3	0	0	3
7	CS1307	Data Structures Laboratory using C	PCC	4	0	0	4	2
8	IT1308	Java Programming Laboratory	PCC	4	0	0	4	2
9	CS1401	Design and Analysis of Algorithm	PCC	3	3	0	0	3
10	CS1402	Operating Systems	PCC	3	3	0	0	3
11	CS1403	Database design and Management (Lab Integrated)	PCC	5	3	0	2	4
12	IT1401	Computer Communication	PCC	3	3	0	0	3
13	ML1401	Foundations of Machine Learning	PCC	3	3	0	0	3
14	CS1407	Operating Systems Laboratory	PCC	4	0	0	4	2
15	ML1408	Machine Learning Laboratory	PCC	4	0	0	4	2
16	CS1502	Object Oriented Analysis and Design	PCC	3	3	0	0	3
17	IT1501	Web Technology	PCC	4	3	1	0	3
18	IT1502	Computational Intelligence	PCC	5	3	0	2	4
19	IT1507	Web technology Laboratory	PCC	4	0	0	4	2
20	CS1508	Object Oriented Analysis and Design Lab	PCC	4	0	0	4	2
21	IT1601	Theory of Computation and Compiler Design	PCC	4	3	1	0	3

22	IT1602	Mobile Networks And Application Development	PCC	4	3	1	0	3
23	IT1603	Computer Graphics and Applications	PCC	4	3	1	0	3
24	IT1604	Data Science and Big Data Analytics	PCC	4	3	1	0	3
25	IT1607	Mobile Networks And Application Development Laboratory	PCC	4	0	0	4	2
26	IT1701	Advanced Neural Network	PCC	4	3	1	0	3
27	IT1702	Principles of Cloud Technologies	PCC	4	3	1	0	3
28	IT1703	Cryptography Algorithms and Applications	PCC	4	3	1	0	3
29	MB1101	Management Concepts and Organizational Behavior	PCC	4	3	1	0	3
30	IT1707	Cloud Application and Development Laboratory	PCC	4	0	0	4	2

PROFESSIONAL ELECTIVE – I(SEMESTER V)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1511	Optimization Techniques	PEC	3	3	0	0	3
2	IT1512	Introduction to Digital Currencies	PEC	3	3	0	0	3
3	IT1513	Information Storage and Management	PEC	3	3	0	0	3
4	IT1514	Knowledge Engineering	PEC	3	3	0	0	3
5	CS1515	Fundamentals of Digital Image Processing	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – II (SEMESTER VI)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1611	Fuzzy Logic and Artifical Neural Network	PEC	3	3	0	0	3
2	IT1612	Software Testing and Quality Assurance	PEC	3	3	0	0	3
3	IT1613	Natural Language Processing Tools And Applications	PEC	3	3	0	0	3

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
4	ML1601	Deep Learning	PEC	3	3	0	0	3
5	MG1615	Engineering Ethics and Human Values	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – III (SEMESTER VII)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1711	Web Development Frameworks	PEC	3	3	0	0	3
2	IT1712	Information Management	PEC	3	3	0	0	3
3	IT1713	Cyber Forensics	PEC	3	3	0	0	3
4	IT1714	Parallel Algorithms	PEC	3	3	0	0	3
5	IT1715	Augmented and Virtual Reality	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE –IV (SEMESTER VII)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1721	Storage Area Networks	PEC	3	3	0	0	3
2	IT1722	NoSQL Database	PEC	3	3	0	0	3
3	IT1723	Software Agents	PEC	3	3	0	0	3
4	CS1722	Quantum Computing	PEC	3	3	0	0	3
5	CE1025	Disaster Management	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – V (SEMESTER VIII)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1811	Information Theory and Coding	PEC	3	3	0	0	3
2	IT1812	Electronic Commerce	PEC	3	3	0	0	3
3	IT1813	Affective Computing	PEC	3	3	0	0	3
4	IT1814	Social Media Mining	PEC	3	3	0	0	3
5	IT1815	Secure Coding	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – VI (SEMESTER VIII)

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1821	IoT Platform For Smart City Planning	PEC	3	3	0	0	3
2	IT1822	Trust Networks	PEC	3	3	0	0	3

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
3	IT1823	Artificial Intelligence and Robotics	PEC	3	3	0	0	3
4	CS1821	Software Defined Networks	PEC	3	3	0	0	3
5	MB1206	Business Analytics	PEC	3	3	0	0	3

OPEN ELECTIVE COURSES – I & II

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

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1608	Mini Project	EEC	4	0	0	4	2
2	IT1708	Project Phase-I	EEC	4	0	0	4	2

3	IT1807	Project Phase-II	EEC	20	0	0	20	10
4	IVA001	Industrial Internet of Things	EEC	45	0	0	1	1
5	IVA002	Augmented Reality & Virtual Reality	EEC	45	0	0	1	1
6	IVA003	Ethical Hacking - Cyber Security	EEC	45	0	0	1	1
7	IVA004	Blockchain And Crypto Currencies	EEC	45	0	0	1	1
8	IVA005	Industrial Practices with Devops	EEC	45	0	0	1	1
9	IVA006	Applied Machine Learning With Python	EEC	45	0	0	1	1

AUDIT COURSES (AC)

Sl. No.	Course Code	Subject Name	Category	Contact Periods	L	T	P	C
1	AD1001	Constitution of India	AC	2	2	0	0	0
2	AD1002	Value Education	AC	2	2	0	0	0
3	AD1003	Pedagogy Studies	AC	2	2	0	0	0
4	AD1004	Stress Management by Yoga	AC	2	2	0	0	0
5	AD1005	Personality Development Through Life EnlightenmentSkills	AC	2	2	0	0	0
6	AD1006	Unnat Bharat Abhiyan	AC	2	2	0	0	0
7	AD1007	Essence of Indian Knowledge Tradition	AC	2	2	0	0	0
8	AD1008	Sanga Tamil LiteratureAppreciation	AC	2	2	0	0	0

* Registration for any of these courses is optional to students

CREDIT SUMMARY

	I	II	III	IV	V	VI	VII	VIII	Total	PERCENTAGE OF CREDIT
HSMC	4	7	1						12	6.59
BSC	12	7	4	4	4				31	17.03
ESC	9	5	4						18	9.89
PCC		5	16	20	14	14	14		83	45.60
PEC					3	3	6	6	18	9.89
OEC					3	3			6	3.30
EEC						2	2	10	14	7.69
AC						0			-	
Total	25	24	25	24	24	22	22	16	182	100

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B.Tech. INFORMATION TECHNOLOGY
REGULATION – 2021
CHOICE BASED CREDIT SYSTEM
I - VIII SEMESTERS SYLLABUS

HS1101	COMMUNICATIVE ENGLISH	L	T	P	C
	(Common for 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 – use of sequence 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	-	-	2	-	2
CO2	-	1	-	2	-	-	-	-	-	3	-	-	2	-	2
CO3	-	2	-	3	-	-	-	-	-	2	-	-	2	-	1
CO4	-	-	-	-	-	-	-	-	2	2	-	-	2	-	2
CO5	-	2	1	1	2	-	2	-	-	3	-	-	1	-	2

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

TEXT BOOKS

1. Grewal B.S., Higher Engineering Mathematsǁ, 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 Mathematicsǁ, 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	3	3	2
CO2	3	3	3	2	2	1	-	-	-	-	1	2	3	3	2
CO3	3	3	3	2	2	1	-	-	-	-	1	2	2	3	2
CO4	3	3	3	2	2	1	-	-	-	-	1	2	2	3	1
CO5	3	3	3	2	1	1	-	-	-	-	1	2	2	3	1

PH1103	ENGINEERING PHYSICS	L	P	T	C
	(Common for 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- conduction through compound media (series and parallel)-Lee's disc method: theory and experiment - 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, the students will gain knowledge on

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 OUCOMES		
	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	P	T	C
	(Common for 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. A. Sheik Mideen, Engineering Chemistry, Airwalk Publications, Chennai (2018)

COURSE OUTCOMES

Upon completion of the course, the students should be

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 OUCOMES		
	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 for all branches of B.E. /B. Tech Programmes)	3	1	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, mergesort, 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 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	-	2	-	-	2	3	2	-	2	2	1	1
CO2	3	3	3	-	2	-	-	2	3	2	-	2	2	1	1
CO3	3	3	3	-	2	-	-	2	3	2	-	2	1	2	2
CO4	3	3	3	-	2	-	-	2	3	2	-	2	1	2	2
CO5	3	3	3	-	2	-	-	2	3	2	-	2	1	2	1

GE1106	ENGINEERING GRAPHICS	L	T	P	C
	(Common for all branches of B.E. /B. Tech Programmes)	1	0	4	4

OBJECTIVES

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products
- 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 cycloid – 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		**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 by rotating object method.		**CO3**

UNIT IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OFSURFACES**	**6+12**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.		**CO4**

UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+12**
Principles of isometric projection – isometric scale –Isometric projections 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 2016
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2011.

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	1
CO2	3	1	2	2	1	1	-	-	3	3	2	3	1	1	1
CO3	3	1	1	3	1	1	-	-	3	3	2	3	1	1	1
CO4	3	1	1	3	1	1	-	-	3	3	2	3	1	1	1
CO5	3	1	2	3	1	1	-	-	3	3	2	3	1	1	1

GE1107	PYTHON PROGRAMMING LABORATORY	L	T	P	C
	(Common for 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, draw flowchart illustrating mail merge concept.		
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.	**CO1**	
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.		
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.	**CO2**	
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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Python 3 interpreter for Windows/Linux

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)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	-	2	-	-	2	3	2	-	2	2	-	-
CO2	3	3	3	-	2	-	-	2	3	2	-	2	2	1	1
CO3	3	3	3	-	2	-	-	2	3	2	-	2	2	-	1

BS1108	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
	(Common for 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 ofMatter
- The Optical properties , Characteristics of Lasers & Optical Fibre
- Electrical & Thermal properties ofMaterials
- Enable the students to enhance accuracy in experimentalmeasurements.
- 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 rigidity modulus of the material of the given wire using torsion pendulum.	CO1
3. Determination of wavelength of mercury spectra using Spectrometer and grating.	CO2
4. Determination of dispersive power of prism using Spectrometer.	CO2
5. (a) Determination of wavelength and particle size using a laser. (b) Determination of numerical aperture and acceptance angle of an optical fibre. (c) Determination of width of the groove of compact disc using laser.	CO2
6. Determination of Young's modulus of the material of the given beam by uniform bending method.	CO1
7. Determination of energy band gap of the semiconductor.	CO2
8. Determination of coefficient of thermal conductivity of the given bad conductor using Lee's disc.	CO2
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. Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.	CO5
2. Determination of total, temporary & permanent hardness of water by EDTA method.	CO5
3. Determination of DO content of water sample by Winkler's method.	CO5
4. Determination of chloride content of water sample by argentometric method.	CO3
5. Estimation of copper content of the given solution by Iodometry.	CO3
6. Determination of strength of given hydrochloric acid using pH meter.	CO3
7. Determination of strength of acids in a mixture of acids using conductivity meter.	CO4
8. Estimation of iron content of the given solution using potentiometer.	CO4
9. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.	CO4
10. Conductometric titration of strong acid vs strong base.	CO4
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	CO5

COURSE OUTCOMES

Upon completion of the course, the students should be

CO1	Able to understand the concept about the basic properties of matter like stress, strain and types of moduli. Able to understand the procedure to estimate the amount of dissolved oxygen present in the water.
CO2	Able to understand the concept of optics like reflection, refraction, diffraction by using spectrometer grating. Able to understand the concept about measuring the conductance of strong acid and strong base and mixture of acids by using conductivity meter.
CO3	Able to understand the thermal properties of solids and to calculate thermal conductivity of a bad conductor. Able to understand the principle and procedure involved in the amount of chloride present in the given sample of water.
CO4	Able to understand the concept of microscope and its applications in determining the moduli. Able to understand the concept of determining the emf values by using potentiometer.
CO5	Able to calculate the particle size of poly crystalline solids. Able to understand the concept of determining the pH value and strength of a given acid sample by using pH meter.

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	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 for 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)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	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 for all branches of B.E. /B. Tech Programmes Except AI-DS & AI-ML)		4	0	0	4

OBJECTIVES

- This course is designed to cover topics such as Differential Equation, Vector Calculus, Complex Analysis and Laplace Transform. Vector calculus can be widely used for modelling the various laws of physics. 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	P	T	C
	(Common to CSE, AI-DS & AI-ML)	3	0	0	3

OBJECTIVES

To make the student

- To acquire knowledge on the electron transport properties
- To understand the essential principles of semiconductor device
- To have the necessary understanding in optical properties of materials.
- To 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 semiconductors - Hall effect and devices - Ohmic contacts – Schottky diode - Semiconducting polymers.		CO2

UNIT III	MAGNETIC PROPERTIES OF MATERIALS	9
Magnetism in materials - magnetic dipole moment - magnetic permeability and susceptibility - Microscopic classification of magnetic materials : 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 small systems, CRC press, 2014

COURSE OUTCOMES

Upon completion of the course, the 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 nano electronic devices.

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	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	P	T	C
	(Common for all branches of B.E. /B. Tech Programmes)	3	0	0	3

OBJECTIVES

- To study the inter relationship between living organisms 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	11
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: Uses 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: Uses 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	8
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		CO4

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.

UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	8
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, Hyderabad, (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, the students should be able

CO1	To obtain knowledge about environment, ecosystems and biodiversity.
CO2	To take measures to control environmental pollution.
CO3	To gain knowledge about natural resources and energy sources.
CO4	To find and implement scientific, technological, economic and political solutions to the environmental problems.
CO5	To understand the impact of environment on human population and human health.

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	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, 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, AI-DS & AI-ML)	3	1	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, Library and Linking, Compiling a C Program; Basic data types , Modifying the basic data types, 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 arrays, 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

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

GE 1207	**ENGINEERING PRACTICES LAB**	L	P	T	C
	(Common for 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.	**CO1**	
(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.		
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.	**CO2**	
(c) Different type of joints.		
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.	**CO3**
2.	Fluorescent lamp wiring.	
3.	Stair case wiring	
4.	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.	
5.	Measurement of energy using single phase energy meter.	**CO4**
6.	Measurement of resistance to earth of an electrical equipment.	
IV ELECTRONICS ENGINEERING PRACTICE **16**		
1.	Study of electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.	**CO5**
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.	
TOTAL : 60 PERIODS		

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.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 equipments 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
C04	3	1	3	-	-	3	-	-	-	-	-	3	3	3	3
C05	3	2	2	-	-	2	-	-	-	-	-	3	2	2	2

CS1208		PROGRAMMING IN C LAB	L	T	P	C
		(Common to CSE, 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.	
2. Scientific problem-solving using decision making and looping.	
3. Generating different patterns using multiple control statements.	**CO1**
4. Problems solving using one dimensional array.	
5. Mathematical problem solving using two dimensional arrays.	
6. Solving problems using string functions.	
7. Solving problems with user defined functions.	
8. Solving problems using recursive function.	**CO2**
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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone desktops with C compiler 30 Nos.

	(or)

Server with C compiler supporting 30 terminals or more.

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, 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 andcontinuous 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 linearregression – 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 forEngineers", 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", 4thEdition,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	Give exposure to random variables and well-founded knowledge of standard distributions which can describe real life phenomena.
CO2	Pave ideas to handle situations involving more than one random variable and functions of random variables.
CO3	Give 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 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	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

IT1301	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand Object Oriented Programming concepts and fundamentals of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces with database connectivity

UNIT I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9
Object Oriented Programming concepts - Abstraction – objects and classes - Encapsulation-Inheritance –Polymorphism- Characteristics of Java – The Java Environment-. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays - JavaDoc comments.		CO1

UNIT II	PACKAGES, INHERITANCE AND INTERFACES	9
Inheritance – Super classes- sub classes – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface - Object cloning -inner classes, ArrayLists – Strings, Packages		CO2

UNIT III	EXCEPTION HANDLING AND I/O CONCEPTS	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 AND GENERIC PROGRAMMING	9
Multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types		CO4

UNIT V	EVENT DRIVEN PROGRAMMING AND DATABASE CONNECTIVITY	9 + 6
Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events – AWT event hierarchy – layout management - Swing Components- JDBC Architecture - Establishing Connectivity – Working with statements - Creating and executing SQL statements - Working with Result Set.-Simple Java Applications		CO5

		TOTAL : 75 PERIODS

TEXT BOOKS

1. Cay S. Horstmann, "Core Java SE 9 for the Impatient", 2nd Edition, Addison-Wesley,2017 .
2. Herbert schildt , "The complete reference", 11th Edition, Tata Mc Graw Hill, New Delhi. 2018.
3. Judith Bishop, "Java Gently : Programming Principles Explained", 3rd Edition, 2000.

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	Inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification
CO3	Build Java applications using exceptions and I/O streams
CO4	A modern coverage of concurrent programming that focuses on high-level synchronization constructs
CO5	Know the concept of event handling used in GUI with Database Connectivity

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

CS1301	DIGITAL PRINCIPLES AND LOGIC DESIGN (Lab Integrated)	L	T	P	C
	Common to CSE	3	0	2	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+6
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 gates **Lab component:** • Verification of Boolean Theorems using basic gates		CO1

UNIT II	COMBINATIONAL LOGIC	9+6
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 **Lab component:** • Design and implement Half/Full Adder and Subtractor. • Design and Implementation of Decoders, Encoders, Multiplexers and Demultiplexers		CO2

UNIT III	SYNCHRONOUS SEQUENTIAL LOGIC	9+6
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 **Lab component:** • Design and implement shift-registers. • Design and implement synchronous counters		CO3

UNIT IV	ASYNCHRONOUS SEQUENTIAL LOGIC	9+6
Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards **Lab component:** • Design and Implementation of Asynchronous Sequential Circuit • Design and implement of Serial Parity Generator.		CO4

UNIT V	SYSTEM DESIGN	9+6
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 **Lab component:** • Coding Combinational circuits using HDL • Coding Sequential circuits using HDL		CO5

	TOTAL : 75 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

CS1302	DATA STRUCTURES	L	T	P	C
	Common to CSE, AI-DS & AI-ML	3	1	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

CS1304	COMPUTER ARCHITECTURE	L	P	T	C
	Common to CSE & 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-pointarithmetic 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 Organizationand 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

CS1305	SOFTWARE ENGINEERING	L	T	P	C
	(Common to CSE)	3	0	0	3

OBJECTIVES

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing, SQA and maintenance measures

UNIT I	SOFTWARE PROCESS AND AGILE DEVELOPMENT	9
Introduction: The Evolving Role of Software, Software Characteristics, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.		CO1

UNIT II	REQUIREMENTS ANALYSIS AND SPECIFICATION	9
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.		CO2

UNIT III	SOFTWARE DESIGN	9
Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.		CO3

UNIT IV	TESTING AND MAINTENANCE	9
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 –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.		CO4

UNIT V	PROJECT MANAGEMENT AND SQA	9
Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan, SQA-Concepts, Cost of Quality, Software Quality Group (SQA).		CO5

TEXT BOOKS

1. Roger S. Pressman, —Software Engineering – A Practitioner"s Approachǁ, Seventh Edition, McGraw-Hill International Edition, 2010.
2. Ian Sommerville, —Software Engineeringǁ, 9th Edition, Pearson Education Asia, 2011.

REFERENCE BOOKS

1. Rajib Mall, —Fundamentals of Software Engineeringǁ, Third Edition, PHI Learning PrivateLimited, 2009.
2. Pankaj Jalote, —Software Engineering, A Precise Approachǁ, Wiley India, 2010.
3. Kelkar S.A., —Software Engineeringǁ, Prentice Hall of India Pvt Ltd, 2007.
4. Fairley R., —Software Engineering Conceptsǁ, Tata McGraw Hill, New Delhi, 2008.
5. Harry Hariom Choudhary , —Java Coding Standardsǁ, Amazon Kindle, USA, 2013. 3. Bernard Homes., —Fundamentals of Software Testingǁ, Wiley & Sons, USA, 2012.
6. Stephen R.Schach, —Software Engineeringǁ, Tata McGraw-Hill Publishing Company Limited,2007.
7. http://nptel.ac.in

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Identify the key activities in managing a software project and process models.
CO2	Concepts of requirements engineering and Analysis Modeling.
CO3	Apply systematic procedure for software design and deployment.
CO4	Compare and contrast the various testing and maintenance.
CO5	Manage project schedule, SQA, estimate project cost and effort required.

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	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. 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.	**CO1**
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. 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.	**CO2**
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

<div align="center">

MAPPING OF COs WITH POs AND PSOs

</div>

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

IT1308	JAVA PROGRAMMING LABORATORY	L	P	T	C
		0	0	4	2

OBJECTIVES

- To build software development skills using java programming for real-world applications
- 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 along with response to events and Database Connectivity using JDBC.

LIST OF EXPERIMENTS

1.	Develop a java application to generate electricity bill. Create a class with the following Consumer no., consumer name, previous month reading, current month reading, and type of EB connection (i.e. domestic or commercial) .Compute the bill amount using the following tariff. If the type of the EB connection is domestic. Calculate the amount to be pain follows. First 100 units –Rs.1 per unit 101-200 units –Rs.2.50 per unit 201-500 units –Rs.4 per unit >501 unit –Rs.6 per unit If the type of the EB connection is commercial ,calculate the amount to be paid follows First 100 units –Rs.2 per unit 101-200 units –Rs.4.50 per unit 201-500 units –Rs. 6 per unit >501 units –Rs. 7 per unit	
2.	Develop a java application with Employee class with Emp_name, Emp_id, Address,Mail_id,Mobile_no as members. Inherit the classes,Programmer,Assistant Professor, Associate Professor with Professor from employee class. Add basic Pay(BP) as the member of all the inherited classes with 97% of BP as DA,10% of BP as HRA,12% of BP as PF,0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.	**CO1**
3.	Write a Java program to make frequency count of words in a given text	
4.	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.	
5.	Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementation	
6.	Complete the following: 1. Create a package named shape. 2. Create some classes in the package representing some common shapes like Square,Triangle, and Circle. 3. Import and compile these classes in other program.	
7.	Write a Java program to implement user defined exception handling.	
8.	Write a java program to find the maximum value from the given type of elements using a generic function.	
9.	Write a program in Java for String handling which performs the following: i) Checks the capacity of StringBuffer objects. ii) Reverses the contents of a string given on console and converts the resultant string in upper case. iii) Reads a string from console and appends it to the resultant string of ii.	**CO2**
10.	Write a program to perform string operations using ArrayList. Write functions for the following a. Append - add at end b. Insert – add at particular index c. Search	

	d. List all string starts with given letter	
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	

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
		CO3

15.	Design and Develop the GUI application with database connectivity of your choice	
		TOTAL : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone desktops with any JDK IDE (like NetBeans 1.8v) 30 Nos.	
	(or)

Server with Java Web Server supporting 30 terminals

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 Graphical user interfaces using principal Java Swing components and JDBC

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

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 andprocess; 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

MA1453	DISCRETE MATHEMATICS	L	T	P	C
	(Common to CSE & AI-DS)	4	0	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 such as permutation and combination and in generating functions. Prove mathematical theorems using mathematical induction. Demonstrate basic counting principles, compute and interpret the meaning in the context of the particular application. 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 for CSE, IT, AI-DS and 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, AI-DS & AI-ML	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 for CSE, AI-DS & AI-ML	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	Able to understand the various normal forms and to minimize the redundancy in the relations
CO3	Able to know the logic behind the transaction processing, concurrency control and to recover system from failures.
CO4	Able to organize, index the files and to optimize the given queries
CO5	Able to know the concepts of distributed databases, Object Oriented databases and XML 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

IT1401	COMPUTER COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of communication
- To impart knowledge on basics of analog and digital communication.
- To understand the basics of data communication models
- To explore the various layers and its functionalities in data communication model

UNIT I	BASICS OF COMMUNICATION	9
Introduction to Communication systems – basic model, point to point, broadcast communication; modulation-need for modulation, types of modulation, Base band and Pass band transmission; Demodulation (detection) - Coherent and Non-coherent detection; Noise – types of noise; Analog to Digital Conversion (ADC) process– Sampling , Quantization and Coding; Sampling theorem, types of sampling – ideal, natural and flat –top sampling; nyquist rate, Signal reconstruction, types of quantization, Quantization noise, Aliasing.		CO1

UNIT II	ANALOG AND DIGITAL COMMUNICATION	9
Amplitude modulation – types of amplitude modulation- Standard AM with Full Carrier ,Comparison of different amplitude modulations; Angle modulation (FM and PM), FM generation using PM, PM generation using FM, Comparison of Narrowband and Wideband FM, Comparison of AM,FM and PM. Analog pulse modulation – PAM,PWM,PPM; Digital pulse modulation – Pulse Code Modulation (PCM), Delta modulation (DM), Adaptive Delta modulation (ADM), Multiplexing – Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM).		CO2

UNIT III	INTRODUCTION TO DATA COMMUNICATION AND OSI MODEL	9
Introduction to computer communication: Transmission modes - Switching: circuit switching and packet switching, OSI model, Layers in OSI model, TCP/IP protocol suite. Physical Layer: Guided and unguided transmission media (Co-axial cable, UTP,STP, Fiber optic cable), Data Link Layer: Framing, Flow control (stop and wait , sliding window flow control) ,Error control, HDLC, Media access control: Ethernet (802.3), CSMA/CD, Logical link control, Wireless LAN (802.11), CSMA/CA.		CO3

UNIT IV	NETWORK LAYER COMPONENTS AND FUNCTIONS	9
Network Layer Logical addressing: IPv4 & IPV6, Subnetting, DHCP, Virtual LAN, Networking devices (Hubs, Bridges & Switches), Network topologies. Routing: Routing and Forwarding, Static routing and Dynamic routing, Routing Algorithms: Distance vector routing algorithm, Link state routing (Dijkstra's algorithm), Routing Protocols: Routing Information protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), MPLS.		CO4

UNIT V	TRANSPORT, SESSION AMD APPLICATION LAYER	9
	Transport Layer –UDP, TCP, Congestion Control & Quality of Service – Data traffic, Congestion, Congestion Control, QoS and Flow Characteristics, Application Layer – DNS, Remote Logging (Telnet), SMTP, FTP, WWW, HTTP, POP3, MIME, SNMP.	**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Wayne Thomasi, "Advanced Electronic Communication Systems", 6th Edition, PHI Publishers, 2003.
2. Simon Haykins, "Communication Systems" John Wiley, 5th Edition, March 2009.
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill 5th edition November 6, 2007.

REFERENCE BOOKS

1. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition, Jan. 21,2001.
2. Behrouz A. Forouzen, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.
3. Andrew S.Tanenbaum, "Computer Networks", 5th Edition, Pearson, 2011.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Describe the essential basics of communication
CO2	Classify different types of analog digital modulation schemes
CO3	Comprehend the need of data communication models
CO4	Identify the required network layer components and functions
CO5	Analyze the various protocols required in various layers

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

ML1401	FOUNDATIONS OF MACHINE LEARNING	L	T	P	C
	Common for CSE, AI-DS & AI-ML	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 Bias-Variance Trade-off, 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

CS1407	**OPERATING SYSTEMS LABORATORY**	L	T	P	C
	Common to CSE & AI-ML	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.,	
2.	Implementation of Shell Programs.	
3.	Implementation of CPU Scheduling Algorithms.	**CO1**
4.	Implementation of Producer Consumer problem using Semaphore.	
5.	Implementation of Inter-process Communication using Shared memory.	
6.	Implementation of Threading and Synchronization Applications.	
7.	Implementation of Bankers Algorithm for Deadlock Avoidance.	**CO2**
8.	Implementation of Deadlock Detection Algorithm.	
9.	Implementation of Contiguous Memory Allocation.	
10.	Implementation of Memory Management scheme using Paging.	
11.	Implementation of Page Replacement Algorithms.	**CO3**
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

ML1408	MACHINE LEARNING LABORATORY	L	T	P	C
	Common for CSE, AI-DS & AI-ML	0	0	4	2

OBJECTIVES

- ❖ To make use of Data sets in implementing the machine learning algorithms
- ❖ To implement the machine learning concepts and algorithms in any suitable language of choice
- ❖ To understand the practical aspects of probabilistic graphical models.

LIST OF EXPERIMENTS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV File	
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.	**CO1**
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample	
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets	**CO2**
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library lasses/API	
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library lasses/API in the program.	**CO3**
9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs	

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. Aurelien Geron , "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow : Concepts, Tools, and Techniques to Build Intelligent Systems", Second Edition, O'Reilly Media

2. Fabio Nelli, "Python Data Analytics with Pandas, Numpy, and Matplotlib", Second Edition, Apress, 2018

3. Practical Machine Learning with Python: A Problem-Solver's Guide to Building Real-World Intelligent Systems" Dipanjan Sarkar, Raghav Bali, Tushar Sharma, Apress.

WEB REFERENCES

1. https://machinelearningmastery.com/machine-learning-in-python-step-by-step/
2. Web Resources: https://www.anaconda.com/enterprise-machine-learning-getting-started/
3. https://www.tutorialspoint.com/machine_learning_with_python/index.htm

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Update the general and specific boundary for each new example in concept learning
CO2	Develop supervised learning predictive model for general data set
CO3	Ability to apply knowledge representation and machine learning techniques to real world 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	-	-	-	-	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

MA1501	ALGEBRA AND NUMBER THEORY	L	T	P	C
	(Common to CSE)	4	0	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 examine the key questions in the Theory of Numbers.
- 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	**GROUPS AND RINGS**	9
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	**FINITE FIELDS AND POLYNOMIALS**	9
Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields		CO2
UNIT III	**DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS**	9
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
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
Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions		CO5
	TOTAL : 45 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	Apply the basic notions of groups, rings, fields which will then be used to solve related problems.
CO2	Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO3	Demonstrate accurate and efficient use of advanced algebraic techniques.
CO4	Demonstrate their mastery by solving non - trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text.
CO5	Apply integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject

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	T	P	C
	(Common to CSE)	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

IT1501	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic internet protocols and explore HTML, CSS
- To design interactive web pages using Javascript and working with DOM
- To understand the concepts of MVC and React Framework
- To work with Node.js for building high scale web applications
- To develop RESTful APIs with Express JS as backend web application framework

UNIT I	Web Essentials, HTML & CSS	9
Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients-Web Servers - XHTML: Syntax and Semantics - HTML Basic Elements - HTML5 control elements – Semantic elements – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – CSS Box Model – Backgrounds – Border Images – Colors – Text Transformation and Shadows – Transitions – Animations.		**CO1**

UNIT II	Client-Side Scripting & HTML DOM	9
Introduction to JavaScript-Perspective-Syntax-Variables and Data Types-Statements Operators-Literals-Functions-Objects-Arrays-Built-in Objects. DOM-Introduction to the Document Object Model - DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling - Working with JSON		**CO2**

UNIT III	React	9
Web Application Frameworks - MVC (Model-View-Controller) framework – Need for front end frameworks – JSX - Getting started with React – Virtual DOM - Creating components – Props – States - Handling user events - Conditional rendering – Loop Array - HTML forms using React – Routing-AJAX		**CO3**

UNIT IV	Node.js	9
Understanding Node.js - Package management and NPM - Callbacks-Promises- Async-Await - Event Loop - Event Emitter - File System – Global Objects - Timers in Node JS - MySQL - Manipulating and Accessing MySQL Database from Node.js		**CO4**

UNIT V	Express Framework	9
Express Framework - Configuring Routes – Express JS Request – Response – GET - POST - Processing URLs - Processing Query Strings and Form Parameters - Cookies - Using Response Objects - Implementing Sessions - REST API - Rendering JSON Data		**CO5**

THEORY : 45 PERIODS

TEXT BOOKS

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2007.
2. Zammetti, Frank, "Modern Full-Stack Development", Apress, 2020.
3. Brad Dayley, "Node.js, MongoDB, and AngularJS Web Development", 2nd edition, Addison Wesley, 2017.
4. Azat Mardan, "Express. js Guide: The Comprehensive Book on Express. Js", Leanpub, 2014.

REFERENCE BOOKS

1. Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development", Wiley,2014
2. Wieruch Robin, "The Road to React", 2021 Edition with React Hooks
3. Alex Banks, Eve Porcello, "Learning React, Modern Patterns for Developing React Apps", O'Reilly Media, 2020.
4. KrasimirTsonev, "Node.js by Example Paperback", May 2015.
5. Azat Mardan, "Pro Express.js", Apress 2014.

WEB REFERENCES

- https://javascript.info/
- https://react.dev/
- https://nodejs.org/en/
- https://expressjs.com/en/

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand web fundamentals
CO2	Create dynamic web pages using DHTML and java script that is easy to navigate and use
CO3	Implement React features and create component-based web pages using them
CO4	Generate dynamic page content using Node.js and create application using Node.js with MySQL
CO5	Build scalable web apps quickly and efficiently using Express 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
C303.1	1	-	1	-	1	-	-	-	1	1	1	1	1	-	2
C303.2	-	-	1	-	1	-	-	-	1	1	1	1	1	-	2
C303.3	-	-	2	-	2	-	-	-	1	1	1	2	2	1	2
C303.4	-	-	2	-	2	-	-	-	1	1	1	2	2	1	2
C303.5	-	-	2	-	2	-	-	-	1	1	1	2	2	1	2

IT1502	COMPUTATIONAL INTELLIGENCE (INTEGRATED LAB)	L	T	P	C
		3	0	2	4

OBJECTIVES

1. To understand the various characteristics of intelligent agents.
2. To learn the different search strategies in AI.
3. To understand the knowledge in solving AI problems.
4. To learn the concepts of learning and communication in AI.
5. To know about the various applications of AI.

UNIT I	INTRODUCTION AND PROBLEM SOLVING	9
Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search – Bidirectional search – Searching with partial Information. **Lab Component:** 1. Solve any problem using depth and breadth first search. 2. Write a program to solve water Jug Problem	CO1

UNIT II	INFORMED SEARCH AND GAME PLAYING	9
Informed search – Strategies – A* Heuristic function – Hill Climbing – Simulated Annealing – Constraint Specification problem – Local Search in continuous space – Genetic algorithm – Optimal decisions in games - Pruning - Imperfect decisions –Alpha-Beta pruning – Games that include an element of chance. **Lab Component** 3. Write a program to perform A* search 4. Write a program to solve 8 queens problem	CO2

UNIT III	KNOWLEDGE AND REASONING	9
Knowledge based agent – The Wumpus world environment – Propositional logic – Inference rules – First-order logic – Syntax and semantics – Situation calculus – Building a knowledge base – Electronic circuit domain – Ontological Engineering – Forward and backward chaining – Resolution – Truth maintenance system-Mental Events and Mental Objects **Lab Component** 5. Study of PROLOG. Write the following programs using PROLOG Program to perform the operations on list. Program to categorize animal characteristics. Program to read address of a person using compound variable. Program of fun to show concept of cut operator 6. Write a program to demonstrate family relationship	CO3

UNIT IV	UNCERTAINTY	9
Non monotonic reasoning-Closed-World Reasoning- Circumscription- Default Logic-Vagueness, Uncertainty, and Degrees of Belief- Objective Probability- Subjective Probability-Dempster–Shafer Theory- Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning	CO4

Lab Component	
7. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets	
UNIT V　　　**APPLICATIONS**	**9**

APPLICATIONS

Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-All

applications – Language Models – Information Retrieval – Information Extraction – Machine

Translation – Machine Learning – Symbol-Based – Machine Learning: Connectionist –

Machine Learning.

CO5

8.Write a program to preprocessing in text using NLTK library

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rd Edition, Pearson Education, 2009.

REFERENCE BOOKS

1. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.

2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., 1 st Edition, 2008.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	An ability to identify, analyze the search algorithm for the AI problems.
CO2	Represent a problem using first order logic.
CO3	Provide the knowledge based agent to solve the problem.
CO4	Understand the Informed search strategies.
CO5	Apply the baye's rule to solve the problem for societal concern.

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	2	2	3	3	3	3
CO2	3	3	3	3	3	1	-	-	1	2	2	3	3	3	3
CO3	3	3	3	3	3	1	-	-	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

IT1507	WEB TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To design dynamic websites with good aesthetic sense using HTML5, CSS3 and Javascript
- To work with Express, Node.js, MySQL
- To practice AJAX framework and explore REST API

LIST OF EXPERIMENTS

1. Design a Webpage using all HTML elements	**CO1**
2. Create a web page with all types of Cascading style sheets and CSS Selectors	
3. Write Client-Side Scripts for Validating Web Form Controls using DHTML	

4. Design the following using JavaScript and DOM
 	
    a. Include Image Slide Show
 	
    b. Digital clock	

5. Develop a web application to implement online quiz system using HTML, CSS and Javascript	
6. Create a <TodoItem> component in React and reuse it inside a <TodoList> component	**CO2**
7. Design a shopping cart application using React. Your shopping webpage should have the provisions for selecting the list of items from different category, Once the items are selected on clicking the submit button the items in the cart with its price should be displayed.	
8. Develop a Command Line Application for an online super market using NodeJS & MySQL to perform: a) search based on product id or name b) On retrieving the results, display the product details of different brands in table format with the Price field in sorted order	
9. Create a basic CRUD operation API by following REST syntax for a given model student with the following fields [field names]	**CO3**
10.To build an AJAX Application	

TOTAL : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 60 STUDENTS

Standalone desktops 60 Nos. with internet

Node JS (along with NPM), Chrome/Mozilla Firefox, Mongo DB Server, Visual Studio Code, NPM
Libraries: angular-cli, react, MySQL, express

REFERENCE BOOKS

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson

Education, 2007

2. KrasimirTsonev, "Node.js by Example Paperback", May 2015

3. Wieruch Robin, "The Road to React", 2021 Edition with React Hooks

WEB REFERENCES

https://nodejs.org/en/download/

https://reactjs.org/

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Create an interactive Webpage
CO2	Build a Webpage and use Node.js as Server-Side JS framework and create component based web pages using React and Express JS and connect with Backend using MySQL
CO3	Understand AJAX Framework and REST API

	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	-	2	-	-	-	1	2	1	2	2	1	2
CO2	1	-	2	-	2	-	-	-	1	2	1	2	2	1	2
CO3	1	-	2	-	2	-	-	-	1	2	1	2	2	1	2

CS1508	OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY	L	T	P	C
	(Common to CSE)	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

1.	Identify a software system that needs to be developed.	
2.	Document the Software Requirements Specification (SRS) for the identified system.	
3.	Identify use cases and develop the Use Case model.	**CO1**
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 usingUML Sequence and Collaboration Diagrams	
6.	Draw relevant State Chart and Activity Diagrams for the same system.	**CO2**
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	
9.	Improve the reusability and maintainability of the software system by applying appropriate design patterns.	**CO3**
10.	Implement the modified system and test it for various scenarios	

Suggested domain 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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Desktop or server with node of 30 systems
1. Windows 7 or higher
2. ArgoUML that supports UML 1.4 and higher
3. Selenium, JUnit or Apache JMeter

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	Approach a real world problem, which is uncertain and provide appropriate reasoning.
CO2	Develop solutions using supervised learning techniques and know how to deal with problems with hidden variables.
CO3	Use natural language processing and program basics of robotics.

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	1	1	2	2	2	3	3	3	3
CO2	3	3	3	3	2	2	1	1	2	2	2	3	3	3	3
CO3	3	3	3	3	3	2	1	1	2	2	2	3	3	3	3

HS1509	PROFESSIONAL SKILLS LAB	L	T	P	C
		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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

One Server

30 Desktop Computers

One Hand Mike

One LCD Projector

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

IT1601	THEORY OF COMPUTATION AND COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To explore the theoretical foundations of computer science from the perspective of formal languages and classify machines by their power to recognize languages.
- To explore the principles, algorithms, and data structures involved in the design and construction of compilers.

UNIT I	INTRODUCTION TO AUTOMATA	9
Formal Language and Regular Expressions: Languages, DefinitionLanguages regular expressions, Finite Automata – DFA,NFA.Conversion of a regular expression to NFA, NFA to DFA.Applications of Finite Automata to lexical analysis, lex tools.		CO1

UNIT II	AUTOMATA GRAMMAR AND PARSING	9
Context-Free grammars and parsing: Context-free grammars, derivation,parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom-upparsing, handle pruning, LR Grammar Parsing, LALR parsing, parsingambiguous grammars, YACC programming specification.		CO2

UNIT III	SEMANTIC AND CONTEXT-SENSITIVE FEATURES	9
Semantics: Syntax directed translation, S-attributed, and L-attributedgrammars, Intermediate code – abstract syntax tree, translation of simplestatements, and control flow statements.Context-Sensitive features – Chomsky hierarchy of languages andrecognizers. Type checking, type conversions, the equivalence of typeexpressions, overloading of functions and operations.		CO3

UNIT IV	CODE OPTIMIZATION	9
The symbol table, Storage organization, storage allocation strategies scopeaccess to now local names, parameters, language facilities for dynamicsstorage allocation. Code optimization Principal sources of optimization,optimization of basic blocks, peephole optimization, flow graphs,optimization techniques.		CO4

UNIT V	CODE GENERATION	9
Code generation: Machine-dependent code generation, object code forms, generic code generation algorithm, Register allocation, and assignment. Using DAG representation of Block.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. John E. Hopcroft, Rajeev M & J D Ullman: "Introduction to Automata Theory Languages &Computation", 3rd Edition, Pearson Education, 2007.

2. Aho, Ullman, Ravisethi: "Compilers Principles, Techniques, and Tools", 2nd Edition, Pearson Education, 2009.

REFERENCE BOOKS

1. Tremblay J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP publication, 2010.

2. Appel W & Andrew G M: "Modern Compiler Implementation in C", 1st Edition, Cambridge University Press, 2003.

3. Louden: "Compiler Construction, Principles & Practice", 1st Edition, Thomson Press, 2006.

4. Sipser Michael: "Introduction to Theory of computation", 1st Edition, Thomson, 2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Explain deterministic and non-deterministic machines.
CO2	Comprehend the hierarchy of problems arising in the computer sciences.
CO3	Design a deterministic finite-state machine to accept a specified language.
CO4	Explain how a compiler can be constructed for a simple context-free language.
CO5	Determine a language's location in the Chomsky hierarchy (regular sets, context-free, context-sensitive, and recursively enumerable languages).

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

IT1602	MOBILE NETWORKS AND APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To endow with the knowledge required to understand emerging communications networks
- To describe the basic concepts and principles in mobile computing
- To understand the concept of Wireless LANs, PAN, and Mobile Networks
- To explain the structure and components for Mobile IP and Mobility Management
- To familiarize with Mobile apps development aspects

UNIT I	WIRELESS COMMUNICATION SYSTEMS	9
Cellular Networks - Types of handover - IEEE 802.11: System and Protocol Architecture - Bluetooth : User Scenarios– Architecture - GSM – Architecture - Location tracking and call setup - Mobility management - Handover- GSM SMS–International roaming for GSM – Mobile Number portability - VoIP service for Mobile Networks – GPRS –Architecture - Attach and detach procedures		**CO1**

UNIT II	MOBILE NETWORK AND TRANSPORT LAYERS	9
Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols– Multicast routing-TCP overWireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery –Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wirelessNetworks		**CO2**

UNIT III	INTRODUCTION TO ANDROID	9
Mobile Application development and trends – Android overview and Versions – Android open stack, features – Setting up Android environment (Eclipse, SDK, AVD)- Simple Android application development – Anatomy of Android applications – Activity and Life cycle – Intents, services and Content Providers		**CO3**

UNIT IV	ANDROID USER INTERFACE	9
Android Architecture - Activity life cycle - Android User Interface – Layouts: Linear, Absolute, Table, Relative, Frame, Scrollview, Resize and reposition - Screen orientation – Views: Textview, EditText, Button, ImageButton, Checkbox, ToggleButton, RadioButton, RadioGroup, ProgressBar, AutocompleteText, Picker, Listviews and Webview– Displaying pictures with views: Gallery and ImageView, ImageSwitcher, Gridview – Displaying Menus: Helper methods, Option and Context		**CO4**

UNIT V	NETWORKING SERVICES & APPLICATION COMPONENTS IN ANDROID	9
SMS Messaging: Sending and Receiving – Sending email and networking – Downloading binary and text data files – Access Web services – Developing android services: create your		**CO5**

own services, performing long running task in a serviceperforming repeated task in a service- Location based service - Display map, zoom control, view and change, Marking, Geocoding, Get location - Publish Android applications and Deployment

	TOTAL : 45 PERIODS

TEXT BOOKS

1.Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2008.
2. Yi Bing Lin Inrichchlamtac, "Wireless and mobile network architecture", Wiley India Edition, Second Edition,2008.
3. Bill Phillips, Chris Stewart, and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide" ,PearsonEducation, Third Edition, 2017.

REFERENCE BOOKS

1. William Stallings, "Wireless Communications and Networks", Pearson Education, Second Edition, 2009.
2. Ed Burnette (2010), "Hello Android: Introducing Google's Mobile Development Platform", The Pragmatic Publishers, 3rd edition, North Carolina USA
3. Wei-Meng Lee, "Beginning Android 4 Application Development", John Wiley, First edition, 2012.
4. Reto Meier, "Professional Android 4 Application Development", John Wiley, Second edition, 2012.
5. ZigurdMednieks, Laird Dornin, Blake Meike G, Masumi Nakamura (2011), "Programming Android: Java Programming for the New Generation of Mobile Devices", OReilly Media, USA

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Identify the various types of handoff and Mobile Networks
CO2	Attain the knowledge to administrate and to maintain a Mobile Communication
CO3	Apply the network and transport layer protocols for mobile networks
CO4	Design and develop simple mobile applications with Android
CO5	Develop mobile applications using various components in 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

IT1603	**COMPUTER GRAPHICS AND APPLICATIONS**	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the line, circle and ellipse drawing algorithms and to study the 2-D transformations
- To apply transformations and texture on the object
- To motivate the students to create the 3-D scenes by adding lighting and shades to the objects in the scene.
- To enable the students to perform modeling
- To have in-depth idea about advanced rendering.

UNIT I	ILLUMINATION MODELS & OUTPUT PRIMITIVES	9

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems,Graphics Software- Application; Output primitives – points and lines, line drawing algorithms, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

UNIT II	2D GRAPHICS	9

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations- Affine Transformations ; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.	**CO2**

UNIT III	3D GRAPHICS	9

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.	**CO3**

UNIT IV	FRACTALS AND ANIMATIONS	

Fractals and Self similarity – Peano curves – Creating image by iterated functions – Mandelbrot sets – Julia Sets – Random Fractals – Overview of Ray Tracing – Intersecting rays with other primitives – Adding Surface texture – Reflections and Transparency – Boolean operations on Objects; Animations – General Computer Animation- Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening.	**CO4**

UNIT V	GRAPHICS PROGRAMMING	
OpenGL – Basic graphics primitives – Drawing three dimensional objects - Drawing three dimensional scenes- Introduction to Shading models – Flat and Smooth shading – Adding texture to faces – Adding shadows of objects – Building a camera in a program – Creating shaded objects – Rendering texture – Drawing Shadows; WebGL Application- Context-Geometry- Shaders- Associating attributes and buffer objects -Drawing a model		**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007

2. Edward Angel, Dave Shreiner, "Interactive Computer Graphics: A Top Down Approach with WebGL", PearsonEducation, Seventh Edition, 2015

3. F .S. Hill, "Computer Graphics using OPENGL", Pearson Education, Second Edition, 2003

REFERENCE BOOKS

1. Kouichi Matsuda, Rodger Lea, "WebGL Programming Guide: Interactive 3D Graphics Programming withWebGL", Pearson Education, 2013

2. Patrick Cozzi, "WebGL Insights", CRC Press

3. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, "Computer Graphics Principles and Practicein C", Pearson Education, Second Edition, 2007.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop the line, circle and ellipse drawing algorithms .
CO2	Design and Apply two dimensional objects & transformations
CO3	Design and Apply three dimensional objects & transformations
CO4	Design Animation Sequences
CO5	Create and Design objects using Graphics 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	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

IT1604	DATA SCIENCE AND BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Understand the fundamental Concepts of Data Science and Big Data Analytics
- To Explore the Analytical Theory and Methods with Clustering, Association, Regression and Classification
- To Understand and learn about the Time Series Analysis
- To know about the research that requires the integration of large amount of data.

UNIT I	INTRODUCTION TO BIG DATA AND DATA ANALYTICS LIFE CYCLE	9
Evolution of Big Data- Big data characteristics -Validating-Big Data Uses Cases-Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Exploratory Data Analysis, Statistical Methods for Evaluation,Map Reduce Programming Model		CO1

UNIT II	ANALYTICAL THEORY AND METHODS	9
Clustering, K-Means, Association Rules, Apriori Algorithm, Evaluation of Candidate Rules, Regression – Linear Regression and Logistic Regression, Classification -Decision Trees, Naïve Bayes		CO2

UNIT III	TIME SERIES ANALYSIS	9
Overview of Time Series Analysis, ARIMA Model; Text Analysis: Text Analysis Steps, Stop WordRemoval, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency— Inverse Document Frequency (TFIDF). Determining Sentiments.		CO3

UNIT IV	STREAM MEMORY	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- Decaying Window- Real Time Analytics Platform (RTAP Applications)- Case Studies-Real Time Sentiment Analysis, Stock Market Predictions, Using Graph Analytics for Big Data: Graph Analytics		CO4

UNIT V	NOSQL DATA MANAGEMENT	9
NoSQL Databases: Schema-Less Models- Increasing Flexibility for Data Manipulation -Key Value Stores-Document Stores- Tabular Stores- Object Data Stores- Graph Databases: Hive-Sharing -Hbase- Analyzing big data with Twitter- Big data for E-Commerce-BigData for Blogs		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. EMC Education Services "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2012.
2. Hastie, Trevor, et al., "The elements of statistical learning: Data Mining, Inference, and Prediction", Vol. 2. No. 1. New York: Springer, 2009.

3. V.K. Jain,"Big Data &Hadoop", Khanna Publishing House, 2017.

REFERENCE BOOKS

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012
2. Mark Gardener, "Beginning R The statistical Programming Language", Wiley, 2015.
3. Han, Kamber, and J Pei, "Data Mining Concepts and Techniques", 3rd edition, Morgan Kaufman, 2012.
4. Big Data Black Book, DT Editorial Services, Wiley India
5. V.K. Jain, "Data Science & Analytics", Khanna Publishing House Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454.
6. Montgomery, Douglas C., and George C. Runger John, "Applied statistics and probability for engineers", Wiley & Sons, 6th edition,2013.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understands various phases of the data analytics life cycle.
CO2	Apply statistical methods to data for inferences.
CO3	Analyze data using Classification, Graphical and computational methods
CO4	Understand Big Data technologies and NOSQL
CO5	Analyze various types of data using Data Analytics 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	1	1	1	1	1	1	1	-	-	-	1	1	2	2	2
CO2	1	2	2	1	2	1	1	-	-	-	1	1	2	2	2
CO3	2	2	2	2	1	`1	1	-	-	-	1	1	2	2	2
CO4	2	2	2	2	2	1	1	-	-	-	1	1	2	2	2
CO5	2	2	2	2	2	1	1	-	-	-	1	1	2	2	2

IT1607	MOBILE NETWORKS AND APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To demonstrate knowledge of programming for Mobile network communications
- To develop mobile Applications using Android

LIST OF EXPERIMENTS

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

TOTAL : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers 30 Nos.

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. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016.
4. AnubhavPradhan, 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 in storing, sharing and retrieving data in Android applications
CO3	Simulate Mobile networks and analyze the QoS Parameters

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

IT1701	ADVANCED NEURAL NETWORK	L	T	P	C
		3	0	0	3

OBJECTIVES

- To explain different network architectures and how these are used in current applications
- To introduce major learning algorithms, the problem settings, and their applications to solve real worldproblems.
- To understand the concept behind neural networks for learning non-linear functions
- To understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.

UNIT I	NEURAL NETWORKS	9
Gradient Descent, Stochastic gradient descent and ADAM (adaptive methods), Loss function The Construction of Deep Neural Networks, CNNs, Back propagation and Chain Rule, Hyper Parameters, The world of Machine learning.		CO1

UNIT II	BOLTZMANN MACHINES	9
Introduction to Boltzmann, Machines, Restricted Boltzmann Machines, Collaborative filtering using Boltzmann Machines.		CO2

UNIT III	RECURRENT NEURAL NETWORK	9
Mini-Batch gradient descent, Recurrent Neural Network, Predicting the next character using RNN, Introduction to Deep Learning, Introduction to Tensor flow, creating a Deep Learning Network using Tensor flow.		CO3

UNIT IV	BELIEF NETWORKS	9
Introduction to Deep Belief Networks, Stacking RBMs to make Deep Belief Nets, The wake-sleep algorithm.		CO4

UNIT V	MODERN STATISTICAL CONCEPT	9
Model free confidence interval, Jackknife regression, Hidden decision trees, Bayesian networks, Better goodness of fit and yield metrics.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Phil Kim, "Matlab Deep Learning with Machine Learning, Neural Networks and Artificial Intelligence",Apress, 2017

REFERENCE BOOKS

1. Daniel Graupe,"Principles of Artificial Neural Networks", World Scientific Publishing Company; 2013.

2. Yoav Goldberg," Neural Network Models in Natural Language Processin",. Morgan & Claypool, 2017.

3. Simon O. Haykin ,"Neural Networks and Learning Machines", 3rd Edition. Prentice Hall, 2008.

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Identify the learning algorithms which are more appropriate for various types of learning tasks in various domains
CO2	Implement, train, and evaluate neural networks using existing software libraries.
CO3	Present and critically assess current research on neural networks and their applications.
CO4	Analyze and Predict various classification problem.
CO5	Apply neural networks to particular applications to know what steps to take to improve performance.

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	2	1	1	1	2	2	2	2
CO2	2	2	1	2	2	1	1	2	1	1	1	2	2	2	2
CO3	2	2	2	2	2	`1	1	2	1	1	1	2	2	2	2
CO4	2	2	2	2	2	1	1	2	1	1	1	2	2	2	2
CO5	2	2	2	2	2	1	1	2	1	1	1	2	2	2	2

IT1702	PRINCIPLES OF CLOUD TECHNOLOGIES	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 TO CLOUD COMPUTING	9
Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning. Cloud Architectures – Basic Approach, NIST and Layered Cloud Architectures.		CO1

UNIT II	CLOUD ENABLING TECHNOLOGIES	9
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 SERVICES AND MODELS	9
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Types of cloud - Public, Private and Hybrid Clouds; Cloud Services –Infrastructure as a Service (IaaS), Platform as a Service (PaaS), - Software as a Service (SaaS), Storage-as-a-Service(SaaS) – Architectural Design Challenges – Cloud Storage –Advantages of Cloud Storage – Cloud Storage Providers – S3. Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management		CO3

UNIT IV	RESOURCE MANAGEMENT AND SECURITY IN CLOUD	9
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 ADVANCEMENTS AND CASE STUDIES	9
Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Cloud application development using third party APIs, Working with EC2 API – Facebook API, Twitter API. Federation in the Cloud – Four Levels of Federation –Federated Services and Applications – Future of Federation. A Case Study: The Grep TheWeb Application.		CO5

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. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Securityll, CRC Press, 2017.

REFERENCE BOOKS

1. Jason Venner, "Pro Hadoop- Build Scalable, Distributed Applications in the Cloud", A Press, 2009
2. Tom White, "HadoopThe Definitive Guide", First Edition. O"Reilly, 2009.
3. Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005
4. Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann.
5. Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009.
6. Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005.
7. Barry Wilkinson, "Grid Computing: Techniques and Applications", Chapman and Hall, CRC, Taylor and Francis Group, 2010.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand about the basics of Grid and Cloud environment
CO2	Apply grid computing techniques to solve large scale scientific problems
CO3	Apply the concept of virtualization.
CO4	Use the grid and cloud tool kits
CO5	Apply the security models in the grid and the cloud environment.

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

IT1703	CRYPTOGRAPHY ALGORITHMS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the fundamental concepts and techniques in cryptography and network security
- To illustrate the working principles of various Symmetric Ciphers
- To explore knowledge on Asymmetric Ciphers
- To learn the various Data integrity algorithms
- To realize the potential applications of cryptography in security

UNIT I	INTRODUCTION	9
Computer Security Concepts - OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - Model for Network Security - Classical Encryption Techniques - Symmetric Cipher Model - Substitution Techniques - Transposition Techniques - Rotor Machines - Steganography - Basic Concepts in Number Theory and Finite Fields - Divisibility and the Division Algorithm - Euclidean Algorithm - Modular Arithmetic - Groups, Rings, and Field s- Finite Fields of the Form GF(p)		CO1

UNIT II	MODERN SYMMETRIC CIPHERS	9
Block Ciphers and the Data Encryption Standard-Block Cipher Principles - The Data Encryption Standard (DES) - Strength of DES-Triple DES - Differential and Linear Cryptanalysis - Block Cipher Design Principles - Advanced Encryption Standard - Block Cipher Modes of Operation - Random Bit Generation and Stream Ciphers - RC4		CO2

UNIT III	ASYMMETRIC CIPHERS	9
Prime Numbers - Fermat's and Euler's Theorem - Testing for Primality - Chinese Remainder Theorem - Discrete Logarithms- Principles of Public-Key Cryptosystems - RSA Algorithm - Diffie-Hellman Key Exchange - ElGamal Cryptosystem - Elliptic Curve Arithmetic - Elliptic Curve Cryptography		CO3

UNIT IV	DATA INTEGRITY ALGORITHMS	9
Cryptographic Hash Functions - Applications of Cryptographic Hash Functions - Secure Hash Algorithm (SHA) - Birthday Attack - Message Authentication Codes - HMAC - Security of MACs - Digital Signatures - ElGamal Digital Signature Scheme - Digital Signature Standard (DSS)		CO4

UNIT V	APPLICATIONS	9
X.509 Certificates - Kerberos - Transport Level Security – SSL - SET- E-mail Security - Pretty Good Privacy - IP Security - Overview of IPSec – IP and IPv6 -Authentication Header - Encapsulation Security Payload (ESP) - Internet Key Exchange - UNIX Password Encipherment - Protecting ATM Transactions		CO5

TEXT BOOKS

1. William Stallings, "Cryptography and network Security", 7th edition Pearson, 2017
2. Alan G. Konheim, "Computer security & cryptography", John Wiley & Sons, 2007

REFERENCE BOOKS

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in computing", Prentice Hall of India, 3rd Edition, 2006
2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", 2nd edition,Pearson, 2007
3. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002
4. BehrouzA.Forouzan, "Cryptography and Network Security", Tata McGraw Hill, 2010
5. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Apply essential mathematical concepts to Cryptography and identify the vulnerabilities in Classical cryptosystems
CO2	Experiment Symmetric-Key cipher algorithms
CO3	Apply Asymmetric-Key Cryptographic techniques
CO4	Manipulate the data integrity algorithms
CO5	Use cryptographic principles for real-time 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	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

MB1101	MANAGEMENT CONCEPTS AND ORGANIZATIONAL BEHAVIOR	L	T	P	C
	(Common to MBA)	3	0	0	3

OBJECTIVES

- To familiarize the students to the basic concepts of management in order to aid in understanding how an organization functions, and in understanding the complexity and wide variety of issues managers face in today's business firms.

- To acquaint the students with the fundamentals of managing business and to understand individual and group behaviour at workplace so as to improve the effectiveness of an organization. The course will use and focus on Indian experiences, approaches and cases.

UNIT I	NATURE AND THEORIES OF MANAGEMENT	9
Evolution of management Thought - Classical, Behavioral and Management Science Approaches Management - meaning, levels, management as an art or science, Managerial functions and Roles, Evolution of Management Theory - Classical era - Contribution of F. W. Taylor, Henri Fayol, Neo – Classical - Mayo & Hawthorne Experiments. Modern era –system & contingency approach Managerial Skills.		CO1

UNIT II	PLANNING AND ORGANISING	9
Planning - Steps in Planning Process - Scope and Limitations - Forecasting and types of Planning - Characteristics of a sound Plan - Management by Objectives (MBO) - Policies and Strategies - Scope and Formulation - Decision Making - Types, Techniques and Processes. Organisation Structure and Design - Authority and Responsibility Relationships - Delegation of Authority and Decentralisation – Interdepartmental Coordination – Impact of Technology on Organisational design – Mechanistic vs Adoptive Structures -Formal and Informal Organisation. Control: meaning, function, Process and types of Control.		CO2

UNIT III	INDIVIDUAL BEHAVIOUR	9
Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception and Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Beliefs – Communication Types - Process – Barriers – Making Communication Effective.		CO3

UNIT IV	GROUP BEHAVIOUR	9
Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership – Styles - Approaches – Power and Politics – Organisational Structure – Organisational Climate and Culture, Conflict: concept, sources, Types, Stages of conflict, Management of conflict Organisational Change and Development.		CO4

UNIT V	EMERGING ASPECTS OF ORGANIZATIONAL BEHAVIOUR	9
Comparative Management Styles and approaches - Japanese Management Practices Organisational Creativity and Innovation – Organizational behavior across cultures - Conditions		CO5

affecting cross cultural organizational operations, Managing International Workforce, Productivity and cultural contingencies, Cross cultural communication, Management of Diversity.

<div align="right">

TOTAL: 45 PERIODS

</div>

TEXT BOOKS

1. Stephen P. Robbins, David DeCenzo and Mary Coulter, Fundamentals of Management, Prentice Hall of India, 9th edition 2016.
2. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 10th edition, 2016.
3. Samuel C. Certoand S. Trevis Certo, Modern Management: Concepts and Skills, Pearson education, 15th edition, 2018.
4. Charles W. L Hill and Steven L McShane, Principles of Management, McGraw Hill Education, Special Indian Edition, 2017.

REFERENCE BOOKS

1. Harold Koontz and Heinz Weihrich, Essentials of Management: An International, Innovation, And Leadership Perspective, 10th edition, Tata McGraw – Hill Education, 2015.
2. Stephen P. Robbins, Timothy A. Judge, Organisational Behavior, PHIL earning / Pearson Education, 16th edition, 2014.
3. Fred Luthans, Organisational Behavior, McGraw Hill, 12th Edition, 2013.
4. Don Hellriegel, Susan E. Jackson and John W, Jr Slocum, Management: A competency – Based Approach, Thompson South Western, 11th edition, 2008.
5. Heinz Weihrich, Mark V Cannice and Harold Koontz, Management – Aglobal entrepreneurial perspective, Tata McGraw Hill, 12th edition, 2008

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understanding of various management concepts and skills required in the business world
CO2	In-depth knowledge of various functions of management in areal time management context
CO3	Understanding of the complexities associated with management of individual behavior in the organizations
CO4	Develop the skill set to have manage group behaviour in Organizations
CO5	Insights about the current trends in managing organizational behavior

MAPPING OF COs WITH POs AND PSOs

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

IT1707		CLOUD APPLICATION DEVELOPMENT LAB	L	T	P	C
			0	0	4	2

OBJECTIVES

❖ Configure various virtualization tools such as Virtual Box, VMware workstation.

❖ Design and deploy a web application in a PaaS environment. How to Install and use a generic cloud environment that can be used as a private cloud.

❖ Learn how to simulate a cloud environment to implement new schedules.

Exp. No	Experiment	Course Outcomes
1	Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories.	CO1
2	Install Virtualbox/VMware Workstation with different flavors of Linux or Windows OS on top of windows7 or 8.	CO1
3	Find a procedure to transfer the files from one virtual machine to another virtual machine	CO1
4	Install a C compiler in the virtual machine and execute simple programs	CO1
5	Use GCC to compile c-programs in Virtual Machine	CO1
6	Install Google App Engine. Create hello world app using Python/Java and launch the web applications.	CO2
7	DaaS – Deployment of a basic web app and add additional Functionality (Javascripts based)	CO2
8	Simulate a cloud scenario using CloudSim and run a scheduling algorithm	CO2
9	Experiment cloud load balancing algorithms using Cloud Sim	CO2
10	Find a procedure to launch a virtual machine using try stack (Online Openstack Demo Version)	CO3
11	Install Hadoop single node cluster and run simple applications like wordcount	CO3
12	Install the Hadoop framework and create an application using Map Reduce Programming Model	CO3

TOTAL : 30 PERIODS

COURSE OUTCOMES

1. Examine the installation and configuration of VM and simple GCC-based execution.

2. Analyze and understand the functioning of different components involved in the GAE Web services cloud platform.

3. Design & Synthesize new techniques and tools in own Cloud

MAPPING BETWEEN CO AND PO, PSO WITH CORRELATION LEVEL 1/2/3

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	2	-	-	1	1	-	-	1	2	2	2
CO2	1	2	2	2	2	-	-	1	1	-	-	1	2	2	2
CO3	1	2	2	2	2	-	-	1	1	1	-	1	2	2	2

SEMESTER V
PROFESSIONAL ELECTIVE – I

IT1511	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

UNIT I	LINEAR PROGRAMMING	9
Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method.		CO1
UNIT II	ADVANCES IN LPP	9
Dualit theory- Dual simplex method - Sensitivity analysis–-Transportation problems– Assignment problems-Traveling sales man problem -Data Envelopment Analysis.		CO2
UNIT III	NON LINEAR PROGRAMMING	9
Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.		CO3
UNIT IV	INTERIOR POINT METHODS	9
Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.		CO4
UNIT V	DYNAMIC PROGRAMMING	9
Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion– Computational procedure–Conversion offinal value problem in to Initial value problem.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.
2. R.Panneerselvam, "Operations Research", PHI, 2006
3. Hamdy ATaha, "Operations Research –An Introduction", Prentice Hall India, 2003.

REFERENCE BOOKS

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
2. Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd. New Delhi, 2005."

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To understand ethical issues, environmental impact and acquire management skills
CO2	To Understand about the linear programming techniques
CO3	To Understand about the Non Linear programming techniques
CO4	To Understand about interior point methods of solving problems.
CO5	To Understand the dynamic programming method

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	3	3	2
CO2	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2

IT1512	INTRODUCTION TO DIGITAL CURRENCIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To study the concepts of Bitcoins
- To study Bitcoin Client and Transactions
- To understand Bitcoin Network and Blockchain
- To understand Storage and Mining
- To study Alternative Chains.

UNIT I	INTRODUCTION	9
How Bitcoins works-Transactions, Blocks, Mining, and the Blockchain-Bitcoin Transactions-Constructing a Transaction-Bitcoin Mining-Mining transactions in blocks -Spending the transaction-Public key cryptography and crypto-currency-Bitcoin Addresses-Wallets		CO1

UNIT II	THE BITCOIN CLIENT AND TRANSACTIONS	9
Bitcoin Core - The reference implementation-Using Bitcoin Core's JSON-RPC API from the command line-Alternative clients, libraries and toolkits-Transaction Lifecycle-Structure-Outputs and Inputs-Chaining and Orphan TransactionsScripts and Script Language-Standard Transactions		CO2

UNIT III	BITCOIN NETWORK AND BLOCKCHAIN	9
Peer-to-Peer Network Architecture-Nodes Types and Roles-The Extended Bitcoin Network-Network Discovery-Full Nodes-Simplified Payment Verification (SPV) Nodes-Bloom Filters and Inventory Updates-Transaction Pools Blockchain-Structure of a Block-Block Header-Block Identifiers-Genesis Block-Linking Blocks in the Blockchain Merkle Trees		CO3

UNIT IV	BITCOIN STORAGE AND MINING	9
Simple Local Storage - Hot and Cold Storage - Splitting and Sharing Keys - Online Wallets and Exchanges - Payment Services - Transaction Fees - Currency Exchange Markets - Task of Bitcoin Miners – Mining Hardware – Energy Consumption and Ecology – Mining Pools – Mining Incentives and strategies – Anonymity Basics – Deanonymize Bitcoin– Mixing - Decentralized Mixing – Zerocoin and Zerocash		CO4

UNIT V	ALTCOINS	9
Altcoins: History and Motivation – Few Altcoins - Relationship Between Bitcoin and Altcoins - Merge Mining - Atomic Cross-chain Swaps - Bitcoin-Backed Altcoins, "Side Chains" - Ethereum and Smart Contracts - The Block Chain as a Vehicle for Decentralization - Routes to Block Chain Integration - Template for Decentralization		CO5

TEXT BOOKS

1. Andreas M.Antonopoulos,"masteringbitcoins" o'reilly media, inc.,2014
2. Arvind Narayanan,"Bitcoin and Cryptocurrency Technologies" Princeton University Press,2016

REFERENCE BOOKS

1. Chris Dannen, Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programmingfor Beginners. Apress 2017
2. ChrisBurniske&jack Tatar, cryptoassets The Innovative Investor's Guide to Bitcoin and Beyond,McGrawHill,2018
3. S Shukla, M. Dhawan, S. Sharma and S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications",Oxford University Press, 2019.
4. Josh Thompson, "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing Platform, 2017

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Implement the basic element of Bitcoins
CO2	Realize Bitcoin Client and Transactions
CO3	Use Bitcoin Network and Blockchain
CO4	Work with Mining techniques
CO5	Work with alternate bitcoin 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	1	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2

IT1513	INFORMATION STORAGE AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the storage architecture and available technologies.
- To learn to establish & manage a data center.
- To learn security aspects of storage & data center.

UNIT I	STORAGE TECHNOLOGY	9
Information Storage- Evolution of Storage Technology and Architecture, Data Center Infrastructure, Information Lifecycle; Storage System Environment- Components of a Storage System Environment, Disk Drive Components, Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host.		CO1

UNIT II	STORAGE SYSTEMS ARCHITECTURE	9
Concept of RAID and its components, Different RAID levels, and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Hotspare, Stripping, and Mirroring, Compare and contrast integrated and modular storage systems, Intelligent Storage System - Components of an Intelligent Storage System, Intelligent Storage Array - EMC CLARiiON: Storage array, Architecture, and Management.		CO2

UNIT III	INTRODUCTION TO NETWORKED STORAGE	9
Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understanding the need for long-term archiving solutions, and describe how CAS full fill the need, understanding the appropriateness of the different networked storage options for different application environments		CO3

UNIT IV	INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTERS	9
List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime -Business continuity (BC) and disaster recovery (DR), RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures, the architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities. Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center		CO4

UNIT V	SECURING STORAGE AND STORAGE VIRTUALIZATION	9
Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level, and file-level virtualization technologies and processes.		CO5

		TOTAL : 45 PERIODS

TEXT BOOKS

1.   EMC Corporation, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley, India, 2010

REFERENCE BOOKS

1. Marc Farley, —Building Storage Networks‖, Tata McGraw Hill ,Osborne, 2001.
2. Robert Spalding, —Storage Networks: The Complete Reference—, Tata McGraw Hill , Osborne, 2003.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basic terminologies of storage technologies and the environment
CO2	Explain the physical and logical components of a storage infrastructure including storage subsystems, RAID, and intelligent storage systems
CO3	Describe storage networking technologies such as FCSAN, IP-SAN, NAS, and object-based, and unified storage
CO4	Develop skills in data center infrastructure management to efficiently monitor and manage data center resources
CO5	Describe information security requirements and solutions, and identify parameters for managing and monitoring storage infrastructure in classic, virtualized and cloud environments

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

IT1514	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about first order logics
- To acquire knowledge about reasoning
- To apply object-oriented concepts for various expert systems
- To assess uncertainty using non monotonic logic
- To understand various action and planning strategies for problem solving

UNIT I	INTRODUCTION	9
Knowledge Representation and Reasoning – First order Logic – Syntax- Semantics Pragmatics – Expressing Knowledge – Levels of Representation – Knowledge Acquisition and Sharing – Sharing Ontologies – Language Ontologies –Language Patterns – Tools for Knowledge Acquisition		CO1

UNIT II	RESOLUTION AND REASONING	9
Proportional Case – Handling Variables and Quantifiers – Dealing with Intractability – Reasoning with Horn Clauses - Procedural Control of Reasoning – Rules in Production– Description Logic - Issues in Engineering		CO2

UNIT III	REPRESENTATION	9
Object Oriented Representations – Frame Formalism – Structured Descriptions – Meaning and Entailment - Taxonomies and Classification – Inheritance – Networks – Strategies for Defeasible Inheritance – Formal Account of Inheritance Networks		CO3

UNIT IV	DEFAULTS, UNCERTAINTY AND EXPRESSIVENESS	9
Defaults – Introduction – Closed World Reasoning – Circumscription – Default Logic imitations of Logic – Fuzzy Logic – Non monotonic Logic – Theories and World – Semiotics – Auto epistemic Logic - Vagueness – Uncertainty and Degrees of Belief – Non categorical Reasoning – Objective and Subjective Probability- linguistic fuzzy rule-based classification system - fuzzy cognitive maps- fuzzy for large data		CO4

UNIT V	ACTIONS AND PLANNING	9
Explanation and Diagnosis – Purpose – Syntax, Semantics of Context – First Order Reasoning Modal Reasoning in Context – Encapsulating Objects in Context – Agents – Actions – Situational Calculus – Frame Problem – Complex Actions – Planning –Strips– Planning as Reasoning – Hierarchical and Conditional Planning		CO5

	TOTAL : 45 PERIODS

TEXT BOOKS

1. Michael K. Bergman "A Knowledge Representation Practionary: Guidance from Charles Sanders Peirce." Springer -2018.
2. Ronald Brachman, Hector Levesque, "Knowledge Representation and Reasoning ", The Morgan Kaufmann Series, First Edition.

REFERENCE BOOKS

1. John F. Sowa, "Knowledge Representation: Logical, Philosophical, and Computational Foundations", Brokes/Cole, First Edition, 2000.
2. Arthur B. Markman, "Knowledge Representation", Lawrence Erlbaum Associates,1998.
3. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill Publishing Company Ltd., New Delhi, Third Edition, ISBN: 13:978-0-07-008770-5, 2010.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Formulate problem in first order logic and ontologies
CO2	Improve resolution and reasoning with horn clauses
CO3	Apply object-oriented abstractions for knowledge representation
CO4	Solve problems with uncertainty using fuzzy rules
CO5	Design and develop applications with action and planning

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	3	2
CO2	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2

CS1515	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
	(Common to CSE)	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	To become familiar with digital image fundamentals
CO2	To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
CO3	To learn concepts of degradation function and restoration techniques.
CO4	To study the image segmentation and representation techniques.
CO5	To become familiar with image compression and recognition methods

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

SEMESTER VI

PROFESSIONAL ELECTIVE – II

IT1611	FUZZY LOGIC AND ARTIFICIAL NEURAL NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impact knowledge on fuzzy logic principles
- To understand models of ANN
- To use the fuzzy logic and neural network for application related to design and manufacture

UNIT I	INTRODUCTION TO FUZZY LOGIC PRINCIPLES	9
Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.		CO1

UNIT II	ADVANCED FUZZY LOGIC APPLICATIONS	9
Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization.		CO2

UNIT III	INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS	9
Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.		CO3

UNIT IV	OTHER ANN ARCHITECTURES	9
Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive reasonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – kohenen self organizing maps – learning vector quantization – counter propagation networks – industrial applications..		CO4

UNIT V	RECENT ADVANCES	9
Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial immune systems – applications in design and manufacturing.		CO5

TEXT BOOKS

1. Rajasekaran. S.. Vijayalakshmi Pai. G.A. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India Private Limited, 2003
2. Timothy J.Ross, "Fuzzy logic with Engineering Applications", McGraw Hill, 2017
3. Zurada J.M. "Introduction to Artificial Neural Systems", Jaico publishing house, 2016.

REFERENCE BOOKS

1. Klir.G, Yuan B.B. "Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
2. Laurene Fausett, "Fundamentals of Neural Networks", Prentice hall, 1992
3. Gen, M. and Cheng R. "Genetic Algorithm and Engineering Design", john wiley 1997

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop the skill in basic understanding on fuzzy logic.
CO2	Develop the skill in basic understanding on neural network.
CO3	Explore the functional components of neural classification conducer and the functional components of fuzzy logic classification on controller
CO4	Develop and implement a basic trainable neural network (or) a fuzzy logic system to design and manufacturing.
CO5	Understand the recent advances in fundamentals of genetic algorithm.

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	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2

IT1612	SOFTWARE TESTING AND QUALITY ASSURANCE	L	P	T	C
		3	0	0	3

OBJECTIVES

- To understand software testing and quality assurance as a fundamental component of software life cycle
- To define the scope of SW T & QA projects
- To efficiently perform T & QA activities using modern software tools
- To estimate cost of a T & QA project and manage budgets
- To prepare test plans and schedules for a T&QA project
- To develop T & QA project staffing requirements
- To effectively manage a T & QA project.

UNIT I	SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES	9
Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, . Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building		CO1

UNIT II	SYSTEM TESTING	9
System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built-in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models.		CO2

UNIT III	SYSTEM TEST CATEGORIES	9
System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests.		CO3

UNIT IV	SOFTWARE QUALITY	9
Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model.		CO4

UNIT V	SOFTWARE QUALITY ASSURANCE	9
Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.		CO5

TEXT BOOKS

1. Software Testing And Quality Assurance-Theory and Practice, Kshirasagar Nak Priyadarshi Tripathy, John Wiley & Sons Inc,2008.

REFERENCE BOOKS

1. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.
2. Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004.
3. Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Familiar with the process of verification, validation and understand the process of applying tests to software and the fundamental components of a test case.
CO2	Derive test cases from software requirement specifications - including being able to partition input and output domains, form test specifications, and identify valid combinations of input.
CO3	Distinguish between methods of judging test case adequacy and how to design tests that will accomplish the obligations of such methods.
CO4	Understand how to build models of system behavior and prove that their obey required properties.
CO5	Make logical arguments that prove the correctness of program implementations and write code to automate test execution and analysis.

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	-	-	-	-	-	2	2	3	2	1
CO2	3	3	3	3	2	-	-	-	-	-	2	2	3	2	1
CO3	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	-	2	2	3	2	1
CO5	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2

IT1613	NATURAL LANGUAGE PROCESSING TOOLS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To explore the fundamental concepts of Natural Language Processing
- To learn the different data pre-processing steps in lexical analysis
- To understand the working of syntactic and semantic analysis using NLTK
- To familiar with text classification and topic modeling methods
- To work with sentiment analysis and machine translation using python

UNIT I	INTRODUCTION TO NLP	9
Natural language processing – History of NLP – Early NLP systems – Phases of natural language processing – Evaluation of NLP systems - Origins and challenges of NLP – Basic English concepts –- Language and Grammar - Processing Indian Languages		CO1

UNIT II	LEXICAL ANALYSIS USING NLTK	9
Introduction and installation of NLTK – Data Pre-processing: Tokenization – Part of Speech (PoS) Tagging - Word Frequency Counting – Stop Words Removal – Text Normalization – Spelling Correction - Stemming – Lemmatization – Named Entity Recognition		CO2

UNIT III	SYNTACTIC AND SEMANTIC ANALYSIS USING NLTK	9
Feature Extraction: Building Bag of Words (BoW) Model – Building TF-IDF Model – Word Embeddings using word2vec - Sentence Boundary Detection – Parsing - Lexical Resources: WordNet – FrameNet - Word Synonyms and Antonyms using NLTK – Word Negation Tracking - Word Sense Disambiguation		CO3

UNIT IV	TEXT CLASSIFICATION AND TOPIC MODELING	9
Introduction to Text Classification – Machine Learning Overview – Classification Metrics – Confusion Matrix – Developing a Text Classifier – Saving and Loading Models - Introduction to Topic Modelling – Topic Discovery – Topic Modelling Algorithms: Latent Semantic Analysis – Latent Dirichlet Algorithms.		CO4

UNIT V	SENTIMENT ANALYSIS AND MACHINE TRANSLATION	9
Introduction to Sentiment Analysis – Need and Growth of Sentiment Analysis – TextBlob – Understanding Data for Sentiment Analysis – Training Sentiment Models – Introduction to Machine Translation - Problems in Machine Translation - Machine Translation Approaches - Translation involving Indian Languages using Python		CO5

		TOTAL : 45 PERIODS

TEXT BOOKS

1.Ela Kumar, "Natural Language Processing", I.K International, New Delhi 2011.
2. SohomGhosh, Dwight Gunning, "Natural Language Processing Fundamentals", Packt Publishing Limited, 2019.
3. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", O'Reilly Media, 1stEdition, 2009.

REFERENCE BOOKS

1. TanveerSiddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University
   Press, 2008.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition 2008.
3. Christopher D. Manning and HinrichSchutze, "Foundations of Statistical Natural Language Processing", MITPress, 2003.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Familiarize with concept of Natural Language Processing
CO2	Pre-process the data from the collected dataset using NLTK
CO3	Extract the features and do the syntactic and semantic analysis using NLTK
CO4	Classify the text using text classification algorithm and find the recent topic using LSA and LDA
CO5	Find the different emotions and sentiment using sentiment analysis and translate from one natural language to other using machine translation

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	2	2	3	3	2
CO2	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2

ML1601	DEEP LEARNING	L	T	P	C
		3	1	0	3

OBJECTIVES

- To familiarize the fundamental concepts and principles of neural networks.
- To explore the basic concepts of deep learning.
- To familiarize with CNN and RNN models.
- To understand and develop deep learning architectures.
- To implement various applications using deep learning.

UNIT I	INTRODUCTION TO DEEP LEARNING	9
Basic Concept of Neurons – Perceptron Algorithm – Shallow Neural Networks – Non Linear Activation Functions - Gradient Descent and Backpropagation – Shallow and Deep Learning Networks		CO1

UNIT II	IMPROVING NEURAL NETWORKS	9
Overfitting – Regularization – Dropout – Vanishing and Exploding Gradients Problem - Mini Batch Gradient Descent – Weight Initialization Strategies - Nesterov Accelerated Gradient - Momentum – RMSProp – ADAM - Mitigation –– Heuristics for Avoiding Bad Local Minima and Faster Training – Mini Batch Gradient Descent - Batch Normalization - Adversarial Training – Optimization for Training Deep Models.		CO2

UNIT III	CONVOLUTIONAL NEURAL NETWORKS	9
Convolution Operations – Pooling Layers – ResNets – CNN Architectures - Transfer Learning – Data Augmentation – Image Classification using Transfer Learning – Autoencoders – Deep Generative Models – Generative Adversarial Networks (GANs) – Evaluation GANs.		CO3

UNIT IV	SEQUENCE MODELS AND NATURAL LANGUAGE PROCESSING	9
Recurrent Neural Networks – Vanishing Gradients in RNNs - Gated Recurrent Units - Long Short Term Memory (LSTM) Networks – Bidirectional RNNs - Sequence Prediction – Transfer Learning – Language Models – Word Embeddings – Beam Search - Attention Models – Transformer Networks.		CO4

UNIT V	APPLICATIONS OF DEEP LEARNING	9
Image segmentation – Object Detection – Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks.		CO5

TEXT BOOKS

1. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.

2. 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.

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	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2
CO2	2	2	1	2	2	1	1	2	1	1	1	2	2	2	2
CO3	2	2	2	2	2	`1	1	2	1	1	1	2	2	2	2
CO4	2	2	2	2	2	1	1	2	1	1	1	2	2	2	2
CO5	2	2	2	2	2	1	1	2	1	1	1	2	2	2	2

MG1615	ENGINEERING ETHICS AND HUMAN VALUES	L	P	T	C
	(Common to CSE)	3	0	0	3

OBJECTIVES

1. Students will understand the importance of Values and Ethics in their Personal lives and professional careers
2. The students will learn the rights and responsibilities
3. Responsibilities of employee, team member and a global citizen.

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.		CO1

UNIT II	Engineering Et	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 Ex	9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study		CO3

UNIT IV	Safety, Responsibilities and Ri	9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl Case Studies Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination		CO4

UNIT V	Global Is	9
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Conduct		CO5

	TOTAL : 45 PERIODS

TEXT BOOKS

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2nd Edition, 2009.

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", Thompson Wadsworth, A Division of Thomson Learning Inc., United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understanding basic purpose of profession, professional ethics and various moral and social issues.
CO2	Awareness of professional rights and responsibilities of a Engineer, safety and risk benefit analysis of a Engineer
CO3	Acquiring knowledge of various roles of Enbgineer In applying ethical principles at various professional levels
CO4	Professional Ethical values and contemporary issues
CO5	Excelling in competitive and challenging environment to contribute to industrial growth.

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	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO2	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO3	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO4	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO5	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2

IT1711	WEB DEVELOPMENT FRAMEWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

1. Understand the fundamentals of web framework
2. Know the concept of the Java web framework
3. Learn the technologies of the Python web framework
4. Be exposed to the concepts of the Web framework
5. Be familiar with the Web framework.

UNIT I	**FUNDAMENTALS OF WEB FRAMEWORK**	9
Web framework-History-Types of framework architectures-Model–view–controller (MVC)- Three-tier organization-Introduction to frameworks-Framework applications -General-purpose website frameworks-Server-side-Client-side-Features		CO1

UNIT II	**JAVA WEB FRAMEWORK**	9
Java Web Frameworks-Struts-The Struts Framework- The Struts Tag Libraries- – Struts Configuration Files- Applying Struts		CO2

UNIT III	**STRUTS**	9
Struts and Agile Development -Basic Configuration.-Actions and Action Support.-Results and Result Types.-OGNL, the Value Stack, and Custom Tags-Form Tags-Form Validation and Type ConversionExceptions and Logging-Getting Started with JavaScript-Advanced JavaScript, the DOM, and CSSThemes and Templates-Rich Internet Applications.		CO3

UNIT IV	**PYTHON WEB FRAMEWORKS**	9
Introduction to Python Frameworks-Web 2.0, Python, and Frameworks-The Role of AJAX in Web 2.0-Web 2.0 with Traditional Python-Introducing the Frameworks-Web Application Frameworks-MVC in Web Application Frameworks-Common Web Application Framework Capabilities		CO4

UNIT V	**TURBOGEARS WEB FRAMEWORK**	9
Introduction to TurboGears-TurboGears History-Main TurboGears Components-Alternate Components-MVC Architecture in TurboGears-Creating an Example Application-The Controller and View-Introduction to Django-Django History-Django Components-Alternate Components-MVC Architecture in Django-Creating an Example Application		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. James Holmes, Struts The Complete Reference, 2nd Edition, Mc.Graw Hill Professional 2006
2. Donald Brown, Chad Michael Davis, Scott Stanlick ,Struts 2 In Action Dreamtech press 2008
3. Dana Moore, Raymond Budd, William Wright, Professional Python Frameworks Web 2.0 John wiley and sons, 2008
4. Programming with Django and TurboGears, Wiley Publishing

5. Carlos De La Guardia,Python Web Frameworks, OReilly

REFERENCE BOOKS

1. Sue Spielman ,The Struts Framework 1: A Practical guide for Java Programmers, 1st Edition. Elsevier 2002
2. Adrian Holovaty Jacob Kaplan-Moss, The Definitive Guide to Django: Web Development Done Right, Apress, 2009
3. Mark Ramm,Rapid Web applications with TurboGears, Prentice Hall.2009

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Analyze the fundamentals of web framework
CO2	Use the concept of Java web framework
CO3	Implement the concept using Struts framework
CO4	Apply the concept of python web framework to the problem solutions.
CO5	Critically analyze the various Web frameworks.

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	-	-	-	-	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

IT1712	INFORMATION MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the importance of information in business
- To know the technologies and methods used for effective decision making in an organization.

UNIT I	INTRODUCTION	9
Data, Information, Intelligence, Information Technology, Information System, evolution, types based on functions and hierarchy, System development methodologies, Functional Information Systems, DSS, EIS, KMS, GIS, International Information System.		CO1

UNIT II	SYSTEM ANALYSIS AND DESIGN	9
Case tools - System flow chart, Decision table, Data flow Diagram (DFD), Entity Relationship (ER), Object Oriented Analysis and Design(OOAD), UML diagram.		CO2

UNIT III	DATABASE MANAGEMENT SYSTEMS	9
DBMS – HDBMS, NDBMS, RDBMS, OODBMS, Query Processing, SQL, Concurrency Management, Data warehousing and Data Mart		CO3

UNIT IV	SECURITY, CONTROL AND REPORTING	9
Security, Testing, Error detection, Controls, IS Vulnerability, Disaster Management, Computer Crimes, Securing the Web, Intranets and Wireless Networks, Software Audit, Ethics in IT, User Interface and reporting		CO4

UNIT V	NEW IT INITIATIVES	9
Role of information management in ERP, e-business, e-governance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM.		CO5

TOTAL: 45 PERIODS

TEXT BOOKS

1. Robert Schultheis and Mary Summer, Management Information Systems – The Managers View, Tata McGraw Hill, 2008.
2. Kenneth C. Laudon and Jane Price Laudon, Management Information Systems – Managing the digital firm, PHI Learning / Pearson Education, PHI, Asia, 2012.

REFERENCE BOOKS

1. Rahul de, MIS in Business, Government and Society, Wiley India Pvt Ltd, 2012
2. Gordon Davis, Management Information System : Conceptual Foundations, Structure and Development, Tata McGraw Hill, 21st Reprint 2008.
3. Haag, Cummings and Mc Cubbrey, Management Information Systems for the Information Age, McGraw Hill, 2005. 9th edition, 2013.

4. Turban, McLean and Wetherbe, Information Technology for Management – Transforming Organisations in the Digital Economy, John Wiley, 6th Edition, 2008.
5. Raymond McLeod and Jr. George P. Schell, Management Information Systems, Pearson Education, 2007.
6. James O Brien, Management Information Systems – Managing Information Technology in the E-business enterprise, Tata McGraw Hill, 2004.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gains knowledge on effective applications of information systems in business
CO2	Gains knowledge on system analysis and design
CO3	Gains knowledge on database management systems
CO4	Gains knowledge on security, control and reporting
CO5	Gains knowledge on new IT Initiatives

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	3	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2

IT1713	CYBER FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn computer forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data

UNIT I	INTRODUCTION TO COMPUTER FORENSICS	9
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.	CO1
UNIT II	EVIDENCE COLLECTION AND FORENSICS TOOLS	9
Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools	CO2
UNIT III	ANALYSIS AND VALIDATION	9
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics	CO3
UNIT IV	ETHICAL HACKING	9
Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing	CO4
UNIT V	ETHICAL HACKING IN WEB	9
Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms	CO5
	TOTAL : 45 PERIODS

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, ―Computer Forensics and Investigationsǁ, Cengage Learning, India Edition, 2016.
2. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015

REFERENCE BOOKS

1. John R.Vacca, ―Computer Forensicsǁ, Cengage Learning, 2005
2. MarjieT.Britz, ―Computer Forensics and Cyber Crimeǁ: An Introductionǁ, 3rd Edition, Prentice Hall, 2013.

3. AnkitFadia — Ethical Hacking‖ Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik —Insider Computer Fraud‖ Auerbach Publications Taylor & Francis Group–2008..

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basics of computer forensics
CO2	Apply a number of different computer forensic tools to a given scenario
CO3	Analyze and validate forensics data
CO4	Identify the vulnerabilities in a given network infrastructure
CO5	Implement real-world hacking techniques to test system 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	-	3	-	-	2	2	2	3	3	2
CO2	3	3	3	3	2	-	3	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	3	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	3	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	3	-	-	2	2	2	3	3	2

IT1714	PARALLEL ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand different parallel architectures and models of computation.
- To introduce the various classes of parallel algorithms.
- To study parallel algorithms for basic problems.

UNIT I	INTRODUCTION	9
Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations - PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages		CO1
UNIT II	PRAM ALGORITHMS	9
Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching -Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring - Graph Searching		CO2
UNIT III	SIMD ALGORITHMS -I	9
2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication		CO3
UNIT IV	SIMD ALGORITHMS -II	9
Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model - Parallel Algorithms for Reduction -Bitonic Merge Sort - Matrix Multiplication - Minimum Cost Spanning Tree		CO4
UNIT V	MIMD ALGORITHMS	9
UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.		CO5
	TOTAL : 45 PERIODS	

TEXT BOOKS

1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition , 2011.
3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.

REFERENCE BOOKS

1. AnanthGrame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.

2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning , 2013.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop parallel algorithms for standard problems and applications.
CO2	Understand various classes of parallel algorithms
CO3	Apply parallel algorithms for basic problems
CO4	Apply techniques for Multiprocessor Model
CO5	Analyze efficiency of different parallel algorithms.

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	3	2
CO2	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
CO3	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
CO5	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2

IT1715		AUGMENTED AND VIRTUAL REALITY	L	P	T	C
			3	0	0	3

OBJECTIVES

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- To know the intricacies of these platform to develop PDA applications with better optimality

UNIT I	VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS	9
The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality. HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces		CO1

UNIT II	3D USER INTERFACE INPUT HARDWARE	9
Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces		CO2

UNIT III	SOFTWARE TECHNOLOGIES	9
Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market		CO3

UNIT IV	3D INTERACTION TECHNIQUES	9
3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestrual Commands, Tools, Mutimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry . DESIGNING AND DEVELOPING 3D USER INTERFACES: Strategies for Designing and Developing Guidelines and Evaluation. VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.		CO4

UNIT V	**Augmented and Mixed Reality**	9
	Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	CO5

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.
2. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
4. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
5. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.
6. John Vince, "Virtual Reality Systems", Addison Wesley, 1995.
7. Howard Rheingold, "Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society", Simon and Schuster, 1991.
8. William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
9. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013. A Grama, AGupra, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley, 2003.

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Analyse and Design a system or process to meet given specifications with realistic engineering constraints.
CO2	Identify problem statements and function as a member of an engineering design team.
CO3	Utilize technical resources
CO4	Propose technical documents related to design mini project results.
CO5	Give technical oral presentations related to design mini project results.

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	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO2	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO3	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO4	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO5	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2

SEMESTER VII
PROFESSIONAL ELECTIVE – IV

IT1721	STORAGE AREA NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Identify key challenges in managing information and analyze different storage networking technologies and virtualization
- To Know about components and the implementation of NAS
- Understand CAS architecture and types of archives and forms of virtualization
- Understand the storage infrastructure and management activities
- Understand the Securing Infrastructure.

UNIT I	Storage System	9
Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host (Compute), Connectivity, Storage. Data Protection: RAID: RAID Implementation Methods, RAID Techniques, RAID Levels, RAID Impact on Disk Performance. Intelligent Storage Systems: Components of Intelligent Storage System, Storage Provisioning.	**CO1**

UNIT II	Storage Networking Technologies	9
Fibre Channel Storage Area Networks: Components of FC SAN, FC connectivity, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network Attached Storage: Components of NAS, NAS I/O Operation, NAS File-Sharing Protocols, File-Level Virtualization, Object-Based Storage and Unified Storage: Object-Based Storage Devices, Content-Addressed Storage, Unified Storage.	**CO2**

UNIT III	Backup, Archive and Replication	9
Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive. Local Replication: Replication Terminology, Uses of Local Replicas, Local Replication Technologies, Local Replication in a Virtualized Environment. Remote Replication: Remote Replication Technologies, Three-Site Replication, Remote Replication and Migration in a Virtualized Environment.	**CO3**

UNIT IV	Cloud Computing and Virtualization	9
Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud	**CO4**

Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Outof-Band Virtualization Appliances, High Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications.

UNIT V	Securing and Managing Storage Infrastructure	9
Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering.		CO5

	TOTAL : 45 PERIODS

TEXT BOOKS

1. Information Storage and Management,Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839

REFERENCE BOOKS

1. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Identify key challenges in managing information and analyze different storage networking technologies and virtualization
CO2	Explain components and the implementation of NAS
CO3	Describe CAS architecture and types of archives and forms of virtualization
CO4	Illustrate the storage infrastructure and management activities
CO5	Illustrate the Securing Infrastructure

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	3	3	2
CO2	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2

IT1722	NoSQL DATABASE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query dataand performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

UNIT I	NoSQL Basics	9
Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access,		**CO1**
UNIT II	**Distribution Models**	**9**
Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes		**CO2**
UNIT III	**Map-Reduce**	**9**
Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets		**CO3**
UNIT IV	**Document Databases**	**9**
Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, ECommerce Applications, When Not to Use, Complex Transactions Spanning Diferent Operations, Queries against Varying Aggregate Structure		**CO4**

UNIT V	Graph Databases	9
Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

REFERENCE BOOKS

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

COURSE OUTCOMES
Upon completion of the course, students will be able to

CO1	Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
CO2	Demonstrate an understanding of the detailed architecture, define objects, load data, query data
CO3	Analyze the performance tune Column-oriented NoSQL databases
CO4	Explain the detailed architecture, define objects, load data, query data and performance
CO5	Analyze the performancetuneDocument-oriented NoSQL 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	2	2	3	3	2
CO2	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	1	2	2	3	3	2

IT1723	SOFTWARE AGENTS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the how software agents reduce information overhead
- gain knowledge in use of software agents for cooperative learning and personal assistance,
- to know how agent can communicate and share knowledge using agent communication language
- gain knowledge in design of an agent interpreter and intelligent agent
- understand the concept of mobile technology and mobile agents and its security

UNIT I	AGENT AND USER EXPERIENCE	9
Agent characteristics- object Vs agent. Agent types- Interacting with Agents - Agent From Direct Manipulation to Delegation - Interface Agent, Metaphor with Character – Designing Agents – problem solving agent, rational agent. Direct Manipulation versus Agent Path to Predictable		CO1

UNIT II	AGENTS FOR LEARNING AND ASSISTANCE	9
Agents for Information Sharing and Coordination - Agents that Reduce Work Information Overhead - Agents without Programming Language - Life like Computer character - S/W Agents for cooperative Learning – Multiple Reasoning agents –M system. Learning agents: computational architectures for learning agents; evolution, adaptation; multi-agent learning.		CO2

UNIT III	AGENT COMMUNICATION AND COLLABORATION	9
Overview of Agent Oriented Programming - Agent Communication Language – KQML-Per formatives. Agent Based Framework of Interoperability. Virtual agents: agents in games and virtual environments; companion and coaching agents; modeling personality, emotions; multimodal interaction; verbal and non-verbal expressiveness.		CO3

UNIT IV	AGENT ARCHITECTURE	9
Strategies for agent design. Agent interpreter- BDI architecture. Architecture of Intelligent Agents. Agents for Information Gathering - Open Agent Architecture - Communicative Action for Artificial Agent. Agent societies and societal issues.		CO4

UNIT V	MOBILE AGENTS	9
Mobile agent paradigm - Mobile agent concepts -Mobile agent technology – programming mobile agents –application of mobile agents- Teleshopping. Mobile agent security- trust, reliability and reputation.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jeffrey M.Bradshaw," Software Agents ", MIT Press 2000, Pearson Indian Reprint 2010.

REFERENCE BOOKS

1. Lin, Fuhua Oscar (Ed.), "Designing Distributed Learning Environments with Intelligent Software Agents", Information Science Publishing, 2004
2. Russel&Norvig, " Artificial Intelligence: A Modern Approach ", Prentice Hall, 2nd Edition, 2002.
3. Murch Richard, Johnson Tony 'Intelligent Software Agents, 'Prentice Hall,1998.
4. Joseph P.Bigus& Jennifer Bigus, "Constructing Intelligent agents with Java: A Programmer's Guide to Smarter Applications ", Wiley, 1997.
5. Knapik, Michael and Jay Johnson 'Developing Intelligent Agents for Distributed Systems: Exploring Architecture, Technologies, and Applications' , McGraw-Hill.1998
6. William R. Cockayne, Michael Zyda, "Mobile Agents", Prentice Hall, 1998

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understanding the fundamentals of agents and agent programming paradigms.
CO2	Apply agents for learning and assistance
CO3	Apply agent for communication and collaboration
CO4	Understand agent architecture
CO5	Apply in mobile 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	3	3	2
CO2	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2

CS1722	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the fundamentals of quantum computing
- The problem solving approach using finite dimensional mathematics

UNIT I	COMPLEX NUMBERS AND VECTORS	9
Complex numbers and its geometrical representations, Complex vector spaces, inner products and Hilbert spaces, Hermitian and unitary matrices, Tensor products of vector spaces. Quantum bits, Bloch sphere representation of a qubit, multiple qubits, Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis	CO1

UNIT II	QUANTUM MECHANICS	9
Quantum Circuits: Single qubit gates, multiple qubit gates, design of quantum circuits. Classical gates versus quantum gates	CO2

UNIT III	QUANTUM INFORMATION AND CRYPTOGRAPHY	9
Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem	CO3

UNIT IV	QUANTUM ALGORITHMS	9
Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search	CO4

UNIT V	NOISE AND ERROR CORRECTION	9
Graph states and codes, Quantum error correction, fault-tolerant computation	CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008.

REFERENCE BOOKS

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008

2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010

3. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995

4. Pittenger A. O., An Introduction to Quantum Computing Algorithms 2000

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Basics of complex vector spaces
CO2	Quantum mechanics as applied in Quantum computing
CO3	Architecture and algorithms
CO4	Fundamentals of Quantum computations
CO5	Understand noise and error correction 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	-	3	-	-	2	2	2	3	2	1
CO2	3	3	3	3	2	-	3	-	-	2	2	2	3	2	1
CO3	3	3	3	3	2	-	3	-	-	2	2	2	3	3	2
CO4	3	3	3	3	2	-	3	-	-	2	2	2	3	2	1
CO5	3	3	3	3	2	-	3	-	-	2	2	2	3	3	2

CE1025	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ To provide students an exposure to disasters, their significance and types.
- ❖ To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- ❖ To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- ❖ To enhance awareness of institutional processes in the country
- ❖ To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I	INTRODUCTION TO DISASTERS	9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc – Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.		CO1

UNIT II	APPROACHES TO DISASTER RISK REDUCTION	9
Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.		CO2

UNIT III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.		CO3

UNIT IV	DISASTER RISK MANAGEMENT IN INDIA	9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.		CO4

UNIT V	DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS	9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.		CO5

	TOTAL : 45 PERIODS

TEXT BOOKS

1. Singhal J.P. Disaster Management, Laxmi Publications, 2010.

2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012.

3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCE BOOKS

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

2. Government of India, National Disaster Management Policy,2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	differentiate the types of disasters, causes and their impact on environment and society
CO2	assess vulnerability and various methods of risk reduction measures as well as mitigation
CO3	enhance awareness of institutional processes in the country
CO4	develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity
CO5	draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and 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	2	0	0	0	2	2	1	3	0	1	2			
CO2	3	2	0	0	0	2	2	1	2	0	2	1			
CO3	3	2	0	0	0	1	2	1	2	0	1	2			
CO4	3	2	0	0	0	1	1	1	1	0	1	3			
CO5	3	2	0	0	0	1	2	1	3	0	1	3			

SEMESTER VIII

PROFESSIONAL ELECTIVE – V

IT1811	INFORMATION THEORY AND CODING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand error–control coding.
- Understand encoding and decoding of digital data streams.
- Be familiar with the methods for the generation of these codes and their decoding techniques.
- Be aware of compression and decompression techniques.
- Learn the concepts of multimedia communication.

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UNIT I	INFORMATION THEORY	9
Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit.		CO1

UNIT II	SOURCE CODING: TEXT, AUDIO AND SPEECH	9
Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding		CO2

UNIT III	SOURCE CODING: IMAGE AND VIDEO	9
Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard		CO3

UNIT IV	ERROR CONTROL CODING: BLOCK CODES	9
Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC		CO4

UNIT V	ERROR CONTROL CODING: CONVOLUTIONAL CODES	9
Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding		CO5

	TOTAL : 45 PERIODS

TEXT BOOKS

1. R Bose, "Information Theory, Coding and Crptography", TMH 2007

2. Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002

REFERENCE BOOKS

1. K Sayood, "Introduction to Data Compression" 3/e, Elsevier 2006

2. S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007

3. Amitabha Bhattacharya, "Digital Communication", TMH 2006

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Design an application with error–control
CO2	Use compression and decompression techniques
CO3	Apply the concepts of multimedia communication
CO4	Apply the concepts of error control coding: block codes
CO5	Apply the concepts of error control coding: convolutional codes

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	1	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2

IT1812	ELECTRONIC COMMERCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Discuss fundamentals of e-commerce, types and applications.
- Evaluate the role of the major types of information systems in a business environment and their relationship to each other
- Assess the impact of the Internet and Internet technology on business electronic commerce and electronic business
- Identify the major management challenges for building and using information systems and learn how to find appropriate solutions to those challenges.
- Learn strategies for e-commerce, Mobile Commerce, Wireless Application Protocol, WAP technology and Mobile Information devices.

UNIT I	INTRODUCTION	9
Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models.		CO1

UNIT II	NETWORK INFRASTRUCTURE FOR E- COMMERCE	9
Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device.		CO2

UNIT III	WEB SECURITY	9
Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.		CO3

UNIT IV	ENCRYPTION	9
Encryption techniques, Symmetric Encryption: Keys and data encryption standard, Triple encryption, Secret key encryption; Asymmetric encryption: public and private pair key encryption, Digital Signatures, Virtual Private Network.		CO4

UNIT V	ELECTRONIC PAYMENTS	9
Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking.EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.		CO5

TEXT BOOKS

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.

REFERENCE BOOKS

1. Pete Lohsin , John Vacca "Electronic Commerce", New Age International

2. Goel, Ritendra "E-commerce", New Age International

3. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education

4. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH

5. Turban, "Electronic Commerce 2004: A Managerial Perspective", Pearson Education

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basic concepts and technologies used in the field of management information systems
CO2	Understand the processes of developing and implementing information systems
CO3	Be aware of the ethical, social, and security issues of information systems
CO4	Develop an understanding of how various information systems work together to accomplish the information objectives of an organization
CO5	Understand the role of information systems in organizations, the strategic management processes, and the implications for the 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	1	3	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	1	3	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	1	3	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	1	3	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	1	3	3	2	-	-	-	-	2	2	2	3	3	2

IT1813		**AFFECTIVE COMPUTING**	L	T	P	C
			3	0	0	3

OBJECTIVES

- To learn emotional recognition techniques.
- To gain a broader knowledge and understanding of the various affective computing models.
- To learn about various machines developed using human emotion.

UNIT I	**Introduction**	**9**
Affective Computing and the Challenge of mood measurement and forecasting. Affective phenomena: emotion, mood, attitude/sentiment, personality. Computers, robots, smartphones with emotional intelligence.		**CO1**
UNIT II	**Emotion Theory**	**9**
Dual-process theories of emotion, Constructivist theories, Appraisal theories. Affective Technology Interaction and Empathy: Computational Appraisal Theory, reinforcement learning based approaches, recognizing emotional context, facial affect recognition		**CO2**
UNIT III	**Emotionand Perception**	**9**
Ethical issues related to emotion and AI, Emotionally Intelligent Human Computer Interaction, Emotion and Perception, Decision-making, and Creativity, Emotion and Learning, Physiology of Emotion, Behavioral game theory, Neurological Mechanisms involved in Emotion,		**CO3**
UNIT IV	**Affect Recognition**	**9**
Affect Recognition by Wearable's and other Machines, Communicating Frustration/Stress in Autism and in Customer Experience, Responding to User Emotion to Reduce User Frustration, Inducing Emotion, Robots/Agents that "have" Emotion, Expression of Emotion by Machines/Agents/Synthetic characters		**CO4**
UNIT V	**Ethical Implications of Affective Computing**	**9**
Philosophical, Social, Ethical Implications of Affective Computing, Machine/Mobile Empathy and Emotional Support, Lie Detection and Stress Detection.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1.Affective Computing and Interaction: Psychological, Cognitive and Neuroscientific Perspectives by DidemGökçay and GülsenYildirim, IGI Global.

2. The Encyclopedia of Human-Computer Interaction by Jonas Lowgren, John M. Carroll, Marc Hassenzahl, andThomas Erickson, Interaction Design Foundation

REFERENCE BOOKS

1. Affective Computing by R.W. Picard, MIT Press.
2. The Oxford Handbook of Affective Computing by R.A. Calvo, S.K. D'Mello, J. Gratch, and A. Kappas,Oxford University Press.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Have a good understanding of the role of emotion
CO2	Have a good understanding of machine interaction.
CO3	Have an understanding of the aesthetic aspect of machine design.
CO4	Develop systems to reduce the emotional gap between humans and machines
CO5	Develop systems to reduce the emotional gap all within the context of interactions.

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	3	3	2
CO2	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
CO3	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
CO4	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
CO5	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2

IT1814	SOCIAL MEDIA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To implement Basics of Text Processing over Social Data
- To understand various Characteristics of OSNs
- To understand Fundamentals of Social Data Analytics
- To Apply the concepts of Social Data Analytics
- Able to properly handle Online experiments for Computational Social Science.

UNIT I	Online Social Networks (OSNs)	9
Introduction - Types of social networks (e.g., Twitter, Facebook), Measurement and Collection of Social Network Data,Social Networks - Basic Structure and Measures,Basics of Text Processing over Social Data,Entity linking and entity resolution for Social data		CO1
UNIT II	Studying Characteristics of OSNs	9
Information Diffusion,Experimental studies over OSNs,Sampling		CO2
UNIT III	Fundamentals of Social Data Analytics	9
Topic Models,RandomWalks,Heterogeneous Information Networks		CO3
UNIT IV	Applied Social Data Analytics	9
Recommendation Systems,Community identification and link prediction		CO4
UNIT V	Advanced Topics	9
Online experiments for Computational Social Science, Big Data Sampling		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1.Matthew A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, Linkedin, Google+, Github, and More, 2nd Edition, O'Reilly Media, 2013.

REFERENCE BOOKS

1. Jennifer Golbeck, Analyzing the social web, Morgan Kaufmann, 2013.
2. CharuAggarwal (ed.), Social Network Data Analytics, Springer, 2011.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To implement Basics of Text Processing over Social Data
CO2	To understand various Characteristics of OSNs
CO3	To understand Fundamentals of Social Data Analytics
CO4	To Apply the concepts of Social Data Analytics
CO5	Able to properly handle Online experiments for Computational Social Science.

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	1	3	2	-	-	-	-	2	2	2	3	3	2
CO2	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO3	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO4	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2
CO5	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2

IT1815	SECURE CODING	L	T	P	C
		3	0	0	3

OBJECTIVES

- This course aims to provide an understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities.
- Itgives an outline of the techniques for developing a secure application.

UNIT I	Introduction	9
Security, CIA Triad, Viruses, Trojans, and Worms In a Nutshell, Security Concepts- exploit, threat, vulnerability, risk, attack. Malware Terminology: Rootkits, Trapdoors, Botnets, Key loggers, Honeypots. Active and Passive Security Attacks. IP Spoofing, Tear drop,DoS, DDoS,XSS, SQL injection, Smurf, Man in middle, Format String attack. Types of Security Vulnerabilities- buffer overflows, Invalidated input, race conditions, access-control problems, weaknesses in authentication, authorization, or cryptographic practices. Access Control Problems		**CO1**

UNIT II	Need for secure systems	9
Proactive Security development process, Secure Software Development Cycle (S-SDLC) , Security issues while writing SRS, Design phase security, Development Phase, Test Phase, Maintenance Phase, Writing Secure Code – Best Practices SD3 (Secure by design, default and deployment), Security principles and Secure Product Development Timeline.		**CO2**

UNIT III	Threat modelling process and its benefits	9
Identifying the Threats by Using Attack Trees and rating threats using DREAD, Risk Mitigation Techniques and Security Best Practices. Security techniques, authentication, authorization. Defence in Depth and Principle of Least Privilege.		**CO3**

UNIT IV	Secure Coding Techniques	9
Protection against DoS attacks, Application Failure Attacks, CPU Starvation Attacks, Insecure Coding Practices In Java Technology. ARP Spoofing and its countermeasures. Buffer Overrun-Stack overrun, Heap Overrun, Array Indexing Errors,FormatString Bugs. Security Issues in C Language: String Handling, Avoiding Integer Overflows and Underflows and Type Conversion Issues- Memory Management Issues, Code Injection Attacks,Canary based countermeasures using StackGuard and Propolice. Socket Security, Avoiding Server Hijacking, Securing RPC, ActiveX and DCOM		**CO4**

UNIT V	Database and Web-specific issues	9
SQL Injection Techniques and Remedies,Race conditions, Time of Check Versus Time of Use	**CO5**

and its protection mechanisms. Validating Input and Page 21 of 46 Interprocess Communication, Securing Signal Handlers and File Operations. XSS scripting attack and its types – Persistent and Non persistent attack XSS Countermeasures and Bypassing the XSS Filters.

TOTAL : 45 PERIODS

TEXT BOOKS

1.Writing Secure Code, Michael Howard and David LeBlanc,Microsoft Press, 2nd Edition, 2004

REFERENCE BOOKS

1. Buffer Overflow Attacks: Detect, Exploit, Prevent by Jason Deckar,Syngress,1st Edition, 2005

2. Threat Modeling, Frank Swiderski and Window Snyder,Microsoft Professional, 1st Edition, 2004.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To implement security as a culture and show mistakes that make applications vulnerable to attacks.
CO2	To understand various attacks like DoS, buffer overflow, web specific, database specific, web-spoofing attacks
CO3	To demonstrate skills needed to deal with common programming errors that lead to most security problems and to learn how to develop secure applications.
CO4	To identify the nature of the threats to software and incorporate secure coding practices throughout the planning and development of the product.
CO5	Able to properly handle application faults, implement secure authentication, authorization and data validation controls used to prevent common vulnerabilities.

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	1	3	2	-	-	-	-	2	1	2	3	3	2
CO2	3	3	1	3	2	-	-	-	-	2	1	2	3	3	2
CO3	3	3	1	3	2	-	-	-	-	2	1	2	3	3	2
CO4	3	3	1	3	2	-	-	-	-	2	1	2	3	3	2
CO5	3	3	1	3	2	-	-	-	-	2	1	2	3	3	2

SEMESTER VIII

PROFESSIONAL ELECTIVE – VI

IT1821	IOT PLATFORM FOR SMART CITY PLANNING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Concepts of Internet of Things.
- IoT Architecture and Terminologies.
- IoT working platform for different system.
- IoT standards for smart city planning.
- IoT applications on different sectors.

UNIT I	INTRODUCTION TO IOT	9
Overview and Introduction - Internet of Things (IoT) - Web of Things (WoT) - Cloud of Things - Need for IoT on Cloud - Services in the Cloud for the Internet of Things - Applications of IoT – Detailed Domain Model.		CO1
UNIT II	IOT ARCHITECTURE	9
IoT Architecture - Sensor Layer - Gateway and Network Layer - Management Service Layer - Application Layer - IoT Enabling Technologies - Addressing Schemes - Data Storage and Analytics – Visualization - Connected Domains – Connected Home -Connected Worker - Connected Automobile - Connected Industry.		CO2
UNIT III	IOT PLATFORMS DESIGN METHODOLOGY	9
IoT Systems – Intel IoT Framework - Qualcomm IoT Framework - Microsoft IoT Framework - ARM IoT Framework - Logical Design - Programming IoT platform (eg: Python, Mono C# , Objective-C, Ruby), Raspberry Pi - Program for Firmware – Case Studies		CO3
UNIT IV	IOT STANDARDS	9
Need for the IOT standards - IOT and Smart City Standards and Policies: Global perspective – Policy Research and Standardization in Europe – Indian Standards formulation – Sectional committee and composition – Challenges in standardization - Digital infrastructure		CO4
UNIT V	IOT APPLICATIONS	9
Lighting as service – Smart Parking -Smart metering – Smart water management- Smart energy– Smart solid waste management - Smart mobility – Smart governance- Challenges in IoT Management.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Olivier Hersent, David Boswarthick and Omar Elloumi, "The Internet of Things: Key Applications and Protocols",

   Second Edition, Wiley Publisher, 2012.

2. Uckelmann, Dieter, Mark Harrison, and Florian Michahelles, "Architecting the Internet of Things". SpringerScience & Business Media, 2011.

REFERENCE BOOKS

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", 2014.

2. Doukas, Charalampos, Building internet of things with the Arduino, CreateSpace Independent Publishing Platform, 2012.

3. Lu, Yan, Yan Zhang, Laurence T. Yang, HuanshengNing. "The Internet of Things: From RFID to the NextGeneration Pervasive Networked Systems", CRC Press.

4. Massimo Banzi, "Getting Started with Arduino (Make: Projects)", O'Reilly Media. 2008.

5. Samuel Greengard, "The Internet of Things (The MIT Press Essential Knowledge series)", MIT Press, 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Analyze the different concepts and theories of Internet of Things.
CO2	Assess the various components of IoT architecture.
CO3	Perform the IoT applications in programming platform
CO4	Adopt the IoT standards for smart city planning
CO5	Apply the understandings of IoT in different sectors of smart city planning.

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	1	3	2	-	-	1	-	2	2	2	3	3	2
CO2	3	3	1	3	2	-	-	1	-	2	2	2	3	3	2
CO3	3	3	1	3	2	-	-	1	-	2	2	2	3	3	2
CO4	3	3	1	3	2	-	-	1	-	2	2	2	3	3	2
CO5	3	3	1	3	2	-	-	1	-	2	2	2	3	3	2

IT1822	TRUST NETWORKS	L	P	T	C
		3	0	0	3

OBJECTIVES

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

UNIT I	Block chain	9
The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS) .		CO1

UNIT II	Crypto Currency	9
cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography		CO2

UNIT III	Crypto Currency Regulation	9
Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.		CO3

UNIT IV	Ethereum	9
Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts		CO4

UNIT V	Trends and Topics	9
Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.		CO5

	TOTAL : 45 PERIODS

TEXT BOOKS

Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. (Free download available)

REFERENCE BOOKS

1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) { curtain raiser kind of generic article, written by seasoned experts and pioneers}.

2. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310. (Also available at eprint.iacr.org/2016/1048)

3. R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017, (eprint.iacr.org/2016/454)

4. R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint.iacr.org/2016/916).

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	List and describe differences between proof-of-work and proof-of-stake consensus
CO2	Understand the basics of cryptocurrency
CO3	Interact with a blockchain system by sending and reading transactions.
CO4	Explain design principles of Ethereum.
CO5	Design, build, and deploy a distributed application.

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	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO2	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO3	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO4	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2
CO5	1	2	2	2	1	-	-	1	1	1	1	1	2	2	2

IT1823	ARTIFICIAL INTELLIGENCE AND ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide an introduction to the basic principles, techniques, and applications of Artificial Intelligence.
- To know about Lisp and Prolog and use of these languages in AI.

UNIT I	Scope of AI	9
Games theorem, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction		CO1

UNIT II	Problem solving	9
State space search; Production systems, search space control: depth first, breadth-first search, heuristic search - hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis		CO2

UNIT III	Knowledge Representation	9
Predicate Logic: unification, modus pones, resolution, dependency directed backtracking. Rule based Systems: forward reasoning, conflict resolution, backward reasoning, use of no backtracks. Structured Knowledge Representation: semantic net slots, exceptions and default frames, conceptual dependency, scripts		CO3

UNIT IV	Handling uncertainty and learning	9
Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, genetic algorithm, learning by inductions, neural network.		CO4

UNIT V	Robotics and its application	9
Robotics and Its applications, DDD concept, Intelligent robots, Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot-Speed of RobotRobot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Elaine Rich, Kevin Knight, Artificial Intelligence TMH (Any Edition).
2. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
3. Max Braber, Logic Programming with Prolog, Springer, 2005.
4. E. Rich and K. Knight, "Artificial intelligence", MH, 2nd ed., 1992.
5. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 2000.

REFERENCE BOOKS

1. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000

2. D. W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.

3. R. J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.

4. George Lugar, .AI-Structures and Strategies for and Strategies for Complex Problem solving, 4/e,2002, Pearson Educations.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Apply basics of Fuzzy logic and neural networks
CO2	Explain Expert System and implementation
CO3	Apply Knowledge representation and semantic in Knowledge representation.
CO4	Develop some familiarity with current research problems and research methods in AI.
CO5	Demonstrate and Illustrate about functionalities of Robots and Robotics.

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

CS1821	SOFTWARE DEFINED NETWORKS	L	T	P	C
	(Common to CSE)	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 HypervisorBased 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 Beginnersǁ, 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	1	3	2	-	-	-	1	-	2	2	2	3	2	2
CO2	3	1	3	2	-	-	-	1	-	2	2	2	3	2	2
CO3	3	1	3	2	-	-	-	1	-	2	2	2	3	2	2
CO4	3	1	3	2	-	-	-	1	-	2	2	2	3	2	2
CO5	3	1	3	2	-	-	-	1	-	2	2	2	3	2	2

MB1206	BUSINESS ANALYTICS	L	P	T	C
	(Common to MBA)	3	0	0	3

OBJECTIVES

- To learn the fundamentals of Business Analytics
- To understand the importance of Resource Management in business Analytics
- To understand the fundamentals of Descriptive Analysis
- To understand the role of Predictive Analysis
- To understand the concepts of Prescriptive Analysis

UNIT I	INTRODUCTION TO BUSINESS ANALYTICS (BA)	9
Business Analytics- Terminologies, Process, Importance, Relationship with Organisational Decision Making, BA for Competitive Advantage.		CO1

UNIT II	MANAGING RESOURCES FOR BUSINESS ANALYTICS	9
Managing BA Personnel, Data and Technology. Organisational Structures aligning BA. Managing Information policy, data quality and change in BA.		CO2

UNIT III	DESCRIPTIVE ANALYTICS	9
Introduction to Descriptive analytics - Visualising and Exploring Data - Descriptive Statistics – Sampling and Estimation – Probability Distribution for Descriptive Analytics – Analysis of Descriptive analytics		CO3

UNIT IV	PREDICTIVE ANALYTICS	9
Introduction to Predictive analytics – Logic and Data Driven Models – Predictive Analysis Modeling and procedure – Data Mining for Predictive analytics. Analysis of Predictive analytics		CO4

UNIT V	PRESCRIPTIVE ANALYTICS	9
Introduction to Prescriptive analytics – Prescriptive Modeling – Non Linear Optimisation – Demonstrating Business Performance Improvement.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications-What, Why, and How", Pearson,2014

2. Christian Albright Sand Wayne L. Winston, "Business Analytics-Data Analysis and Decision Making", Fifth edition, Cengage Learning, 2015.

REFERENCE BOOKS

1. James R. Evans, "Business Analytics - Methods, Models and Decisions", Pearson Ed,2012.

2. Newbold, Carlson, Thorne – Statistics for Business and Economics, 6th ed., Pearson

3. S. C.Gupta – Fundamentals of Statistics, Himalaya Publishing

4. Walpole – Probability and Statistics for Scientists and Engineers, 8th ed., Pearson

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To understand the fundamentals of Business Analytics
CO2	To understand the intricacies in managing resources for business Analytics
CO3	To understand the applications of Descriptive Analysis
CO4	To understand and importance of Predictive Analysis
CO5	To understand the importance and applications of Prescriptive Analytics

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	3	2	2	3	2	2	1	3	2	1	2	2	3
CO2	3	2	2	3	2	2	1	3	2	2	2	2	3
CO3	3	3	1	3	2	2	2	3	2	1	3	1	3
CO4	3	3	2	3	3	2	2	3	2	1	3	2	3
CO5	3	3	2	3	2	2	2	3	2	1	3	2	3

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.		CO2
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.		

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

TEXT BOOKS

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, KamaliKannargare., 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 DATAMODELS	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 INPUTANDTOPOLOGY	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 QUALITYANDSTANDARDS	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 MANAGEMENTANDOUTPUT	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 - TsungChang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition,2011.
2. Ian Heywood, Sarah Cornelius, SteveCarver,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
Introduction to Embedded Systems –Building blocks of Embedded System, Structural units in Embedded processor, selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Oscillator and Reset Circuits-Real Time Clock. Introduction to a brief study on a typical embedded processor.		**CO1**

			9
UNIT II	**INTRODUCTION TO EMBEDDED PROCESSORS**		
Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocolsRS232 standard – RS422 – RS 485- Inter Integrated Circuits (I2C), Serial Peripheral Interface (SPI), CAN Bus, – USB- Wi-Fi- Bluetooth- Zigbee - need for Device Drivers.		**CO2**

UNIT III	INTRODUCTION TO IoT		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	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- MQTT- AT Commands		**CO4**

UNIT V	EMBEDDED And IoT CASE STUDIES		9
Industry 4.0 Concepts - Sensors and Sensor Node – Interfacing using any Embedded Target Boards (Raspberry Pi / Aurdino) – Soil Moisture Monitoring – Weather Monitoring – Air Quality Monitoring – Movement Detection		**CO5**

TOTAL : 60 PERIODS

TEXT BOOKS:
1. Raj Kamal, 'Embedded Systems-Architecture, Programming, Design', Second Edition, Mc Graw Hill, 2013. 2. C.R. Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd,2013)
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

REFERENCES:
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.

COURSE OUTCOMES:
By the end of this course, the student should 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	PSO 3
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, WileyIndia 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
		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 – SacreHermant – 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. PoornimaM.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

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

IVA001	INDUSTRIAL INTERNET OF THINGS	L	T	P	C
		1	0	1	1

OBJECTIVES

1. The main learning objective of this course is to make the students an appreciation for:

2. To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.

3. Knowledge for the design and analysis of Industry 4.0Systems for Electronics Engineering students

UNIT I	INTRODUCTION TO INDUSTRIAL IOT (IIOT) SYSTEMS	6
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	6
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	6
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	6
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	6
Healthcare Power Plants – Inventory Management & Quality Control – Plant Safety and Security Oil – Chemical and Pharmaceutical industry – Applications of UAVs in Industries.		CO5

TOTAL : 30 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)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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

IVA002	**AUGMENTED REALITY & VIRTUAL REALITY**	L	T	P	C
		1	0	1	1

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)**	6
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**	**6**
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**	**6**
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**	**6**
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**	**6**
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 : 30 PERIODS

REFERENCE:

Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018

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)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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

IVA003	ETHICAL HACKING - CYBER SECURITY	L	T	P	C
		1	0	1	1

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	6
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	6
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	6
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	6
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	6
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 : 30 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	PSO1	PSO2	PSO3
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

IVA004	BLOCKCHAIN AND CRYPTO CURRENCIES	L	T	P	C
		1	0	1	1

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**	6
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**	6
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**	6
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**	6
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**	6
Introduction to Hyperledger – Hyperledger Fabric architecture– language supports for hyperledger fabric – setting up hyprledger fabric - Building application in hyperledger fabric.		**CO5**

TOTAL : 30 PERIODS

REFERENCES:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
2. A. 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	3	3	2	-	2	1	-	-	1	-	-	1	2	2	3
CO2	3	3	2	-	2	2	-	-	1	-	-	1	2	2	3
CO3	3	3	2	1	2	-	-	-	1	-	-	1	2	2	3
CO4	3	3	2	1	2	-	-	-	1	-	-	1	2	2	3
CO5	3	3	2	1	2	-	-	-	1	-	-	1	2	2	3

IVA005	INDUSTRIAL PRACTICES WITH DEVOPS	L	T	P	C
		1	0	1	1

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	6
Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github		CO1
UNIT II	COMPILE AND BUILD USING MAVEN & GRADLE	6
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	6
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	6
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	6
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 : 30 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

IVA006	APPLIED MACHINE LEARNING WITH PYTHON	L	T	P	C
		1	0	1	1

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	6
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	6
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	6
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	6
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	6
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 : 30 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)		
	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

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	9
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**	**9**
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**	**9**
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**	**9**
Emergency Provisions - National Emergency, President Rule, Financial Emergency		CO4
UNIT V	**LOCAL ADMINISTRATION**	**9**
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 ZilaPachayat- Position and role-Block level Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

4. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
5. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.
6. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
7. The Constitution of India (Bare Act), Government Publication,1950

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	9
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	9
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	9
Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and 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	9
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	9
Equality, Non-violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively		CO5

	TOTAL : 45 PERIODS

REFERENCE:

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	9
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	9
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	9
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	REINCARNATION THROUGH VALUE EDUCATION	9
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	9
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.		CO5

	TOTAL : 45 PERIODS

REFERENCE:

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	9
Definitions of Eight parts of yog.(Ashtanga)		CO1

UNIT II	YAM	9
Do`s and Don't's in life.Shaucha, santosh, tapa, swadhyay, ishwarpranidhan		CO2

UNIT III	NIYAM	9
Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha		CO3

UNIT IV	ASAN	9
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	9
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.		CO5

TOTAL : 45 PERIODS

REFERENCE:

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

COs	MAPPING OF COs WITH POs AND PSOs														
	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	9
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	9
Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)		CO2
UNIT III	ORGANS OF GOVERNANCE	9
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	9
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	9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63		CO5
	TOTAL : 45 PERIODS	

REFERENCE:

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	9
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	9
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	9
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	9
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.		CO4

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.		
UNIT V	**FIELD WORK**	**9**

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

CO5

• 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.

TOTAL : 45 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	Able to understand of rural life, culture and social realities
CO2	Able to understand the concept of measurement by comparison or balance of parameters.
CO3	Able to develop a sense of empathy and bonds of mutuality with local community
CO4	Able to appreciate significant contributions of local communities to Indian society and economy
CO5	Learned to 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	0

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	9
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	9
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	9
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)	9
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	9
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 : 45 PERIODS

REFERENCE:

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	Know the contribution of scientists of different eras.

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	-	-	-

		L	**T**	**P**	**C**
AD1008	**SANGA TAMIL LITERATURE APPRECIATION**				
		2	**0**	**0**	**0**

OBJECTIVES

The main learning objective of this course is to make the students an appreciation for:

- 1. Introduction to Sanga Tamil Literature.
- 2.'Agathinai' and'Purathinai' in SangaTamil Literature.
- 3.'Attruppadai' in SangaTamil Literature.
- 4.'Puranaanuru' in SangaTamil Literature.
- 5.'Pathitrupaththu' in SangaTamil Literature.

UNIT I	SANGA TAMIL LITERATURE – AN INTRODUCTION	9
Introduction to Tamil Sangam–History of Tamil Three Sangams–Introduction to Tamil Sangam Literature–Special Branches in Tamil Sangam Literature- Tamil Sangam Literature's Grammar Tamil Sangam Literature's parables.		**CO1**
UNIT II	'AGATHINAI'AND'PURATHINAI'	9
Tholkappiyar's Meaningful Verses–Three literature materials–Agathinai's message- History of Culture from Agathinai– Purathinai–Classification–Mesaage to Society from Purathinai.		**CO2**
UNIT III	'ATTRUPPADAI'.	9
AttruppadaiLiterature–Attruppadaiin'Puranaanuru'-Attruppadaiin'Pathitrupaththu'-Attruppadaiin 'Paththupaattu'.		**CO3**
UNIT IV	'PURANAANURU'	9
Puranaanuru on Good Administration, Ruler and Subjects–Emotion & its Effect in Puranaanuru.		**CO4**
UNIT V	'PATHITRUPATHTHU'	9
Pathitrupaththuin'Ettuthogai'–Pathitrupaththu'sParables–Tamildynasty:Valor, Administration,Charity in Pathitrupaththu- Mesaage to Society from Pathitrupaththu.		**CO5**

	TOTAL : 45 PERIODS

REFERENCE:

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	-	-	-

GE1209   தமிழர் மரபு   **L T P C**
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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
நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின்
வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன்
ஆகியோரின் பங்களிப்பு.

**அலகு II   மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை –
                 சிற்பக் கலை:   3**
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 விளையாட்டுகள்:   3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம்,
தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்
விளையாட்டுகள்.

அலகு IV   தமிழர்களின் திணைக் கோட்பாடுகள்:   3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க
இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய
அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் –
சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி
மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V   இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத்
                 தமிழர்களின் பங்களிப்பு:   3**
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.   கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.   கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல்
     துறை வெளியீடு)

                                    1

4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (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 BOOKS

UNIT I   LANGUAGE AND LITERATURE   3

Language Families in India - Dravidian Languages – Tamil as aClassical 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.   கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.   கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.   பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5.   Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.   Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.   Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.   The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9.   Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.   Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (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   <u>தமிழரும் தொழில்நுட்பமும்</u>   **L T P C**
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அலகு I   <u>நெசவு மற்றும் பானைத் தொழில்நுட்பம்</u>:   3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II   <u>வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்</u>:   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   <u>உற்பத்தித் தொழில் நுட்பம்</u>:   3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எழும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV   <u>வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்</u>:   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   <u>அறிவியல் தமிழ் மற்றும் கணித்தமிழ்</u>:   3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் 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. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
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12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

TAMILS AND TECHNOLOGY

UNIT I   WEAVING AND CERAMIC TECHNOLOG   **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 gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY   **3**

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 SpecificSociety.

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 (வெளியிடு: தமிழ்நாடு பாட நூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).

3. கீழடி – வைகை நதிக் கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை– ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

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

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