



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



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



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**B.Tech INFORMATION TECHNOLOGY**  
**REGULATION 2021**  
**CHOICE BASED CREDIT SYSTEM**  
**I TO VIII SEMESTERS CURRICULAM AND SYLLABUS**  
**For the candidate Admitted in the Academic Year 2022-2026**

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs):**

**PEO1: Intellectual progress**

To ensure graduates will be proficient in utilizing the fundamental knowledge of basic sciences, mathematics and Information Technology for the applications relevant to various streams of Engineering and Technology.

**PEO2: Skill augmentation**

To enrich graduates with the core competencies necessary for applying knowledge of computers and telecommunications equipment to store, retrieve, transmit, manipulate and analyze data in the context of business enterprise.

**PEO3: Continuing education**

To enable graduates to think logically, pursue lifelong learning and will have the capacity to understand technical issues related to computing systems and to design optimal solutions.

**PEO4: Nurture Technocrat**

To enable graduates to develop hardware and software systems by understanding the importance of social, business and environmental needs in the human context.

**PEO5: Career development**

To enable graduates to gain employment in organizations and establish themselves as professionals by applying their technical skills to solve real world problems and meet the diversified needs of industry, academia and research.

**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 OUTCOMES (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	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	3										
2	2		2	1	3							
3												3
4						2	3	3	2		1	
5			2	2	2	1				2	1	

## MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

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

PROGRAM SPECIFIC OUTCOMES	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	√	√	√	√	√	√			√	√	√	√	√	√	√
	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	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	தமிழர் மரபு / Heritage of Tamils															
	Engineering Practice Laboratory	√	√	√			√						√	√	√	√
	Programming in C Laboratory	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
III	Probability and Statistics	√	√	√	√	√	√				√	√	√	√	√	√
	Java Programming	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Digital Principles and Logic Design (Lab Integrated)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

	Data Structures	√	√	√	√	√	√				√	√	√	√	√	√
	Computer Architecture	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Software Engineering	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology															
	Data Structures Laboratory using C	√	√	√	√	√			√	√	√	√	√	√	√	√
	Java Programming Laboratory	√	√	√	√	√			√	√	√	√	√	√	√	√
	Professional Skills Laboratory		√		√	√				√	√			√	√	√
<b>IV</b>	Discrete Mathematics	√	√	√	√	√	√				√	√	√	√	√	√
	Design and Analysis of Algorithms	√	√	√	√	√				√		√	√	√	√	√
	Operating Systems	√	√	√	√							√	√	√	√	√
	Database Design and Management (Lab Integrated)	√	√	√	√	√	√	√				√	√	√	√	√
	Computer Communication	√	√	√	√	√					√	√	√	√	√	√
	Foundations of Machine Learning	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Operating Systems Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Machine Learning Laboratory	√	√	√	√	√						√	√	√	√	√
<b>V</b>	Algebra and Number Theory	√	√	√		√				√	√			√	√	√
	Object Oriented Analysis and Design	√	√	√	√	√						√	√	√	√	√
	Web Technology			√		√					√	√	√	√	√	√
	Computational Intelligence (Lab Integrated)	√	√	√	√	√	√				√	√	√	√	√	√
	Web Technology Laboratory	√		√		√					√	√	√	√	√	√
	Object Oriented Analysis and Design Laboratory	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<b>VI</b>	Theory of Computation and Compiler Design	√	√	√	√	√				√	√	√	√	√	√	√

	Mobile Networks and Application Development	√	√	√	√	√					√	√	√	√	√	√
	Computer Graphics and Applications	√	√	√	√	√					√	√	√	√	√	√
	Data Science and Big Data Analytics	√	√	√	√	√	√	√				√	√	√	√	√
	Mobile Networks and Application Development Laboratory	√	√	√	√	√					√	√	√	√	√	√
	Mini Project	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<b>VII</b>	Neural Networks and Deep Learning	√	√	√	√	√	√			√	√	√	√	√	√	√
	Cloud and Edge Computing	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Cryptography and Network Security	√	√	√	√	√				√	√	√	√	√	√	√
	Organizational Behavior	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Cloud and Edge Computing Laboratory	√	√	√	√	√			√	√	√	√	√	√	√	√
	Project Phase- I	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<b>VIII</b>	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
<b>V</b>	Optimization Techniques	√	√	√	√	√					√	√	√	√	√	√
	Video Creation and Editing	√	√	√	√	√					√	√	√	√	√	√
	Information Storage and Management	√	√	√	√	√					√	√	√	√	√	√
	Knowledge Engineering	√	√	√	√	√		√			√	√	√	√	√	√
	Fundamentals of Digital Image Processing	√	√	√	√	√				√	√	√	√	√	√	√
<b>VI</b>	Fuzzy Logic and Artificial Neural Networks	√	√	√	√	√					√		√	√	√	√
	Software Testing and Quality Assurance	√	√	√	√	√					√	√	√	√	√	√
	Natural Language Processing Tools and Applications	√	√	√	√	√			√		√	√	√	√	√	√

	Engineering Ethics and Human Values	√	√	√	√	√			√	√	√	√	√	√	√	√
	Image and Video Analytics	√	√	√	√	√					√	√	√	√	√	√
<b>VII</b>	Web Development Frameworks	√	√	√	√	√					√	√	√	√	√	√
	Management Information Systems	√	√	√	√	√					√	√	√	√	√	√
	Parallel Algorithms	√	√	√	√	√		√			√	√	√	√	√	√
	Techniques and Applications of Mixed Reality	√	√	√	√	√			√	√	√	√	√	√	√	√
	Virtualization Techniques	√	√	√	√	√					√	√	√	√	√	√
<b>VII</b>	Storage Area Networks	√	√	√	√	√						√	√	√	√	√
	UI/UX Application Development	√	√	√	√	√	√					√	√	√	√	√
	Software Agents	√	√	√	√	√						√	√	√	√	√
	5G Networks	√	√	√	√	√					√	√	√	√	√	√
	Social Network Analytics	√	√	√	√	√					√	√	√	√	√	√
<b>VIII</b>	Information Theory and Coding	√	√	√	√	√					√	√	√	√	√	√
	Electronic Commerce	√	√	√	√	√					√	√	√	√	√	√
	Affective Computing	√	√	√	√	√					√		√	√	√	√
	Social Media Mining	√	√	√	√	√					√	√	√	√	√	√
	Speech Processing and Synthesis	√	√	√	√	√	√				√	√	√	√	√	√
<b>VIII</b>	Introduction to Digital Currencies	√	√	√	√	√					√	√	√	√	√	√
	Trust Networks	√	√	√	√	√			√	√	√	√	√	√	√	√
	Artificial Intelligence and Robotics	√	√	√	√	√		√				√	√	√	√	√
	IoT Platform for Smart City Planning	√	√	√	√	√			√		√	√	√	√	√	√
	Blockchain Technologies	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

**SEMESTER – I**

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS1101	Communicative English <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	HSMC	45	3	0	0	3
2.	MA1102	Engineering Mathematics – I <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	BSC	60	3	1	0	4
3.	PH1103	Engineering Physics <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	BSC	45	3	0	0	3
4.	CY1104	Engineering Chemistry <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	BSC	45	3	0	0	3
5.	GE1105	Problem Solving and Python Programming <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	ESC	45	3	0	0	3
6.	GE1106	Engineering Graphics <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	ESC	90	2	0	4	4
<b>PRACTICALS</b>								
7.	GE1107	Python Programming Laboratory <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	ESC	60	0	0	4	2
8.	BS1108	Physics and Chemistry Laboratory <b>(Common for all branches of B.E. /B. Tech Programmes)</b>	BSC	60	0	0	4	2
<b>TOTAL</b>				<b>450</b>	<b>17</b>	<b>1</b>	<b>12</b>	<b>24</b>

**SEMESTER II**

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS1201	Professional English (Common for all branches of B.E. /B. Tech Programmes)	HSMC	45	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	60	3	1	0	4
3.	PH1252	Physics for Information Science (Common to CSE, IT, AI-DS & AI-ML)	BSC	45	3	0	0	3
4.	GE1204	Environmental Science and Engineering (Common for all branches of B.E. /B. Tech Programmes)	HSMC	45	3	0	0	3
5.	BE1251	Basic Electrical, Electronics and Measurement Engineering (Common to CSE, IT, AI-DS & AI-ML)	ESC	45	3	0	0	3
6.	CS1206	Programming in C (Common to CSE, IT, AI-DS & AI-ML)	PCC	45	3	0	0	3
7	GE1209	தமிழர் மரபு / Heritage of Tamils (Common for all branches of B.E. /B. Tech Programmes)	HSMC	15	1	0	0	1
<b>PRACTICALS</b>								
8.	GE1207	Engineering Practices Laboratory (Common for all branches of B.E. /B. Tech Programmes)	ESC	60	0	0	4	2
9.	CS1208	Programming in C Laboratory (Common to CSE, IT, AI-DS & AI-ML)	PCC	60	0	0	4	2
<b>TOTAL</b>				<b>420</b>	<b>19</b>	<b>1</b>	<b>8</b>	<b>24</b>

**SEMESTER – III**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	MA1351	Probability and Statistics (Common to CSE, IT & AI-DS)	BSC	60	3	1	0	4
2	IT1301	Java Programming	PCC	45	3	0	0	3
3	CS1301	Digital Principles and Logic Design (Lab Integrated) (Common to CSE & IT)	ESC	75	3	0	2	4
4	CS1302	Data Structures (Common to CSE, IT, AI-DS & AI-ML, ECE IV Sem)	PCC	45	3	0	0	3
5	CS1304	Computer Architecture (Common to CSE & IT)	PCC	45	3	0	0	3
6	CS1305	Software Engineering (Common to CSE & IT)	PCC	45	3	0	0	3
7.	GE1210	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology (Common for all branches of B.E. /B. Tech Programmes)	HSMC	15	1	0	0	1
<b>PRACTICALS</b>								
8.	CS1307	Data Structures Laboratory using C (Common to CSE, IT & ECE IV Sem)	PCC	60	0	0	4	2
9.	IT1308	Java Programming Laboratory	PCC	60	0	0	4	2
10.	HS1310	Professional Skills Laboratory (Common to IT & AI-ML)	HSMC	30	0	0	2	1
<b>Total</b>				<b>480</b>	<b>19</b>	<b>1</b>	<b>12</b>	<b>26</b>

**SEMESTER – IV**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	MA1453	Discrete Mathematics (Common to CSE, IT & AI-DS)	BSC	60	3	1	0	4
2	CS1401	Design and Analysis of Algorithms (Common to CSE, IT, AI-DS & AI-ML)	PCC	45	3	0	0	3
3	CS1402	Operating Systems (Common to CSE, IT, AI-DS & AI-ML)	PCC	45	3	0	0	3
4	CS1403	Database Design and Management (Lab Integrated) (Common to CSE, IT, AI-DS & AI-ML)	PCC	75	3	0	2	4
5	IT1401	Computer Communication	PCC	45	3	0	0	3
6	ML1401	Foundations of Machine Learning (Common to AI-ML, IT & AI-DS)	PCC	45	3	0	0	3
<b>PRACTICALS</b>								
7	CS1407	Operating Systems Laboratory (Common to CSE, IT & AI-ML)	PCC	60	0	0	4	2
8	ML1408	Machine Learning Laboratory (Common to AI-ML, IT & AI-DS)	PCC	60	0	0	4	2
<b>Total</b>				<b>435</b>	<b>18</b>	<b>1</b>	<b>10</b>	<b>24</b>

**SEMESTER – V**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	MA1501	Algebra and Number Theory <b>(Common to CSE &amp; IT)</b>	BSC	60	3	1	0	4
2	CS1502	Object Oriented Analysis and Design <b>(Common to CSE &amp; IT)</b>	PCC	45	3	0	0	3
3	IT1501	Web Technology	PCC	45	3	0	0	3
4	IT1502	Computational Intelligence (Lab Integrated)	PCC	75	3	0	2	4
5		Open Elective-I	OEC	45	3	0	0	3
6		Professional Elective-I	PEC	45	3	0	0	3
<b>PRACTICALS</b>								
7	IT1507	Web Technology Laboratory	PCC	60	0	0	4	2
8	CS1508	Object Oriented Analysis and Design Laboratory <b>(Common to CSE &amp; IT)</b>	PCC	60	0	0	4	2
<b>Total</b>				<b>435</b>	<b>18</b>	<b>1</b>	<b>10</b>	<b>24</b>
Employability Enhancement Skill based Course-I			EEC	<b>45</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**SEMESTER – VI**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	IT1601	Theory of Computation and Compiler Design	PCC	45	3	0	0	3
2	IT1602	Mobile Networks and Application Development	PCC	45	3	0	0	3
3	IT1603	Computer Graphics and Applications	PCC	45	3	0	0	3
4	IT1604	Data Science and Big Data Analytics	PCC	45	3	0	0	3
5		Open Elective-II	OEC	45	3	0	0	3
6		Professional Elective-II	PEC	45	3	0	0	3
<b>PRACTICAL</b>								
7	IT1607	Mobile Networks and Application Development Laboratory	PCC	60	0	0	4	2
8	IT1608	Mini Project	EEC	60	0	0	4	2
<b>Total</b>				<b>390</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>
9		Value Added Course	EEC					2
10		Audit Course (Optional)	AC					
		Employability Enhancement Skill based Course-II	EEC	<b>45</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

For Value Added Courses, the grade earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

### SEMESTER – VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	IT1701	Neural Networks and Deep Learning	PCC	45	3	0	0	3
2	IT1702	Cloud and Edge Computing	PCC	45	3	0	0	3
3	CS1703	Cryptography and Network Security (Common to CSE & IT)	PCC	45	3	0	0	3
4	IT1703	Organizational Behavior	PCC	45	3	0	0	3
5		Professional Elective-III	PEC	45	3	0	0	3
6		Professional Elective-IV	PEC	45	3	0	0	3
<b>PRACTICALS</b>								
7	IT1707	Cloud and Edge Computing Laboratory	PCC	60	0	0	4	2
8	IT1708	Project Phase – I	EEC	60	0	0	4	2
<b>Total</b>				<b>390</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>
9	IT1709	Internship	EEC					1

\*Two weeks summer internship carries one credit and it will be done during VI semester vacation and same evaluated in VII semester.

\*Credit course evaluation is fully internal

**SEMESTER – VIII**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1		Professional Elective-V	PEC	45	3	0	0	3
2		Professional Elective-VI	PEC	45	3	0	0	3
<b>PRACTICALS</b>								
3	IT1807	Project Phase-II	EEC	300	0	0	20	10
<b>Total</b>				<b>390</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>

**Total Credits: 182**

**HUMANITIES SCIENCE AND MANAGEMENT COURSES (HSMC)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS1101	Communicative English	HSMC	45	3	0	0	3
2	HS1201	Professional English	HSMC	45	3	0	0	3
3	GE1204	Environmental Science and Engineering	HSMC	45	3	0	0	3
4	HS1310	Professional Skills Laboratory	HSMC	30	0	0	2	1
5	GE1209	தமிழர் மரபு / Heritage of Tamils	HSMC	15	1	0	0	1
6	GE1210	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HSMC	15	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	60	3	1	0	4
2	PH1103	Engineering Physics	BSC	45	3	0	0	3
3	CY1104	Engineering Chemistry	BSC	45	3	0	0	3
4	BS1108	Physics and Chemistry Laboratory	BSC	60	0	0	4	2
5	MA1202	Engineering Mathematics- II	BSC	60	3	1	0	4
6	PH1252	Physics for Information Science	BSC	45	3	0	0	3
7	MA1351	Probability and Statistics	BSC	60	3	1	0	4
8	MA1453	Discrete Mathematics	BSC	60	3	1	0	4
9	MA1501	Algebra and Number Theory	BSC	60	3	1	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	45	3	0	0	3
2	GE1106	Engineering Graphics	ESC	90	2	0	4	4
3	GE1107	Python Programming Laboratory	ESC	60	0	0	4	2
4	BE1251	Basic Electrical, Electronics and	ESC	45	3	0	0	3

		Measurement Engineering						
5	GE1207	Engineering Practices Laboratory	ESC	60	0	0	4	2
6	CS1301	Digital Principles & Logic Design (Lab Integrated)	ESC	75	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	45	3	0	0	3
2	CS1208	Programming in C Laboratory	PCC	60	0	0	0	2
3	IT1301	Java Programming	PCC	45	3	0	0	3
4	CS1302	Data Structures	PCC	45	3	0	0	3
5	CS1304	Computer Architecture	PCC	45	3	0	0	3
6	CS1305	Software Engineering	PCC	45	3	0	0	3
7	CS1307	Data Structures Laboratory using C	PCC	60	0	0	4	2
8	IT1308	Java Programming Laboratory	PCC	60	0	0	4	2
9	CS1401	Design and Analysis of Algorithms	PCC	45	3	0	0	3
10	CS1402	Operating Systems	PCC	45	3	0	0	3
11	CS1403	Database Design and Management (Lab Integrated)	PCC	45	3	0	2	4
12	IT1401	Computer Communication	PCC	45	3	0	0	3
13	ML1401	Foundations of Machine Learning	PCC	45	3	0	0	3
14	CS1407	Operating Systems Laboratory	PCC	60	0	0	4	2
15	ML1408	Machine Learning Laboratory	PCC	60	0	0	4	2
16	CS1502	Object Oriented Analysis and Design	PCC	45	3	0	0	3
17	IT1501	Web Technology	PCC	45	3	0	0	3
18	IT1502	Computational Intelligence (Lab Integrated)	PCC	75	3	0	2	4
19	IT1507	Web Technology Laboratory	PCC	60	0	0	4	2
20	CS1508	Object Oriented Analysis and Design Laboratory	PCC	60	0	0	4	2
21	IT1601	Theory of Computation and Compiler Design	PCC	45	3	0	0	3

22	IT1602	Mobile Networks and Application Development	PCC	45	3	0	0	3
23	IT1603	Computer Graphics and Applications	PCC	45	3	0	0	3
24	IT1604	Data Science and Big Data Analytics	PCC	45	3	0	0	3
25	IT1607	Mobile Networks and Application Development Laboratory	PCC	60	0	0	4	2
26	IT1701	Neural Networks and Deep Learning	PCC	45	3	0	0	3
27	IT1702	Cloud and Edge Computing	PCC	45	3	0	0	3
28	CS1703	Cryptography and Network Security	PCC	45	3	0	0	3
29	IT1703	Organizational Behavior	PCC	45	3	0	0	3
30	IT1707	Cloud and Edge Computing Laboratory	PCC	60	0	0	4	2

**PROFESSIONAL ELECTIVE – I(SEMESTER V)**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1511	Optimization Techniques	PEC	45	3	0	0	3
2	IT1512	Video Creation and Editing	PEC	45	3	0	0	3
3	IT1513	Information Storage and Management	PEC	45	3	0	0	3
4	IT1514	Knowledge Engineering (Common to IT & AI-DS)	PEC	45	3	0	0	3
5	CS1515	Fundamentals of Digital Image Processing (Common to IT & CSE)	PEC	45	3	0	0	3

**PROFESSIONAL ELECTIVE – II (SEMESTER VI)**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1611	Fuzzy Logic and Artificial Neural Networks	PEC	45	3	0	0	3
2	IT1612	Software Testing and Quality Assurance	PEC	45	3	0	0	3
3	IT1613	Natural Language Processing Tools and Applications	PEC	45	3	0	0	3
4	DS1611	Image and Video Analytics (Common to IT &AI-DS)	PEC	45	3	0	0	3
5	GE1614	Engineering Ethics and Human Values	PEC	45	3	0	0	3

**PROFESSIONAL ELECTIVE – III (SEMESTER VII)**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1711	Web Development Frameworks	PEC	45	3	0	0	3
2	IT1712	Management Information Systems	PEC	45	3	0	0	3
3	IT1714	Parallel Algorithms	PEC	45	3	0	0	3
4	IT1715	Techniques and Applications of Mixed Reality	PEC	45	3	0	0	3
5	CS1712	Virtualization Techniques (Common to CSE & IT)	PEC	45	3	0	0	3

**PROFESSIONAL ELECTIVE –IV (SEMESTER VII)**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1721	Storage Area Networks	PEC	45	3	0	0	3
2	IT1722	UI/UX Application Development	PEC	45	3	0	0	3
3	IT1723	Software Agents	PEC	45	3	0	0	3
4	IT1724	5G Networks	PEC	45	3	0	0	3
5	DS1723	Social Network Analytics (Common to IT&AI-DS)	PEC	45	3	0	0	3

**PROFESSIONAL ELECTIVE – V (SEMESTER VIII)**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1811	Information Theory and Coding	PEC	45	3	0	0	3
2	IT1812	Electronic Commerce	PEC	45	3	0	0	3
3	IT1813	Affective Computing	PEC	45	3	0	0	3
4	IT1814	Social Media Mining	PEC	45	3	0	0	3
5	DS1812	Speech Processing and Synthesis (Common to IT & AI-DS)	PEC	45	3	0	0	3

**PROFESSIONAL ELECTIVE – VI (SEMESTER VIII)**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1821	Introduction to Digital Currencies	PEC	45	3	0	0	3
2	IT1822	Trust Networks	PEC	45	3	0	0	3
3	IT1823	Artificial Intelligence and Robotics	PEC	45	3	0	0	3
4	IT1824	IoT Platform for Smart City Planning	PEC	45	3	0	0	3
5	CS1824	Block chain Technologies (Common to IT & CSE)	PEC	45	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	45	3	0	0	3
2	OBT104	Biosensors	OEC	45	3	0	0	3
3	OBT105	Introduction to Nanoscience and Nanotechnology	OEC	45	3	0	0	3
4	OCE102	Introduction to Geographic Information System	OEC	45	3	0	0	3
5	OCH101	Hospital Management	OEC	45	3	0	0	3
6	OEC103	Basics of Embedded Systems and IoT	OEC	45	3	0	0	3
7	OEE101	Basic Circuit Theory	OEC	45	3	0	0	3
8	OEE103	Introduction to Renewable Energy Systems	OEC	45	3	0	0	3
9	OEI102	Robotics	OEC	45	3	0	0	3
10	OMB101	Total Quality Management	OEC	45	3	0	0	3

11	OME104	Industrial Safety Engineering	OEC	45	3	0	0	3
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**OPEN ELECTIVE COURSES OFFERED BY CSE, IT, AI-ML & AI-DS**

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

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IT1608	Mini Project	EEC	60	0	0	4	2
2	IT1708	Project Phase-I	EEC	60	0	0	4	2
3	IT1807	Project Phase-II	EEC	300	0	0	20	10
4	IT1709	Internship	EEC					1
5	Employability Enhancement Skill based Course-I		EEC	45	1	0	2	2
6	Employability Enhancement Skill based Course-II		EEC	45	1	0	2	2

VALUE ADEED COURSES								
7	VAC001	Industrial Internet of Things	EEC	45	1	0	2	2
8	VAC002	Augmented Reality and Virtual Reality	EEC	45	1	0	2	2
9	VAC003	Ethical Hacking - Cyber Security	EEC	45	1	0	2	2
10	VAC004	Blockchain and Crypto Currencies	EEC	45	1	0	2	2
11	VAC005	Industrial Practices with Devops	EEC	45	1	0	2	2
12	VAC006	Applied Machine Learning with Python	EEC	45	1	0	2	2

#### AUDIT COURSES (AC)

Sl. No.	Course Code	Subject Name	Category	Contact Periods	L	T	P	C
1	AD1001	Constitution of India	AC	30	2	0	0	0
2	AD1002	Value Education	AC	30	2	0	0	0
3	AD1003	Pedagogy Studies	AC	30	2	0	0	0
4	AD1004	Stress Management by Yoga	AC	30	2	0	0	0
5	AD1005	Personality Development Through Life Enlightenment Skills	AC	30	2	0	0	0
6	AD1006	Unnat Bharat Abhiyan	AC	30	2	0	0	0
7	AD1007	Essence of Indian Knowledge Tradition	AC	30	2	0	0	0
8	AD1008	Sanga Tamil Literature Appreciation	AC	30	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
<b>HSMC</b>	3	7	3						12	6.59
<b>BSC</b>	12	7	4	4	4				31	17.03
<b>ESC</b>	9	5	4						18	9.89
<b>PCC</b>		5	16	20	14	14	14		83	45.60
<b>PEC</b>					3	3	6	6	18	9.89
<b>OEC</b>					3	3			6	3.29
<b>EEC</b>						2	2	10	14	7.69
<b>Total</b>	<b>24</b>	<b>24</b>	<b>27</b>	<b>24</b>	<b>24</b>	<b>22</b>	<b>22</b>	<b>16</b>	<b>182</b>	<b>100</b>

Board Chairman	Dr. A. Chandrasekar	
Dean Academics	Dr. G. Sreekumar	
Principal	Dr. Vaddi Seshagiri Rao	





**SEMESTER I**

HS1101	<b>COMMUNICATIVE ENGLISH</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	(Common for all Branches of B.E. /B. Tech Programmes)	3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• To develop the basic reading and writing skills of first year engineering and technology students.</li> <li>• To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.</li> <li>• To help learners develop their speaking skills and speak fluently in real contexts.</li> <li>• To help learners develop vocabulary of a general kind by developing their reading skills.</li> </ul>					
<b>UNIT I</b>	<b>SHARING INFORMATION RELATED TO ONESELF/FAMILY&amp; FRIENDS</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>GENERAL READING AND FREE WRITING</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>GRAMMAR AND LANGUAGE DEVELOPMENT</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>READING AND LANGUAGE DEVELOPMENT</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>EXTENDED WRITING</b>	<b>9</b>			
Reading: Reading for comparisons and contrast and other deeper levels of meaning –Writing-					<b>CO5</b>

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.

**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

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

**OBJECTIVES**

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

<b>UNIT I</b>	<b>MATRICES</b>	<b>12</b>
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		<b>CO1</b>
<b>UNIT II</b>	<b>CALCULUS OF ONE VARIABLE</b>	<b>12</b>
Limit of a function - Continuity - Derivatives - Differentiation rules – Interval of increasing and decreasing functions – Maxima and Minima - Intervals of concavity and convexity.		<b>CO2</b>
<b>UNIT III</b>	<b>CALCULUS OF SEVERAL VARIABLES</b>	<b>12</b>
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.		<b>CO3</b>
<b>UNIT IV</b>	<b>INTEGRAL CALCULUS</b>	<b>12</b>
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.		<b>CO4</b>
<b>UNIT V</b>	<b>MULTIPLE INTEGRALS</b>	<b>12</b>
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		<b>CO5</b>
<b>TOTAL : 60 PERIODS</b>		

**TEXT BOOKS**

1. Grewal B.S., Higher Engineering MathematicsII, 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 MathematicsII, 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
<b>OBJECTIVES</b>					
To make the students conversant with					
<ul style="list-style-type: none"> <li>• Elastic properties of materials and various moduli of elasticity.</li> <li>• Principles of laser and fiber optics and its various technological applications.</li> <li>• Thermal conduction in solids, heat exchangers and its applications in various devices.</li> <li>• Quantum concepts to explain black body radiation, Compton effect and matter waves.</li> <li>• Various crystal structures, Miller indices and crystal growth techniques.</li> </ul>					
<b>UNIT I</b>	<b>PROPERTIES OF MATTER</b>				<b>9</b>
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.					<b>CO1</b>
<b>UNIT II</b>	<b>LASER AND FIBER OPTICS</b>				<b>9</b>
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.					<b>CO2</b>
<b>UNIT III</b>	<b>THERMAL PHYSICS</b>				<b>9</b>
Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conduction 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.					<b>CO3</b>
<b>UNIT IV</b>	<b>QUANTUM PHYSICS</b>				<b>9</b>
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.					<b>CO4</b>
<b>UNIT V</b>	<b>CRYSTAL PHYSICS</b>				<b>9</b>
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).	<b>CO5</b>
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**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	
<b>OBJECTIVES</b>						
To make the student conversant with the						
<ul style="list-style-type: none"> <li>Principles of water characterization and treatment for industrial purposes.</li> <li>Principles and applications of surface chemistry and catalysis.</li> <li>Phase rule and various types of alloys</li> <li>Various types of fuels, applications and combustion</li> <li>Conventional and non-conventional energy sources and energy storage device</li> </ul>						
<b>UNIT I</b>	<b>WATER AND ITS TREATMENT</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>SURFACE CHEMISTRY AND CATALYSIS</b>					<b>9</b>
<b>Surface chemistry</b> : 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.					<b>CO2</b>	
<b>Catalysis</b> : 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.						
<b>UNIT III</b>	<b>PHASE RULE AND ALLOYS</b>					<b>9</b>
<b>Phase rule</b> : 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.					<b>CO3</b>	
<b>Alloys</b> : 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.						
<b>UNIT IV</b>	<b>FUELS AND COMBUSTION</b>					<b>9</b>
<b>Fuels</b> : 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.					<b>CO4</b>	
<b>Combustion of fuels</b> : 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.						
<b>UNIT V</b>	<b>NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES</b>					<b>9</b>
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					<b>CO5</b>	

batteries.

**TOTAL : 45 PERIODS**

### TEXT BOOKS

1. P.C.Jain, Monica Jain, "Engineering Chemistry" 17<sup>th</sup> 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

<b>GE1105</b>	<b>PROBLEM SOLVING AND PYTHON PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
	(Common for all branches of B.E. /B. Tech Programmes)	3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To know the basics of algorithmic problem solving</li> <li>To write simple python programs</li> <li>To develop python program by using control structures and functions</li> <li>To use python predefined data structures</li> <li>To write file based program</li> </ul>						
<b>UNIT I</b>	<b>ALGORITHMIC PROBLEM SOLVING</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>INTRODUCTION TO PYTHON</b>					<b>9</b>
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.					<b>CO2</b>	
<b>UNIT III</b>	<b>CONTROL FLOW, FUNCTIONS AND STRINGS</b>					<b>9</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>LISTS, TUPLES, DICTIONARIES</b>					<b>9</b>
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.					<b>CO4</b>	
<b>UNIT V</b>	<b>FILES, MODULES, PACKAGES</b>					<b>9</b>
Files and exception: Concept of Files, Text Files; File opening in various modes and closing of a					<b>CO5</b>	

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.

**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 PythonII, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First ProgramsII, 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)		2	0	4	4
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products</li> <li>To expose them to existing national standards related to technical drawings.</li> </ul>					
<b>CONCEPTS AND CONVENTIONS</b> (Not for Examination)					<b>1</b>
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.					
<b>UNIT I</b>	<b>PLANE CURVES AND FREEHAND SKETCHING</b>				<b>7+12</b>
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					<b>CO1</b>
<b>UNIT II</b>	<b>PROJECTION OF POINTS, LINES AND PLANE SURFACE</b>				<b>6+12</b>
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.					<b>CO2</b>
<b>UNIT III</b>	<b>PROJECTION OF SOLIDS</b>				<b>5+12</b>
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES</b>				<b>6+12</b>
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.					<b>CO4</b>
<b>UNIT V</b>	<b>ISOMETRIC AND PERSPECTIVE PROJECTIONS</b>				<b>6+12</b>
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.					<b>CO5</b>
<b>TOTAL : 90 PERIODS</b>					
<b>TEXT BOOKS</b>					

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 Computer 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

<b>GE1107</b>	<b>PYTHON PROGRAMMING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	(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.	<b>CO1</b>
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. <ul style="list-style-type: none"> <li>• Armstrong number, palindrome of a number, Perfect number.</li> </ul>	
4. Simple programming for one dimensional and two dimensional arrays. <ul style="list-style-type: none"> <li>• Transpose, addition, multiplication, scalar , determinant of a matrix</li> </ul>	
5. Program to explore string functions and recursive functions.	<b>CO2</b>
6. Utilizing 'Functions' in Python <ul style="list-style-type: none"> <li>• Find mean, median, mode for the given set of numbers in a list.</li> <li>• Write a function dups to find all duplicates in the list.</li> <li>• Write a function unique to find all the unique elements of a list.</li> <li>• Write function to compute gcd, lcm of two numbers.</li> </ul>	
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.	
11. Demonstrate Exceptions in Python.	<b>CO3</b>
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)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	3	-	2	-	-	2	3	2	-	2	2	-	-
<b>CO2</b>	3	3	3	-	2	-	-	2	3	2	-	2	2	1	1
<b>CO3</b>	3	3	3	-	2	-	-	2	3	2	-	2	2	-	1

<b>BS1108</b>	<b>PHYSICS AND CHEMISTRY LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
(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 of Matter
- The Optical properties , Characteristics of Lasers & Optical Fibre
- Electrical & Thermal properties of Materials
- Enable the students to enhance accuracy in experimental measurements.
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis
- Instrumental method of analysis such as potentiometry, conductometry and pHmetry

### LIST OF EXPERIMENTS - PHYSICS

(A minimum of 5 experiments to be performed from the given list)	
1. Determination of Young's modulus of the material of the given beam by Non-uniform bending method.	CO1
2. Determination of 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.	CO2
(c) Determination of width of the groove of compact disc using laser.	
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
<b>DEMONSTRATION EXPERIMENT</b>	
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 <sub>2</sub> CO <sub>3</sub> 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
<b>DEMONSTRATION EXPERIMENTS</b>	
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

**TOTAL : 60 PERIODS**

### 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
<b>CO1</b>	3	1	2	2	2	1	1	1	3	2	2	3	2	2	2
<b>CO2</b>	3	1	2	1	1	1	1	1	2	1	1	2	2	2	2
<b>CO3</b>	3	1	2	1	2	2	2	1	2	1	1	1	2	2	1
<b>CO4</b>	3	2	1	1	2	1	1	1	2	1	1	2	2	1	2
<b>CO5</b>	3	2	1	1	1	2	2	1	2	1	2	1	2	1	1

## SEMESTER II

HS1201	PROFESSIONAL ENGLISH	L	T	P	C
(Common for all branches of B.E. /B. Tech Programmes)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.</li> <li>• Foster their ability to write convincing job applications and effective reports.</li> <li>• Develop their speaking skills to make technical presentations, participate in group discussions.</li> <li>• Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO PROFESSIONAL ENGLISH</b>	<b>9</b>			
Listening: Listening to technical talks with comprehension tasks -Speaking- conversation methods in real life occurrences using expressions of different emotions and imperative usages- Reading – reading short technical texts from journals- newspapers-Writing- purpose statements – extended definitions – writing instructions – checklists-recommendations- Vocabulary Development- technical vocabulary Language Development –tenses- subject verb agreement - compound words.					<b>CO1</b>
<b>UNIT II</b>	<b>READING AND STUDY SKILLS</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>TECHNICAL WRITING AND GRAMMAR</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>REPORT WRITING</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>GROUP DISCUSSION AND JOB APPLICATIONS</b>	<b>9</b>			
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					

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

### REFERENCE BOOKS

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

### COURSE OUTCOMES

Upon completion of the course, students will be able to

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

### MAPPING OF COs WITH POs AND PSOs

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

MA1202	ENGINEERING MATHEMATICS - II	L	T	P	C
(Common for all branches of B.E. /B. Tech Programmes Except AI-DS & AI-ML)		3	1	0	4
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>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</li> </ul>					
<b>UNIT I</b>	<b>ORDINARY DIFFERENTIAL EQUATIONS</b>	<b>12</b>			
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					<b>CO1</b>
<b>UNIT II</b>	<b>VECTOR CALCULUS</b>	<b>12</b>			
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					<b>CO2</b>
<b>UNIT III</b>	<b>COMPLEX VARIABLES</b>	<b>12</b>			
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					<b>CO3</b>
<b>UNIT IV</b>	<b>COMPLEX INTEGRATION</b>	<b>12</b>			
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)					<b>CO4</b>
<b>UNIT V</b>	<b>LAPLACE TRANSFORMS</b>	<b>12</b>			
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					<b>CO5</b>
<b>TOTAL : 60 PERIODS</b>					
<b>TEXT BOOKS</b>					
1. Grewal B.S., —Higher Engineering MathematicsII, 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 MathematicsII, 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 II, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. O'Neil, P.V. —Advanced Engineering MathematicsII, 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, IT, AI-DS & AI-ML)		3	0	0	3
<b>OBJECTIVES</b>					
To make the student					
<ul style="list-style-type: none"> <li>To acquire knowledge on the electron transport properties</li> <li>To understand the essential principles of semiconductor device</li> <li>To have the necessary understanding in optical properties of materials.</li> <li>To grasp the principles of magnetic materials and its applications.</li> <li>To understand the basics of Nano-electronic devices.</li> </ul>					
<b>UNIT I</b>	<b>ELECTRICAL PROPERTIES OF MATERIALS</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>SEMICONDUCTOR PHYSICS</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>MAGNETIC PROPERTIES OF MATERIALS</b>	<b>9</b>			
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)					<b>CO3</b>
<b>UNIT IV</b>	<b>OPTICAL PROPERTIES OF MATERIALS</b>	<b>9</b>			
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.					<b>CO4</b>

<b>UNIT V</b>	<b>NANO DEVICES</b>	<b>9</b>
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		<b>CO5</b>

**TOTAL : 45 PERIODS**

**TEXT BOOKS**

1. Jasprit Singh, — Semiconductor Devices: Basic Principles, Wiley 2012.
2. Donald Neaman, Dhruves Biswas , Semiconductor Physics and Devices (SIE), 4<sup>th</sup> 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
<b>CO1</b>	3	3	3	2	2	1	2	1	1	1	2	1	3	2	2
<b>CO2</b>	3	3	1	1	3	1	1	1	2	2	2	1	2	2	3
<b>CO3</b>	3	3	1	1	2	2	1	1	1	1	1	2	2	2	2
<b>CO4</b>	3	3	3	2	2	1	1	1	2	2	1	3	3	3	3
<b>CO5</b>	3	3	3	2	3	1	1	1	2	1	2	3	3	3	3

<b>GE1204</b>	<b>ENVIRONMENTAL SCIENCE AND ENGINEERING</b>	<b>L</b>	<b>P</b>	<b>T</b>	<b>C</b>
(Common for all branches of B.E. /B. Tech Programmes)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To study the inter relationship between living organisms and environment.</li> <li>To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.</li> <li>To find and implement scientific, technological, economic and political solutions to environmental problems.</li> <li>To study the integrated themes and biodiversity, natural resources, pollution control and waste management.</li> <li>To study the dynamic processes and understand the features of the earth's interior and surface.</li> </ul>					
<b>UNIT I</b>	<b>ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY</b>	<b>11</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>ENVIRONMENTAL POLLUTION</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>NATURAL RESOURCES</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>SOCIAL ISSUES AND THE ENVIRONMENT</b>	<b>8</b>			
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					<b>CO4</b>

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.

<b>UNIT V</b>	<b>HUMAN POPULATION AND THE ENVIRONMENT</b>	<b>8</b>
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		<b>CO5</b>

**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', 2<sup>nd</sup> 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**

CO 1	To obtain knowledge about environment, ecosystems and biodiversity.
CO 2	To take measures to control environmental pollution.
CO 3	To gain knowledge about natural resources and energy sources.
CO 4	To find and implement scientific, technological, economic and political solutions to the environmental problems.
CO 5	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		
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2	3	3	3	3	3	2	2	2	3	2	1	2
<b>CO2</b>	3	2	3	3	2	3	3	3	3	2	2	3	2	2	2
<b>CO3</b>	3	3	2	2	3	3	2	2	1	2	1	3	2	2	2
<b>CO4</b>	3	3	3	3	1	2	3	3	2	2	2	2	2	1	2
<b>CO5</b>	3	2	3	2	3	3	3	2	2	2	2	3	3	2	3

BE1251	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING	L	T	P	C
(Common to CSE, IT, AI-DS & AI-ML)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To learn the fundamental laws, network theorems and analyse the electric circuits.</li> <li>To study the basic principles of electrical machines and their performance.</li> <li>To study the fundamentals of power systems.</li> <li>To learn the characteristics of various electron devices and Op Amp integrated circuit.</li> <li>To understand the principle and operation of measuring instruments and transducers.</li> </ul>					
<b>UNIT I</b>	<b>ELECTRIC CIRCUITS ANALYSIS</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>ELECTRICAL MACHINES</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>FUNDAMENTALS OF POWER SYSTEM</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>ELECTRON DEVICES AND INTEGRATED CIRCUITS</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>MEASURING INSTRUMENTS AND TRANSDUCERS</b>	<b>9</b>			
Characteristic of measurement-errors in measurement – Principle and working of indicating 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.					<b>CO5</b>

**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 Technologyll, Fourth Edition, Elsevier, sixth edition,2017.
5. Mittle,Mittal, Basic Electrical Engineeringll, 2nd Edition, Tata McGraw-Hill Edition, 2016.
6. C.L.Wadhwa, —Generation, Distribution and Utilisation of Electrical Energyll, New Age international pvt.ltd.,2003

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

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

**MAPPING OF COs WITH POs AND PSOs**

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

CS1206	PROGRAMMING IN C	L	T	P	C	
(Common to CSE, IT, AI-DS & AI-ML)		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To develop C Programs using basic programming constructs</li> <li>To develop C programs using arrays, strings and functions</li> <li>To develop applications in C using pointers</li> <li>To develop applications in C using structures and union</li> <li>To develop applications using sequential and random-access file processing.</li> </ul>						
<b>UNIT I</b>	<b>BASICS OF C PROGRAMMING</b>					<b>9</b>
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					<b>CO1</b>	
<b>UNIT II</b>	<b>ARRAYS, STRINGS AND FUNCTIONS</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>POINTERS</b>					<b>9</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>STRUCTURES AND UNIONS</b>					<b>9</b>
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.					<b>CO4</b>	
<b>UNIT V</b>	<b>FILE PROCESSING</b>					<b>9</b>
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.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						

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
<b>CO1</b>	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
<b>CO2</b>	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
<b>CO3</b>	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
<b>CO4</b>	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2
<b>CO5</b>	3	3	3	2	2	1	1	1	1	1	1	1	2	2	2

GE1207	ENGINEERING PRACTICES LABORATORY	L	T	P	C
(Common for all branches of B.E. /B. Tech Programmes)		0	0	4	2
<b>OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering</li> </ul>					
<b>LIST OF EXPERIMENTS</b>					
<b>GROUP A (CIVIL &amp; MECHANICAL)</b>					
<b>I CIVIL ENGINEERING PRACTICE</b>		<b>13</b>		<b>CO1</b>	
<p><b>Buildings:</b></p> <p>(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.</p> <p><b>Plumbing Works:</b></p> <p>(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.</p> <p>(b) Study of pipe connections requirements for pumps and turbines.</p> <p>(c) Preparation of plumbing line sketches for water supply and sewage works.</p> <p>(d) <b>Hands-on-exercise:</b> Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.</p> <p>(e) Demonstration of plumbing requirements of high-rise buildings.</p> <p><b>Carpentry using Power Tools only:</b></p> <p>(a) Study of the joints in roofs, doors, windows and furniture.</p> <p>(b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.</p>					
<b>II MECHANICAL ENGINEERING PRACTICE</b>		<b>18</b>		<b>CO2</b>	
<p><b>Welding:</b></p> <p>(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.</p> <p>(b) Gas welding practice</p> <p><b>Basic Machining:</b></p> <p>(a) Simple Turning and Taper turning</p> <p>(b) Drilling Practice</p> <p><b>Sheet Metal Work:</b></p> <p>(a) Forming &amp; Bending:</p> <p>(b) Model making – Trays and funnels.</p> <p>(c) Different type of joints.</p> <p><b>Machine assembly practice:</b></p> <p>(a) Study of centrifugal pump</p> <p>(b) Study of air conditioner</p> <p><b>Demonstration on:</b></p> <p>(a) Smithy operations, upsetting, swaging, setting down and bending. Example –Exercise – Production of hexagonal headed bolt.</p> <p>(b) Foundry operations like mould preparation for gear and step cone pulley.</p> <p>(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.</p>					

<b>GROUP B (ELECTRICAL &amp; ELECTRONICS)</b>		
<b>III ELECTRICAL ENGINEERING PRACTICE</b>	<b>13</b>	
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.		<b>CO3</b>
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.		<b>CO4</b>
6. Measurement of resistance to earth of an electrical equipment.		
<b>IV ELECTRONICS ENGINEERING PRACTICE</b>	<b>16</b>	
1. Study of electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.		<b>CO5</b>
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.		
<b>TOTAL : 60 PERIODS</b>		

#### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

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

1.	Assorted electrical components for house wiring.	15 Sets
2.	Electrical measuring instruments.	10 Sets
3.	<b>Study purpose items:</b> Iron box, fan and regulator, emergency lamp.	1 each
4.	Megger (250V/500V).	1 No.
5.	<b>Power Tools:</b> (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.	<b>Study purpose items:</b> 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
CO4	3	1	3	-	-	3	-	-	-	-	-	3	3	3	3
CO5	3	2	2	-	-	2	-	-	-	-	-	3	2	2	2

<b>CS1208</b>	<b>PROGRAMMING IN C LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	(Common to CSE, IT, AI-DS & AI-ML)	0	0	4	2

### OBJECTIVES

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

### LIST OF EXPERIMENTS

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

### SEMESTER III

MA1351	PROBABILITY AND STATISTICS	L	T	P	C
Common to CSE, IT, AI-DS		3	1	0	4
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• 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.</li> <li>• To understand the basic concepts of random processes which are widely used in engineering applications.</li> <li>• To acquaint the knowledge of testing of hypothesis for small and large samples, which plays an important role in real life problems.</li> <li>• 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.</li> </ul>					
<b>UNIT I</b>	<b>PROBABILITY AND RANDOM VARIABLES</b>	<b>12</b>			
Probability – The axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.					<b>CO1</b>
<b>UNIT II</b>	<b>TWO - DIMENSIONAL RANDOM VARIABLES</b>	<b>12</b>			
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Central limit theorem (for independent and identically distributed random variables).					<b>CO2</b>
<b>UNIT III</b>	<b>RANDOM PROCESSES</b>	<b>12</b>			
Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.					<b>CO3</b>
<b>UNIT IV</b>	<b>TESTING OF HYPOTHESIS</b>	<b>12</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>DESIGN OF EXPERIMENTS</b>	<b>12</b>			
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.					<b>CO5</b>
<b>TOTAL : 60 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2017.</li> <li>2. Ibe, O.C., —Fundamentals of Applied Probability and Random Processes", Elsevier, 2nd Indian Reprint, 2014.</li> </ol>					

**REFERENCE BOOKS**

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

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

CO1	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
<b>CO1</b>	3	3	2	3	2	1	-	-	-	-	1	1	3	2	1
<b>CO2</b>	3	3	2	2	2	1	-	-	-	-	1	1	3	2	1
<b>CO3</b>	3	2	2	1	1	1	-	-	-	-	1	1	3	2	1
<b>CO4</b>	3	3	2	3	3	2	1	-	-	-	2	2	3	2	1
<b>CO5</b>	3	3	2	3	2	2	1	-	-	-	1	2	2	1	1

<b>IT1301</b>	<b>JAVA PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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

<b>UNIT I</b>	<b>INTRODUCTION TO OOP AND JAVA FUNDAMENTALS</b>	<b>9</b>
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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**

<b>UNIT II</b>	<b>PACKAGES, INHERITANCE AND INTERFACES</b>	<b>9</b>
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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, Array Lists – Strings, Packages

**CO2**

<b>UNIT III</b>	<b>EXCEPTION HANDLING AND I/O CONCEPTS</b>	<b>9</b>
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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**

<b>UNIT IV</b>	<b>CONCURRENT AND GENERIC PROGRAMMING</b>	<b>9</b>
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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**

<b>UNIT V</b>	<b>EVENT DRIVEN PROGRAMMING AND DATABASE CONNECTIVITY</b>	<b>9</b>
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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 : 45 PERIODS**

**TEXT BOOKS**

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

**REFERENCE BOOKS**

1. T. Budd, "An Introduction to Object Oriented Programming", 3<sup>rd</sup> Edition, Pearson Education, 2009.
2. Y. Daniel Liang , "Introduction to Java programming", 7<sup>th</sup> 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", 3<sup>rd</sup> 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 &IT		3	0	2	4
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To learn Boolean algebra and simplification of Boolean functions.</li> <li>❖ To learn to design and analyze different combinational circuits.</li> <li>❖ To study the basics of synchronous sequential logic, analyze and design sequential circuits.</li> <li>❖ To learn about basic memory devices and programmable logic devices to build simple digital systems.</li> <li>❖ To learn to write code in Hardware Definition Language for designing larger digital systems</li> </ul>					
<b>UNIT I</b>	<b>BOOLEAN ALGEBRA AND LOGIC GATES</b>	<b>9+6</b>			
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 <b>Lab component:</b> <ul style="list-style-type: none"> <li>• Verification of Boolean Theorems using basic gates</li> </ul>					<b>CO1</b>
<b>UNIT II</b>	<b>COMBINATIONAL LOGIC</b>	<b>9+6</b>			
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 <b>Lab component:</b> <ul style="list-style-type: none"> <li>• Design and implement Half/Full Adder and Subtractor.</li> <li>• Design and Implementation of Decoders, Encoders, Multiplexers and Demultiplexers</li> </ul>					<b>CO2</b>
<b>UNIT III</b>	<b>SYNCHRONOUS SEQUENTIAL LOGIC</b>	<b>9+6</b>			
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 <b>Lab component:</b> <ul style="list-style-type: none"> <li>• Design and implement shift-registers.</li> <li>• Design and implement synchronous counters</li> </ul>					<b>CO3</b>
<b>UNIT IV</b>	<b>ASYNCHRONOUS SEQUENTIAL LOGIC</b>	<b>9+6</b>			
Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards <b>Lab component:</b> <ul style="list-style-type: none"> <li>• Design and Implementation of Asynchronous Sequential Circuit</li> <li>• Design and implement of Serial Parity Generator.</li> </ul>					<b>CO4</b>
<b>UNIT V</b>	<b>SYSTEM DESIGN</b>	<b>9+6</b>			
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 <b>Lab component:</b> <ul style="list-style-type: none"> <li>• Coding Combinational circuits using HDL</li> <li>• Coding Sequential circuits using HDL</li> </ul>					<b>CO5</b>
<b>TOTAL : 75 PERIODS</b>					

**LAB REQUIREMENTS**

Desktop with HDL Simulator, Digital Trainer Kits, Digital ICs

**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
<b>CO1</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO5</b>	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, IT, AI-DS, AI-ML & ECE-IV Sem		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To understand the concepts of ADTs.</li> <li>❖ To learn linear data structures like lists, stacks, and queues.</li> <li>❖ To learn Non-linear tree data structures.</li> <li>❖ To apply Graph structures</li> <li>❖ To understand sorting, searching and hashing algorithms</li> </ul>					
<b>UNIT I</b>	<b>LINEAR DATA STRUCTURES – LIST</b>	<b>9</b>			
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).					<b>CO1</b>
<b>UNIT II</b>	<b>LINEAR DATA STRUCTURES – STACKS, QUEUES</b>	<b>9</b>			
Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.					<b>CO2</b>
<b>UNIT III</b>	<b>NON-LINEAR DATA STRUCTURES – TREES</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>NON-LINEAR DATA STRUCTURES – GRAPHS</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>SEARCHING, SORTING AND HASHING TECHNIQUES</b>	<b>9</b>			
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

#### 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. Necaie, 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
<b>CO1</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
<b>CO2</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
<b>CO3</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
<b>CO4</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3
<b>CO5</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	3

CS1304	COMPUTER ARCHITECTURE	L	P	T	C
Common to CSE & IT		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To learn the basic structure and operations of a computer.</li> <li>❖ To learn the arithmetic and logic unit and implementation of fixed-point and floating-point arithmetic unit.</li> <li>❖ To learn the basics of pipelined execution.</li> <li>❖ To understand parallelism and multi-core processors.</li> <li>❖ To understand the memory hierarchies and the ways of communication with I/O devices.</li> </ul>					
<b>UNIT I</b>	<b>BASIC STRUCTURE OF A COMPUTER SYSTEM</b>				<b>9</b>
Eight ideas-Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.					<b>CO1</b>
<b>UNIT II</b>	<b>DATA REPRESENTATION AND ARITHMETIC FOR COMPUTERS</b>				<b>9</b>
Signed number representation, Addition and Subtraction – Multiplication – Division – Fixed- and Floating-Point Representation – Floating Point Operations.					<b>CO2</b>
<b>UNIT III</b>	<b>DATA PATH AND CONTROL UNIT</b>				<b>9</b>
A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions.					<b>CO3</b>
<b>UNIT IV</b>	<b>PARALLELISM</b>				<b>9</b>
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.					<b>CO4</b>
<b>UNIT V</b>	<b>MEMORY AND PERIPHERAL DEVICES</b>				<b>9</b>
Memory Hierarchy - Memory technologies – Cache memory – Measuring and improving cache performance – virtual memory, TLBs – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits – USB					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. M. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.</li> <li>2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012</li> </ol>					

**REFERENCE BOOK**

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
<b>CO1</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2

<b>CS1305</b>	<b>SOFTWARE ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
(Common to CSE & IT)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To understand the phases in a software project</li> <li>To understand fundamental concepts of requirements engineering and Analysis Modeling.</li> <li>To understand the various software design methodologies</li> <li>To learn various testing, SQA and maintenance measures</li> </ul>					
<b>UNIT I</b>	<b>SOFTWARE PROCESS AND AGILE DEVELOPMENT</b>	<b>9</b>			
Introduction: The Evolving Role of Software, Software Characteristics, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.					<b>CO1</b>
<b>UNIT II</b>	<b>REQUIREMENTS ANALYSIS AND SPECIFICATION</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>SOFTWARE DESIGN</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>TESTING AND MAINTENANCE</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>PROJECT MANAGEMENT AND SQA</b>	<b>9</b>			
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).					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**TEXT BOOKS**

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

**REFERENCE BOOKS**

1. Rajib Mall, —Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
2. Pankaj Jalote, —Software Engineering, A Precise Approach, Wiley India, 2010.
3. Kelkar S.A., —Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
4. Fairley R., —Software Engineering Concepts, Tata McGraw Hill, New Delhi, 2008.
5. Harry Hariom Choudhary , —Java Coding Standards, Amazon Kindle, USA, 2013. 3. Bernard Homes., —Fundamentals of Software Testing, Wiley & Sons, USA, 2012.
6. Stephen R.Schach, —Software Engineering, 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	2	2	2	2	2	3	2	3	3	3	3	3	2	2
CO2	3	3	3	3	2	2	2	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	2	2	3	3	3	3	3	2	2

CS1307	DATA STRUCTURES LABORATORY USING C	L	T	P	C
Common to CSE, IT and ECE IV Sem		0	0	4	2
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To introduce the concepts of primitive data structures.</li> <li>❖ To understand the process in linear and non-linear data structures.</li> <li>❖ To introduce the concepts of sorting, searching and hashing.</li> </ul>					
<b>LIST OF EXPERIMENTS</b>					
<b>1. IMPLIMENTATION OF LIST</b> Write C programs to <ul style="list-style-type: none"> <li>a) Array implementation of Stack ADTs.</li> <li>b) Array implementation of Queue ADTs.</li> </ul>					<b>CO1</b>
<b>2. LIST ADT</b> Array implementation of List ADT.					
<b>3. IMPLEMENTATION OF STACK AND QUEUE</b> Write C programs to <ul style="list-style-type: none"> <li>a) Design and implement Single Linked List.</li> <li>b) Design and implement Stack and its operations using List.</li> <li>c) Design and implement Queue and its operations using List.</li> </ul>					
<b>4. APPLICATIONS OF LINEAR DATA STRUCTURE</b> Write C programs for the following: <ul style="list-style-type: none"> <li>a) Design and implement polynomial ADT using list</li> <li>b) Uses Stack operations to convert infix expression into postfix expression.</li> <li>c) Uses Stack operations for evaluating the postfix expression.</li> </ul>					<b>CO2</b>
<b>5. APPLICATIONS OF TREE</b> <ul style="list-style-type: none"> <li>a) Write a C program to Design and implement binary tree.</li> <li>b) Traverse the above binary tree recursively in pre-order, post-order &amp; in-order.</li> </ul>					
<b>6. IMPLEMENTATION OF TREE</b> Write a C program to Design and implement binary search tree.					
<b>7. IMPLEMENTATION OF ADVANCED TREE</b> <ul style="list-style-type: none"> <li>a) Design and Implement AVL tree using Templates.</li> <li>b) Design and Implement heap tree using Templates.</li> </ul>					<b>CO3</b>
<b>8. IMPLEMENTATION OF SHORTEST PATH ALGORITHMS</b> Write C programs for the following: <ul style="list-style-type: none"> <li>a) Design and Implement Dijkstra's algorithm</li> <li>b) Design and Implement Floyd Warshall algorithm.</li> </ul>					
<b>9. IMPLEMENTATION OF MINIMUM SPANNING TREE</b> Write C programs for the following: <ul style="list-style-type: none"> <li>a) Design and Implement Kruskal's algorithm.</li> <li>b) Design and Implement Prim's algorithm.</li> </ul>					<b>CO3</b>
<b>10. GRAPH TRAVERSAL &amp; APPLICATIONS</b>					

Write C programs to implement the following algorithms:

- a) Depth first search.
- b) Breadth first search.
- c) Topological 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**

#### LAB REQUIREMENTS

Processors: Intel Atom® processor or Intel® Core™ i3 processor. Operating systems: Windows\* Turbo C

#### REFERENCE BOOKS

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

#### WEB REFERENCES

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

#### COURSE OUTCOMES

**Upon completion of the course, students will be able to**

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

#### MAPPING OF COs WITH POs AND PSOs

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

IT1308	JAVA PROGRAMMING LABORATORY	L	T	P	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.

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.

10. Write a program to perform string operations using ArrayList. Write functions for the following a. Append - add at end

CO1

CO2

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	CO3
14. Create a GUI program in java with the following components. a. A frame with Flow layout. b. Add the following components on to the frame. i. Two Text Field ii. A button with the label display c. Allow the user to enter data into the JTextField d. When the button is clicked paint the frame by displaying the data entered in the JTextField e. Allow the user to properly close the frame	
15. 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, 11<sup>th</sup> 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 IT & AI-ML		0	0	2	1
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ Enhance the Employability and Career Skills of students</li> <li>❖ Orient the students towards grooming as a professional</li> <li>❖ Make them Employable Graduates</li> <li>❖ Develop their confidence and help them attend interviews successfully.</li> </ul>					
<b>LIST OF EXPERIMENTS</b>					
<b>UNIT I</b>					<b>6</b>
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.					<b>CO1</b>
<b>UNIT II</b>					<b>6</b>
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					<b>CO2</b>
<b>UNIT III</b>					<b>6</b>
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					<b>CO3</b>
<b>UNIT IV</b>					<b>6</b>
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					<b>CO4</b>
<b>UNIT V</b>					<b>6</b>
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					<b>CO5</b>
<b>TOTAL : 30 PERIODS</b>					

**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
<b>CO1</b>	-	-	-	-	-	-	-	1	2	3	-	-	2	1	2
<b>CO2</b>	-	1	-	2	-	-	-	-	-	3	-	-	1	-	2
<b>CO3</b>	-	2	-	3	-	-	-	-	1	2	-	-	-	-	2
<b>CO4</b>	-	-	-	-	1	-	-	-	2	2	-	-	-	-	2
<b>CO5</b>	-	2	1	1	2	-	2	-	-	3	-	-	1	2	2

## SEMESTER IV

MA1453	DISCRETE MATHEMATICS	L	T	P	C	
(Common to CSE, IT & AI-DS )		3	1	0	4	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• To introduce Mathematical Logic, Inference Theory and proof methods.</li> <li>• To provide fundamental principles on combinatorial counting techniques.</li> <li>• To introduce graph models, their representation, connectivity and traverse ability.</li> <li>• To explain the fundamental algebraic structures, groups and their algebraic properties.</li> <li>• To introduce partial ordering and some functions on a set.</li> </ul>						
<b>UNIT I</b>	<b>LOGIC AND PROOFS</b>					<b>12</b>
Propositional Logic – Propositional Equivalences – Normal Forms - Predicates and Quantifiers – Nested Quantifiers – Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.					<b>CO1</b>	
<b>UNIT II</b>	<b>COMBINATORICS</b>					<b>12</b>
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.					<b>CO2</b>	
<b>UNIT III</b>	<b>SETS AND FUNCTIONS</b>					<b>12</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>GRAPHS</b>					<b>12</b>
Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.					<b>CO4</b>	
<b>UNIT V</b>	<b>ALGEBRAIC STRUCTURES</b>					<b>12</b>
Groups – Subgroups – Homomorphisms – Isomorphism - Normal Subgroup and Coset – Lagrange’s Theorem.					<b>CO5</b>	
<b>TOTAL : 60 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Tata McGraw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2012.</li> <li>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.</li> </ol>						

**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
<b>CO1</b>	3	3	2	2	1	1	-	-	-	1	1	2	2	2	1
<b>CO2</b>	3	3	2	2	1	1	-	-	-	1	1	2	2	2	1
<b>CO3</b>	3	3	2	2	1	1	-	-	-	1	1	2	2	2	1
<b>CO4</b>	3	3	2	2	1	1	-	-	-	-	1	2	2	2	1
<b>CO5</b>	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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To learn the general framework for analyzing algorithm efficiency</li> <li>❖ To be conversant with algorithms for common problems.</li> <li>❖ To analyse the algorithms for time/space complexity.</li> <li>❖ To write algorithms for a given problem using different design paradigms.</li> <li>❖ To understand computational complexity of problems</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>DECREASE AND CONQUER AND DIVIDE-AND-CONQUER</b>					<b>9</b>
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.					<b>CO2</b>	
<b>UNIT III</b>	<b>DYMANIC PROGRAMMING AND GREEDY TECHNIQUE</b>					<b>9</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>ITERATIVE IMPROVEMENT</b>					<b>9</b>
Graphical Method – The Simplex Method – The maximum Flow Problem – Maximum Matching in Bipartite Graphs – The Stable Marriage Problem.					<b>CO4</b>	
<b>UNIT V</b>	<b>BACKTRACKING, BRANCH-AND-BOUND AND APPROXIMATION ALGORITHMS</b>					<b>9</b>
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.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.</li> <li>2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, McGraw Hill, 2009.</li> </ol>						
<b>REFERENCE BOOKS</b>						

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

### COURSE OUTCOMES

Upon completion of the course, students will be able to

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

### MAPPING OF COs WITH POs AND PSOs

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

CS1402	OPERATING SYSTEMS	L	T	P	C
Common to CSE, IT, AI-DS & AI-ML		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To understand the basic concepts and functions of operating systems.</li> <li>❖ To understand Processes and Threads</li> <li>❖ To analyze Scheduling algorithms.</li> <li>❖ To understand the concept of Deadlocks.</li> <li>❖ To analyze various memory management schemes.</li> <li>❖ To understand I/O management and File systems.</li> <li>❖ To be familiar with the basics of Linux system and Mobile OS like iOS and Android</li> </ul>					
<b>UNIT I</b>	<b>OPERATING SYSTEM OVERVIEW</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>PROCESS MANAGEMENT</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>STORAGE MANAGEMENT</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>FILE SYSTEMS AND I/O SYSTEMS</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>CASE STUDY</b>	<b>9</b>			
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
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 ApproachII, 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 SystemsII, McGraw Hill Education, 2016.
4. Andrew S. Tanenbaum, —Modern Operating SystemsII, 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 kernelII, 3rd edition, O'Reilly, 2005.
7. Neil Smyth, —iPhone iOS 4 Development Essentials – Xcodell, 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	1	-	-	-	-	-	-	-	-	2	2	2	2	1
CO2	3	2	1	1	-	-	-	-	-	-	2	2	2	2	1
CO3	3	2	1	1	-	-	-	-	-	-	2	2	2	2	1
CO4	3	2	1	1	-	-	-	-	-	-	2	2	2	2	1
CO5	3	1	2	1	1	-	1	-	1	1	2	2	2	2	2

CS1403	DATABASE DESIGN AND MANAGEMENT (Lab Integrated)	L	T	P	C
Common for CSE, IT, AI-DS, AI-ML		3	0	2	4
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To learn the fundamentals of data models, ER diagrams and to study SQL and relational database design.</li> <li>❖ To familiarize relational model with Relational Database design and Normal Forms.</li> <li>❖ To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.</li> <li>❖ 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.</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO RELATIONAL DATABASES</b>	<b>9 + 6</b>			
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 <b>Lab Component</b> <ul style="list-style-type: none"> <li>• 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</li> <li>• Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views, Synonyms, Sequences.</li> <li>• Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)</li> </ul>					<b>CO1</b>
<b>UNIT II</b>	<b>RELATIONAL DATABASE DESIGN</b>	<b>9 + 6</b>			
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 <b>Lab Component</b> <ul style="list-style-type: none"> <li>• Simple Embedded SQL Program to demonstrate the concepts.</li> <li>• Database Design using normalization and Implementation for any application.</li> </ul>					<b>CO2</b>
<b>UNIT III</b>	<b>TRANSACTIONS</b>	<b>9 + 6</b>			
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. <b>Lab Component</b> <ul style="list-style-type: none"> <li>• Usage of Transaction control language commands like commit, rollback and save point.</li> <li>• Develop Programs using BEFORE and AFTER Triggers for INSERT, DELETE and UPDATE statements</li> </ul>					<b>CO3</b>
<b>UNIT IV</b>	<b>IMPLEMENTATION TECHNIQUES</b>	<b>9 + 6</b>			
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. <b>Lab Component</b> <ul style="list-style-type: none"> <li>• Implementation of B tree and B+ Tree.</li> <li>• Develop programs to demonstrate hashing techniques.</li> </ul>					<b>CO4</b>
<b>UNIT V</b>	<b>ADVANCED TOPICS</b>	<b>9 + 6</b>			
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.					<b>CO5</b>

**Lab Component**

- Database Connectivity with Front End Tools
- Case Study using real life database applications.

**TOTAL : 75 PERIODS****LAB REQUIREMENTS**

Intel i5 or equivalent AMD processor.

Operating Systems: Windows 7 (or) later, ubuntu, macOS &amp; linux.

Software:MySQL, PostgreSQL, or Oracle Database for relational database management.

MongoDB or Cassandra for NoSQL database examples.

**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 Systemsll, 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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To understand the basics of communication</li> <li>To impart knowledge on basics of analog and digital communication.</li> <li>To understand the basics of data communication models</li> <li>To explore the various layers and its functionalities in data communication model</li> </ul>						
<b>UNIT I</b>	<b>BASICS OF COMMUNICATION</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>ANALOG AND DIGITAL COMMUNICATION</b>					<b>9</b>
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).					<b>CO2</b>	
<b>UNIT III</b>	<b>INTRODUCTION TO DATA COMMUNICATION AND OSI MODEL</b>					<b>9</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>NETWORK LAYER COMPONENTS AND FUNCTIONS</b>					<b>9</b>
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.					<b>CO4</b>	

<b>UNIT V</b>	<b>TRANSPORT, SESSION AND APPLICATION LAYER</b>	<b>9</b>
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.		<b>CO5</b>

**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. Forouzan, "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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

ML1401	FOUNDATIONS OF MACHINE LEARNING	L	T	P	C	
Common for IT, AI-DS & AI-ML		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To understand the basic concepts of machine learning and probability theory.</li> <li>❖ To appreciate supervised learning and their applications.</li> <li>❖ To understand unsupervised learning like clustering and EM algorithms.</li> <li>❖ To understand the theoretical and practical aspects of probabilistic graphical models.</li> <li>❖ To learn other learning aspects such as reinforcement learning, representation learning, deep learning, neural networks and other technologies.</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
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					<b>CO1</b>	
<b>UNIT II</b>	<b>SUPERVISED LEARNING</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>UNSUPERVISED LEARNING</b>					<b>9</b>
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)					<b>CO3</b>	
<b>UNIT IV</b>	<b>GRAPHICAL MODELS</b>					<b>9</b>
Bayesian Networks – Conditional Independence – Markov Random Fields – Learning – Naive Bayes Classifiers – Markov Model – Hidden Markov Model.					<b>CO4</b>	
<b>UNIT V</b>	<b>ADVANCED LEARNING</b>					<b>9</b>
Reinforcement Learning – Representation Learning – Neural Networks – Active Learning – Ensemble Learning – Bootstrap Aggregation – Boosting – Gradient Boosting Machines – Deep Learning					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
1. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, Prentice Hall of India, 2015.						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.</li> <li>2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.</li> <li>3. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition, CRC Press, 2014.</li> <li>4. Tom Mitchell, “Machine Learning”, McGraw-Hill, 2017.</li> <li>5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, Second Edition, Springer, 2008.</li> <li>6. Fabio Nelli, “Python Data Analytics with Pandas, Numpy, and Matplotlib”, Second Edition, Apress, 2018.</li> </ol>						

**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

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

**TOTAL: 60 PERIODS**

### LAB REQUIREMENTS

Intel based Desktop Pc RAM of 512M, Language: Turbo C/Borland C. OS-Linux,Windows

### REFERENCE BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, —Operating System ConceptsII, 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
<b>CO1</b>	3	3	3	3	3	-	-	-	-	2	2	2	2	2	1
<b>CO2</b>	3	3	3	3	3	-	-	-	-	2	2	2	2	2	1
<b>CO3</b>	3	3	3	3	3	-	-	-	-	2	2	2	2	2	1

ML1408	MACHINE LEARNING LABORATORY	L	T	P	C
Common for IT, AI-DS & AI-ML		0	0	4	2
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To make use of Data sets in implementing the machine learning algorithms</li> <li>❖ To implement the machine learning concepts and algorithms in any suitable language of choice</li> <li>❖ To understand the practical aspects of probabilistic graphical models.</li> </ul>					
<b>LIST OF EXPERIMENTS</b>					
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					<b>CO1</b>
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.					
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					<b>CO2</b>
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets					
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.					<b>CO3</b>
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 classes/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 classes/API in the program.					
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					
<b>TOTAL : 60 PERIODS</b>					
<b>LAB REQUIREMENTS</b>					
Processors: Intel Atom® processor or Intel® Core™ i3 processor. Operating systems: Windows* 7 or later, Ubuntu, macOS, and Linux. Python versions: 3.6.X. and above, Spyder 5.4.0					
<b>REFERENCE BOOKS</b>					
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](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

**SEMESTER V**

MA1501	ALGEBRA AND NUMBER THEORY	L	T	P	C
(Common to CSE & IT)		3	1	0	4
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.</li> <li>• To introduce and apply the concepts of rings, finite fields and polynomials.</li> <li>• To understand the basic concepts in number theory</li> <li>• To examine the key questions in the Theory of Numbers.</li> <li>• To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject</li> </ul>					
<b>UNIT I</b>	<b>GROUPS AND RINGS</b>				<b>12</b>
Groups: Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism					<b>CO1</b>
<b>UNIT II</b>	<b>FINITE FIELDS AND POLYNOMIALS</b>				<b>12</b>
Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields					<b>CO2</b>
<b>UNIT III</b>	<b>DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS</b>				<b>12</b>
Division algorithm – Base - b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM					<b>CO3</b>
<b>UNIT IV</b>	<b>DIOPHANTINE EQUATIONS AND CONGRUENCES</b>				<b>12</b>
Linear Diophantine equations – Congruence's – Linear Congruence's - Applications: Divisibility tests - Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems					<b>CO4</b>
<b>UNIT V</b>	<b>CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS</b>				<b>12</b>
Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions					<b>CO5</b>
<b>TOTAL : 60 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007.</li> <li>2. Koshy, T., —Elementary Number Theory with ApplicationsII, Elsevier Publications, New Delhi, 2002</li> </ol>					

**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
<b>CO1</b>	3	3	2	-	2	-	-	2	2	1	-	2	3	3	2
<b>CO2</b>	3	3	2	-	2	-	-	2	2	1	-	2	3	3	2
<b>CO3</b>	3	3	3	-	2	-	-	2	2	1	-	2	3	3	2
<b>CO4</b>	3	3	3	-	2	-	-	2	2	1	-	2	3	3	2
<b>CO5</b>	3	3	3	-	2	-	-	2	2	1	-	2	3	3	2

<b>CS1502</b>	<b>OBJECT ORIENTED ANALYSIS AND DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
(Common to CSE &IT)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To capture the requirements specifications of an intended software system</li> <li>❖ To design software with static and dynamic UML diagrams</li> <li>❖ To map the design properly to code</li> <li>❖ To improve the software design with design patterns</li> </ul> <p>To test the software against its requirements specifications</p>					
<b>UNIT I</b>	<b>INTRODUCTION</b>				<b>9</b>
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.					<b>CO1</b>
<b>UNIT II</b>	<b>STATIC MODELLING</b>				<b>9</b>
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					<b>CO2</b>
<b>UNIT III</b>	<b>DYNAMIC MODELLING</b>				<b>9</b>
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					<b>CO3</b>
<b>UNIT IV</b>	<b>DESIGN PATTERNS</b>				<b>9</b>
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					<b>CO4</b>
<b>UNIT V</b>	<b>TESTING</b>				<b>9</b>
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

IT1501	WEB TECHNOLOGY	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To understand the basic internet protocols and explore HTML, CSS</li> <li>To design interactive web pages using Javascript and working with DOM</li> <li>To understand the concepts of MVC and React Framework</li> <li>To work with Node.js for building high scale web applications</li> <li>To develop RESTful APIs with Express JS as backend web application framework</li> </ul>						
<b>UNIT I</b>	<b>Web Essentials, HTML &amp; CSS</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>Client-Side Scripting &amp; HTML DOM</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>React</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>Node.js</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>Express Framework</b>					<b>9</b>
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					<b>CO5</b>	
<b>THEORY : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2007.</li> <li>Zammetti, Frank, "Modern Full-Stack Development", Apress, 2020.</li> <li>Brad Dayley, "Node.js, MongoDB, and AngularJS Web Development", 2nd edition, Addison Wesley, 2017.</li> <li>Azat Mardan, "Express. js Guide: The Comprehensive Book on Express. Js", Leanpub, 2014.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development", Wiley,2014</li> <li>Wieruch Robin, "The Road to React", 2021 Edition with React Hooks</li> <li>Alex Banks, Eve Porcello, "Learning React, Modern Patterns for Developing React Apps", O'Reilly Media, 2020.</li> <li>KrasimirTsonov, "Node.js by Example Paperback", May 2015.</li> <li>Azat Mardan, "Pro Express.js", Apress 2014.</li> </ol>						
<b>WEB REFERENCES</b>						
<ul style="list-style-type: none"> <li><a href="https://javascript.info/">https://javascript.info/</a></li> <li><a href="https://react.dev/">https://react.dev/</a></li> <li><a href="https://nodejs.org/en/">https://nodejs.org/en/</a></li> <li><a href="https://expressjs.com/en/">https://expressjs.com/en/</a></li> </ul>						

**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
CO1	1	-	1	-	1	-	-	-	1	1	1	1	1	-	2
CO2	-	-	1	-	1	-	-	-	1	1	1	1	1	-	2
CO3	-	-	2	-	2	-	-	-	1	1	1	2	2	1	2
CO4	-	-	2	-	2	-	-	-	1	1	1	2	2	1	2
CO5	-	-	2	-	2	-	-	-	1	1	1	2	2	1	2

IT1502	COMPUTATIONAL INTELLIGENCE ( LAB INTEGRATED)	L	T	P	C
		3	0	2	4
<b>OBJECTIVES</b>					
<ol style="list-style-type: none"> <li>To understand the various characteristics of intelligent agents.</li> <li>To learn the different search strategies in AI.</li> <li>To understand the knowledge in solving AI problems.</li> <li>To learn the concepts of learning and communication in AI.</li> <li>To know about the various applications of AI.</li> </ol>					
<b>UNIT I</b>	<b>INTRODUCTION AND PROBLEM SOLVING</b>	<b>9+6</b>			
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.					<b>CO1</b>
<b>Lab Component:</b> <ol style="list-style-type: none"> <li>Solve any problem using depth and breadth first search.</li> <li>Write a program to solve water Jug Problem</li> </ol>					
<b>UNIT II</b>	<b>INFORMED SEARCH AND GAME PLAYING</b>	<b>9+6</b>			
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.					<b>CO2</b>
<b>Lab Component</b> <ol style="list-style-type: none"> <li>Write a program to perform A* search</li> <li>Write a program to solve 8 queens problem</li> </ol>					
<b>UNIT III</b>	<b>KNOWLEDGE AND REASONING</b>	<b>9+6</b>			
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					<b>CO3</b>
<b>Lab Component</b> <ol style="list-style-type: none"> <li>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</li> <li>Write a program to demonstrate family relationship</li> </ol>					
<b>UNIT IV</b>	<b>UNCERTAINTY</b>	<b>9+6</b>			
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					<b>CO4</b>
<b>Lab Component</b> <ol style="list-style-type: none"> <li>Write a program to implement the naïve Bayesian classifier for a sample training data set</li> </ol>					

stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets

<b>UNIT V</b>	<b>APPLICATIONS</b>	<b>9+6</b>
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<b>APPLICATIONS</b>		<b>CO5</b>
<p>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.</p> <p>8. Write a program to preprocessing in text using NLTK library</p>		

**TOTAL : 75 PERIODS**

**LAB REQUIREMENTS**

Processors: Intel Atom® processor or Intel® Core™ i3 processor. Operating systems: Windows 7 or later, Ubuntu, macOS, and Linux. Python versions: 3.6.X. and above, Spyder 5.4.0, SWI-Prolog-9.3

**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
<b>CO1</b>	3	3	3	3	3	1	-	-	1	2	2	3	3	3	3
<b>CO2</b>	3	3	3	3	3	1	-	-	1	2	2	3	3	3	3
<b>CO3</b>	3	3	3	3	3	1	-	-	1	2	2	3	3	3	3
<b>CO4</b>	3	3	3	3	3	1	-	-	2	2	2	3	3	3	3
<b>CO5</b>	3	3	3	3	3	1	-	-	2	2	2	3	3	3	3

<b>IT1507</b>	<b>WEB TECHNOLOGY LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

### OBJECTIVES

- To design dynamic websites with good aesthetic sense using HTML5, CSS3 and Java script
- 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	<b>CO1</b>
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	<b>CO2</b>
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]	<b>CO3</b>
10. To build an AJAX Application	
<b>TOTAL : 60 PERIODS</b>	

### 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. KrasimirTsonov, "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
<b>CO1</b>	1	-	2	-	2	-	-	-	1	2	1	2	2	1	2
<b>CO2</b>	1	-	2	-	2	-	-	-	1	2	1	2	2	1	2
<b>CO3</b>	1	-	2	-	2	-	-	-	1	2	1	2	2	1	2

<b>CS1508</b>	<b>OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
(Common to CSE &IT )		0	0	4	2

### OBJECTIVES

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

### LIST OF EXPERIMENTS

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

### Suggested 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

**TOTAL : 60 PERIODS**

**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

**SEMESTER VI**

<b>IT1601</b>	<b>THEORY OF COMPUTATION AND COMPILER DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To explore the theoretical foundations of computer science from the perspective of formal languages and classify machines by their power to recognize languages.</li> <li>To explore the principles, algorithms, and data structures involved in the design and construction of compilers.</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION TO AUTOMATA</b>					<b>9</b>
Formal Language and Regular Expressions: Languages, Definition Languages 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.					<b>CO1</b>	
<b>UNIT II</b>	<b>AUTOMATA GRAMMAR AND PARSING</b>					<b>9</b>
Context-Free grammars and parsing: Context-free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom-up parsing, handle pruning, LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.					<b>CO2</b>	
<b>UNIT III</b>	<b>SEMANTIC AND CONTEXT-SENSITIVE FEATURES</b>					<b>9</b>
Semantics: Syntax directed translation, S-attributed, and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements, and control flow statements. Context-Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, the equivalence of type expressions, overloading of functions and operations.					<b>CO3</b>	
<b>UNIT IV</b>	<b>CODE OPTIMIZATION</b>					<b>9</b>
The symbol table, Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. Code optimization Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, optimization techniques.					<b>CO4</b>	
<b>UNIT V</b>	<b>CODE GENERATION</b>					<b>9</b>
Code generation: Machine-dependent code generation, object code forms, generic code generation algorithm, Register allocation, and assignment. Using DAG representation of Block.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						

**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. Loudon: "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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To endow with the knowledge required to understand emerging communications networks</li> <li>To describe the basic concepts and principles in mobile computing</li> <li>To understand the concept of Wireless LANs, PAN, and Mobile Networks</li> <li>To explain the structure and components for Mobile IP and Mobility Management</li> <li>To familiarize with Mobile apps development aspects</li> </ul>						
<b>UNIT I</b>	<b>WIRELESS COMMUNICATION SYSTEMS</b>					<b>9</b>
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					<b>CO1</b>	
<b>UNIT II</b>	<b>MOBILE NETWORK AND TRANSPORT LAYERS</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>INTRODUCTION TO ANDROID</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>ANDROID USER INTERFACE</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>NETWORKING SERVICES &amp; APPLICATION COMPONENTS IN ANDROID</b>					<b>9</b>
SMS Messaging: Sending and Receiving – Sending email and networking – Downloading binary and text data files – Access Web services – Developing android services: create your own services, performing long running task in a serviceperforming repeated task in a service-					<b>CO5</b>	

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", Pearson Education, 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", O'Reilly 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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

IT1603	COMPUTER GRAPHICS AND APPLICATIONS	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To learn the line, circle and ellipse drawing algorithms and to study the 2-D transformations</li> <li>To apply transformations and texture on the object</li> <li>To motivate the students to create the 3-D scenes by adding lighting and shades to the objects in the scene.</li> <li>To enable the students to perform modeling</li> <li>To have in-depth idea about advanced rendering.</li> </ul>						
<b>UNIT I</b>	<b>ILLUMINATION MODELS &amp; OUTPUT PRIMITIVES</b>					<b>9</b>
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.						
<b>UNIT II</b>	<b>2D GRAPHICS</b>					<b>9</b>
Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations- Affine Transformations ; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.						
<b>UNIT III</b>	<b>3D GRAPHICS</b>					<b>9</b>
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.						
<b>UNIT IV</b>	<b>FRACTALS AND ANIMATIONS</b>					<b>9</b>
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.						
	<b>GRAPHICS PROGRAMMING</b>					<b>9</b>

<b>UNIT V</b>	
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	<b>CO5</b>

**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", Pearson Education, 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 with WebGL", 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 Practice in 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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

IT1604	<b>DATA SCIENCE AND BIG DATA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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.

<b>UNIT I</b>	<b>INTRODUCTION TO BIG DATA AND DATA ANALYTICS LIFE CYCLE</b>	<b>9</b>
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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**

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

**CO2**

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

**CO3**

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<b>UNIT IV</b>	<b>STREAM MEMORY</b>	<b>9</b>
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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**

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<b>UNIT V</b>	<b>NOSQL DATA MANAGEMENT</b>	<b>9</b>
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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	<b>MOBILE NETWORKS AND APPLICATION DEVELOPMENT LABORATORY</b>	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	<b>CO1</b>
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.	
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.	<b>CO2</b>
8. Develop an application that makes use of RSS Feed.	
9. Implement an application that implements Multi-threading	
10. Develop a native application that uses GPS location information.	<b>CO3</b>
11. Implement an application that writes data to the SD card.	
12. Implement an application that creates an alert upon receiving a message.	
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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

**SEMESTER VII**

IT1701	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• To understand the basics in deep neural networks</li> <li>• To analyze optimization and regularization concepts in neural networks.</li> <li>• To estimate the concepts of deep learning for computer vision.</li> <li>• To analyze the key computations of deep learning to evaluate Object Detection.</li> <li>• To understand the concepts of Sequence Models with RNN</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction – Perceptron Learning Algorithm - Activation Functions – Need for non-linear activation functions – Chain Rule and Backpropagation – Deep Neural Networks – Shallow vs Deep Networks					<b>CO1</b>	
<b>UNIT II</b>	<b>OPTIMIZATION AND REGULARIZATION IN NEURAL NETWORKS</b>					<b>9</b>
Regularization – L1 and L2 regularization – Dropout – Vanishing and Exploding Gradients – Weight Initialization – He and Xavier initialization – Gradient checking – Mini Batch Gradient Descent – Momentum – RMSProp – Adam Optimization – Local Optima – Learning Rate Decay					<b>CO2</b>	
<b>UNIT III</b>	<b>DEEP LEARNING FOR COMPUTER VISION</b>					<b>9</b>
Introduction to Computer Vision – Edge detection with Kernels – Padding and Strides – Pooling layers – Convolutional Neural Networks – CNN Architectures [VGG16 - ResNets – Inception Net – MobileNet] – What CNNs learn – Transfer Learning – Data Augmentation					<b>CO3</b>	
<b>UNIT IV</b>	<b>ADVANCED COMPUTER VISION WITH DEEP LEARNING</b>					<b>9</b>
Object Detection – Landmark Detection – Sliding Windows – Intersection Over Union – Non Max Suppression – Anchor boxes – YOLO Algorithm – Object Detection accuracy metrics – Image Segmentation – UNet architecture – Transpose Convolution – Semantic Segmentation with UNet – Image2Image Translation with UNet					<b>CO4</b>	
<b>UNIT V</b>	<b>SEQUENCE MODELS</b>					<b>9</b>
Recurrent Neural Networks – Backpropagation through Time – Language Models – Vanishing Gradients with RNNs – GRU – LSTM – Bidirectional RNNs – Deep RNNs – Word Embeddings – Learning Word Embeddings – Word2Vec – Negative Sampling – GloVE Embeddings – Attention Mechanism – Self Attention – Transformer Architecture – Positional Encodings -					<b>CO5</b>	
<b>TOTAL: 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.</li> <li>2. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021.</li> </ol>						

**REFERENCE BOOKS**

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'ReillyMedia, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017
9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

CO1	Apply Deep Learning concepts in Artificial Neural Networks
CO2	Understand the concepts of Regularization and Optimization required in Deep Learning
CO3	Apply Computer vision concepts in Deep Learning
CO4	Analyze the key computations of Object detection using Advanced Computer Vision.
CO5	Apply Sequence Models with RNN for suitable 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
<b>CO1</b>	1	1	1	1	1	1	-	-	1	1	1	2	2	2	2
<b>CO2</b>	2	2	1	2	2	1	-	-	1	1	1	2	2	2	2
<b>CO3</b>	2	2	2	2	2	1	-	-	1	1	1	2	2	2	2
<b>CO4</b>	2	2	2	2	2	1	-	-	1	1	1	2	2	2	2
<b>CO5</b>	2	2	2	2	2	1	-	-	1	1	1	2	2	2	2

IT1702	CLOUD AND EDGE COMPUTING	L	P	T	C
		3	0	0	3
<b>OBJECTIVES</b> <ul style="list-style-type: none"> <li>To understand the concepts of cloud and utility computing.</li> <li>To educate students on the architecture of cloud computing and virtualization.</li> <li>To familiarize with cloud storage solutions, service level agreements, and pipeline management.</li> <li>To introduce fog and edge computing paradigms, including their architectures, components, and use cases.</li> <li>To explore middleware solutions for edge cloud architectures and address security management concerns in edge computing environments.</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO CLOUD COMPUTING</b>	<b>9</b>			
Origins of Cloud computing – Cloud Components – Cloud Characteristics – Elasticity in Cloud - Comparing cloud providers with traditional IT service providers - Advantages of Cloud Computing - Cloud Deployment Models: Public clouds – Private clouds – Community clouds - Hybrid clouds – Types of cloud services: Software as a Service (SaaS) - Platform as a Service (PaaS) - Infrastructure as a Service (IaaS) - Anything as a service (XaaS).		<b>CO1</b>			
<b>UNIT II</b>	<b>CLOUD ARCHITECTURE &amp; VIRTUALIZATION</b>	<b>9</b>			
Layered Cloud Architecture – NIST Cloud Computing Reference - Challenges and risks in Cloud adoption - Basics of Virtualization – Types of Virtualizations – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.		<b>CO2</b>			
<b>UNIT III</b>	<b>CLOUD STORAGE AND PIPELINE</b>	<b>9</b>			
Cloud Storage –Advantages of Cloud Storage – Cloud Storage Providers – S3, Service Level Agreements - Types of SLA – Lifecycle of SLA - SLA Management - Pipeline overview, create and configure pipeline, Building WDL pipeline with graphical Pipeline Builder, launch a pipeline, Delete and unregister Pipeline.		<b>CO3</b>			
<b>UNIT IV</b>	<b>FOG AND EDGE COMPUTING PARADIGMS</b>	<b>9</b>			
Fog computing - Open Fog reference architecture - Fog topologies - Edge Computing and Architectures - Components of Edge Computing - Orchestration of Network Slices in Fog, Edge and Clouds: Introduction - Network Slicing - Network Slicing in Software-Defined Clouds - Network Slicing Management in Edge and Fog - Edge Computing to support User Applications: 5G-Slicing & Self-driving cars.		<b>CO4</b>			
<b>UNIT V</b>	<b>MIDDLEWARE FOR EDGE CLOUD ARCHITECTURES</b>	<b>9</b>			
Edge cloud architectures – Use Case - Lightweight Edge Clouds – Clusters for Lightweight Edge Clouds – Architecture management – Storage and Orchestration – Security Management for Edge Cloud Architectures – Smart Surveillance Video Stream Processing at the Edge - A Case Study: Human Object Detection & Object Tracking		<b>CO5</b>			
<b>TOTAL : 45 PERIODS</b>					

**TEXT BOOKS**

1. Rajkumar Buyya, Satish Narayana Srirama, Fog and Edge Computing: Principles and Paradigms, Wiley publication, 2019.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W., and James F. Ransome, — Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

**REFERENCE BOOKS**

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
2. Albert Y. Zomaya, Assad Abbas, Samee U. Khan, "Fog Computing Theory and Practice", Wiley 21 April 2020.

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing.
CO3	Identify the advantages of cloud storage, understand different cloud storage providers and service level agreements, and Data Pipelines.
CO4	Identify the Fog and Edge architecture.
CO5	Apply knowledge of edge cloud architectures in real-world use cases, manage architecture.

**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
<b>CO1</b>	3	2	1	3	2	3	2	1	3	2	3	2	3	2	3
<b>CO2</b>	3	2	1	3	3	2	2	2	3	2	3	2	3	3	2
<b>CO3</b>	2	1	2	3	3	1	3	3	3	2	3	1	3	2	3
<b>CO4</b>	3	2	2	2	3	2	3	3	3	2	2	2	3	1	2
<b>CO5</b>	2	1	1	2	2	2	3	1	3	2	2	3	3	3	2

CS1703	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
(Common to CSE & IT)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To define security attacks, services and mechanisms.</li> <li>❖ To review modern symmetric-key ciphers based on algebraic structures.</li> <li>❖ To understand asymmetric-key cryptography based on some topics in number theory.</li> <li>❖ To define cryptographic data integrity algorithms and mutual trust.</li> <li>❖ To discuss various security practices and system security measures.</li> </ul>					
<b>UNIT I</b>	<b>FUNDAMENTALS</b>				<b>9</b>
Computer Security Concepts – The OSI Security Architecture - Security Attacks, Services and Mechanisms - Model for network security – Classical Encryption Techniques: Substitution Techniques, Transposition Techniques, Steganography – Legal and Ethical Aspects.					<b>CO1</b>
<b>UNIT II</b>	<b>SYMMETRIC CRYPTOGRAPHY</b>				<b>9</b>
Mathematics of Symmetric Key Cryptography: Algebraic structures — Modular arithmetic- GF (2 <sup>n</sup> Fields) –The Euclidian Algorithm- Polynomial Arithmetic - Symmetric Key Ciphers: Block Cipher and Data Encryption Standard (DES) - Advanced Encryption Standard (AES) — Block Cipher Operation – Random Bit Generation and Stream Ciphers - RC4.					<b>CO2</b>
<b>UNIT III</b>	<b>PUBLIC KEY CRYPTOGRAPHY</b>				<b>9</b>
Mathematics of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Chinese Remainder Theorem — Quadratic Congruence- Exponentiation and Logarithm - Asymmetric Key Ciphers: RSA Cryptosystem – Rabin Cryptosystem - Diffie Hellman Key Exchange - ElGamal Cryptosystem – Elliptic Curve Arithmetic - Elliptic Curve Cryptography.					<b>CO3</b>
<b>UNIT IV</b>	<b>CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS AND MUTUAL TRUST</b>				<b>9</b>
Cryptographic Hash Functions – Message Authentication Codes - Digital Signatures –Key Management and Distribution – X.509 Certificates - User Authentication- Kerberos					<b>CO4</b>
<b>UNIT V</b>	<b>INTERNET SECURITY AND SYSTEM SECURITY</b>				<b>9</b>
Electronic Mail security – PGP, S/MIME – IP security – Cloud Security- Wireless Network Security – System Security: Intruders – Malicious software – Firewalls.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 5th Edition, 2011.</li> <li>2. Behrouz A.Forouzan, Introduction to Cryptography and Network Security, McGraw-Hill Ferouzan Networking Series, 2008.</li> </ol>					
<b>REFERENCE BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Shyamala C K, N Harini and Dr T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd.</li> <li>2. Charlie Kaufman, Radia Periman and Mike Speciner, Network Security: private Communication in a public World, Prentice Hall, ISBN 0-13-046019-2</li> <li>3. William Stallings, “Network Security Essentials Applications and Standards”, 2<sup>nd</sup> edition, Pearson Education, 2003.</li> </ol>					

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

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

**MAPPING OF COs WITH POs AND PSOs**

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

IT1703	ORGANIZATIONAL BEHAVIOR	L	P	T	C
		3	0	0	3
<b>OBJECTIVES</b>					
To make the students conversant to					
<ul style="list-style-type: none"> <li>Analyze the determinants of group culture and strategies for establishing productive relationships with associates.</li> <li>Understand the concept and determinants of personality, including the Myers-Briggs Type Indicator (MBTI).</li> <li>Understand the concept of motivation and examine need, content, and process theories of motivation.</li> <li>Promote innovation and shape organizational culture to foster a culture of innovation.</li> <li>Address barriers to inclusion and combat unconscious bias to make the business case for diversity and inclusion.</li> </ul>					
<b>UNIT I</b>	<b>LEADERSHIP AND ORGANIZATIONAL BEHAVIOUR (LEAD)</b>	<b>9</b>			
The determinants of group culture-Establishing productive relationships with associates-Develop a vision of the future-Align the organization behind that vision-Motivate people to achieve their vision-Design effective organizations and change them to achieve superior performance.					<b>CO1</b>
<b>UNIT II</b>	<b>PERSONALITY &amp; PERCEPTION</b>	<b>9</b>			
Concept of Personality-Determinants of Personality-Concept of Myers-Briggs Type Indicator (MBTI), Concept of Perception-Factors that influence Perception-Nature of Perception-Process of Perception-Individual Values.					<b>CO2</b>
<b>UNIT III</b>	<b>LEARNING &amp; MOTIVATION</b>	<b>9</b>			
Concept of Learning-Theories of Learning: Classical Conditioning-Operant Conditioning-Social Learning-Reinforcement-Concept of Motivation-Need, Content, and Process theories of Motivation-Contributions of Maslow, McGregor, Herzberg, Vroom and Adam.					<b>CO3</b>
<b>UNIT IV</b>	<b>ORGANIZATIONAL CULTURE AND CHANGE MANAGEMENT</b>	<b>9</b>			
Understanding organizational culture and why it's important-Exploring the continuum of corporate culture-the good, the bad, and the ugly-Translating understanding into action and impact-Diagnose the need for organizational change in response to external shifts or internal challenges-Utilize the change model to implement organizational change successfully-Appreciate how to overcome resistance to change-Steps for driving innovation within established organizations-how to shape organizational culture into a culture of innovation.					<b>CO4</b>
<b>UNIT V</b>	<b>DIVERSITY, EQUITY AND INCLUSION</b>	<b>9</b>			
Understand gender imbalance, race identity and LGBTQ+ communities-managing bias and creating safe, inclusive work environments-Building and nurturing an inclusive and diverse team to changing customer needs-Defining, understanding, and leveraging different types of diversity to increase business outcomes-Addressing known and unknown barriers to build inclusive and diverse teams, Making the business case and combating unconscious bias.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
1. McShane, S., Von Glinow, M. A., & Rai, H. (2022). "Organizational Behavior" (9th edition.). McGraw-Hill Education.					
2. Coyle, D. (2018). "The Culture Code: The Secrets of Highly Successful Groups". Bantam Books					
3. Huxley, A. (2004). "The Doors of Perception and Heaven and Hell". Harper Perennial Modern Classics.					

**REFERENCE BOOKS**

1. Harvard Business Review, Kotter, J. P., Kim, W. C., & Mauborgne, R. A. (2011). "HBR's 10 Must Reads on Change Management (including featured article "Leading Change," by John P. Kotter)". Harvard Business Review Press.
2. Wisdom, J. P., & Jenkins, L. D. (2021). "Millennials' Guide to Diversity, Equity & Inclusion: What No One Ever Told You About the Importance of Diversity, Equity, and Inclusion".

**COURSE OUTCOMES**

**Upon completion of the course, the students will gain knowledge on**

CO1	To learn effective organizational behavior
CO2	To understand human behavior, perceptions and values in a better way
CO3	To gain knowledge on learning tendencies and motivation
CO4	To explore successful change management strategies
CO5	To equip skills required to become an inclusive leader

**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
<b>CO1</b>	3	3	3	3	2	2	2	1	2	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	2	2	1	2	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	1	2	1	1	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	1	1	1	1	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	1	2	1	2	2	2	2	3	3	2

IT1707	<b>CLOUD AND EDGE COMPUTING LABORATORY</b>	L	T	P	C
		0	0	4	2

### OBJECTIVES

- To Setup an account on Amazon Web Services and Create S3 storage service.
- Design and deploy the pricing models on AWS cloud services and pipeline.
- Design & Synthesize new techniques and tools using AWS IoT for Edge.

### LIST OF EXPERIMENTS

1. Setting up an AWS Account and Implementing Multi-Factor Authentication (MFA).	<b>CO1</b>
2. Launching EC2 Instances with Custom AMIs and User Data Scripts.	
3. Implementing S3 with Versioning, Lifecycle Policies, and Cross-Region Replication.	
4. Configuring a Highly Available Web Application using EC2, ELB, and Auto Scaling.	
5. Designing a Multi-tier VPC Architecture with NAT Gateways and VPN Connection	
6. Implementing Auto Scaling with Custom Metrics and Scheduled Actions.	<b>CO2</b>
7. Setting up Application Load Balancer with Path-based Routing and SSL/TLS.	
8. Deploying a Containerized Application using ECS with Fargate.	
9. Implementing a CI/CD Pipeline with Jenkins, CodePipeline, and Blue/Green Deployment.	
10. Designing a Serverless Architecture with API Gateway, Lambda, and DynamoDB.	<b>CO3</b>
11. Implementing a Disaster Recovery Solution using Route 53 and Cross-Region Replication.	
12. Deploy and connect RTOS using AWS IoT for edge.	
13. Manage and secure RTOS using AWS IoT for edge.	
14. Case Study –DevOps Services and Solutions.	

**TOTAL : 60 PERIODS**

### LAB REQUIREMENTS

Intel i5 or equivalent AMD processor. AWS Educate, Microsoft Azure, or Google Cloud KubeEdge or AWS IoT Greengrass, Node-RED or EdgeX Foundry

### REFERENCE BOOKS

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
2. Albert Y. Zomaya, Assad Abbas, Samee U. Khan, "Fog Computing Theory and Practice", Wiley 21 April 2020

### WEB REFERENCES

1. <https://github.com/Amey-Thakur/CLOUD-COMPUTING-LAB>.
2. [www.nittrchd.ac.in/imee/Labmanuals/manual%20Internet%20of%20Things%20I.pdf](http://www.nittrchd.ac.in/imee/Labmanuals/manual%20Internet%20of%20Things%20I.pdf).

### COURSE OUTCOMES

**Upon completion of the course, students will be able to**

CO1	Understands the various Services in AWS like Storage, Infrastructure, Compute, Data and also Learn to Setup an account on Amazon Web Services(AWS).
CO2	Understand the pricing models on AWS cloud services and pipeline.
CO3	Design & Synthesize new techniques and tools using AWS IoT for Edge.

### 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
<b>CO1</b>	3	3	3	1	1	-	-	2	2	2	3	3	3	3	2
<b>CO2</b>	3	3	3	1	1	-	-	2	2	2	3	3	3	3	2
<b>CO3</b>	3	3	3	1	1	-	-	2	2	2	3	3	3	3	2

**SEMESTER V**  
**PROFESSIONAL ELECTIVE – I**

IT1511	OPTIMIZATION TECHNIQUES	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• To introduce the basic concepts of linear programming</li> <li>• To educate on the advancements in Linear programming techniques</li> <li>• To introduce non-linear programming techniques</li> <li>• To introduce the interior point methods of solving problems</li> <li>• To introduce the dynamic programming method□</li> </ul>						
<b>UNIT I</b>	<b>LINEAR PROGRAMMING</b>					<b>9</b>
Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method.					<b>CO1</b>	
<b>UNIT II</b>	<b>ADVANCES IN LPP</b>					<b>9</b>
Dualit theory- Dual simplex method - Sensitivity analysis--Transportation problems– Assignment problems-Traveling sales man problem -Data Envelopment Analysis.					<b>CO2</b>	
<b>UNIT III</b>	<b>NON LINEAR PROGRAMMING</b>					<b>9</b>
Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.					<b>CO3</b>	
<b>UNIT IV</b>	<b>INTERIOR POINT METHODS</b>					<b>9</b>
Karmarkar’s algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.					<b>CO4</b>	
<b>UNIT V</b>	<b>DYNAMIC PROGRAMMING</b>					<b>9</b>
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.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Hillier and Lieberman “Introduction to Operations Research”, TMH, 2000.</li> <li>2. R.Panneerselvam, “Operations Research”, PHI, 2006</li> <li>3. Hamdy ATaha, “Operations Research –An Introduction”, Prentice Hall India, 2003.</li> </ol>						

**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

C O1	To understand ethical issues, environmental impact and acquire management skills
C O2	To Understand about the linear programming techniques
C O3	To Understand about the Non Linear programming techniques
C O4	To Understand about interior point methods of solving problems.
C O5	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
<b>CO1</b>	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	2	2	-	-	-	-	2	2	2	3	3	2

IT1512	VIDEO CREATION AND EDITING	L	P	T	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ol style="list-style-type: none"> <li>1. To provide a comprehensive understanding of linear and non-linear editing principles.</li> <li>2. To explore various storytelling techniques and their application in digital media.</li> <li>3. To equip students with practical skills in audio and video recording and editing.</li> <li>4. To familiarize students with industry-standard software tools, specifically AVID XPRESS DV 4 and Final Cut Pro.</li> <li>5. To develop critical thinking and creative problem-solving skills in the context of video production.</li> </ol>						
<b>UNIT I</b>	<b>FUNDAMENTALS OF VIDEO EDITING</b>					<b>9</b>
History of video editing-Linear vs. non-linear editing concepts-Digital video formats and codecs-Introduction to editing software interfaces-Basic editing terminology and techniques.					<b>CO1</b>	
<b>UNIT II</b>	<b>STORYTELLING AND EDITING TECHNIQUES</b>					<b>9</b>
Narrative structures in video-Visual storytelling with cuts, transitions, and effects-Pacing and rhythm in editing-Legal and ethical considerations in editing-Scriptwriting and storyboarding for video					<b>CO2</b>	
<b>UNIT III</b>	<b>AUDIO AND VIDEO PRODUCTION</b>					<b>9</b>
Principles of audio and video capture-Digital signal processing and audio mixing-Color correction and grading-Exporting and distribution formats-Camera operation and shot composition					<b>CO3</b>	
<b>UNIT IV</b>	<b>ADVANCED EDITING WITH FINAL CUT PRO</b>					<b>9</b>
Mastering the Final Cut Pro Interface-Editing and fine-tuning clips-Compositing and visual effects-Motion graphics and titles-Advanced audio editing					<b>CO4</b>	
<b>UNIT V</b>	<b>PROFESSIONAL EDITING WITH AVID XPRESS DV 4</b>					<b>9</b>
Navigating the AVID XPRESS DV 4 workspace-Media management and organization-Advanced trimming and editing techniques-Working with multicam sequences-Outputting and delivering final projects					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Avid Xpress DV 4 User Guide, 2007.</li> <li>2. Final Cut Pro 6 User Manual, 2004.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.</li> <li>2. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003.</li> </ol>						

**COURSE OUTCOMES**

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

CO1	Analyze the advantages and constraints of non-linear editing workflows.
CO2	Apply different storytelling methods to enhance the narrative impact of video content.
CO3	Execute professional-quality audio and video recording and post-production techniques.
CO4	Utilize advanced editing features and effects in Final Cut Pro and AVID XPRESS DV 4.
CO5	Produce a portfolio of video projects that demonstrate proficiency in digital video editing.

**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
<b>CO1</b>	3	1	2	1	1	-	-	-	1	2	3	2	3	2	2
<b>CO2</b>	3	3	3	2	3	-	-	-	2	2	2	1	2	2	3
<b>CO3</b>	2	1	2	2	2	-	-	-	2	1	1	2	2	2	2
<b>CO4</b>	3	3	1	1	1	-	-	-	1	1	1	3	3	3	3
<b>CO5</b>	2	1	2	1	2	-	-	-	3	1	1	3	3	3	3

IT1513	INFORMATION STORAGE AND MANAGEMENT	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To understand the storage architecture and available technologies.</li> <li>To learn to establish &amp; manage a data center.</li> <li>To learn security aspects of storage &amp; data center.</li> </ul>						
<b>UNIT I</b>	<b>STORAGE TECHNOLOGY</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>STORAGE SYSTEMS ARCHITECTURE</b>					<b>9</b>
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.					<b>CO2</b>	
<b>UNIT III</b>	<b>INTRODUCTION TO NETWORKED STORAGE</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>INFORMATION AVAILABILITY, MONITORING &amp; MANAGING DATACENTERS</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>SECURING STORAGE AND STORAGE VIRTUALIZATION</b>					<b>9</b>
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.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						

**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 Networksll, 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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

IT1514	KNOWLEDGE ENGINEERING	L	T	P	C
(Common to IT & AI-DS)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To learn about first order logics</li> <li>To acquire knowledge about reasoning</li> <li>To apply object-oriented concepts for various expert systems</li> <li>To assess uncertainty using non monotonic logic</li> <li>To understand various action and planning strategies for problem solving</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION</b>				<b>9</b>
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					<b>CO1</b>
<b>UNIT II</b>	<b>RESOLUTION AND REASONING</b>				<b>9</b>
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					<b>CO2</b>
<b>UNIT III</b>	<b>REPRESENTATION</b>				<b>9</b>
Object Oriented Representations – Frame Formalism – Structured Descriptions – Meaning and Entailment - Taxonomies and Classification – Inheritance – Networks – Strategies for Defeasible Inheritance – Formal Account of Inheritance Networks					<b>CO3</b>
<b>UNIT IV</b>	<b>DEFAULTS, UNCERTAINTY AND EXPRESSIVENESS</b>				<b>9</b>
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					<b>CO4</b>
<b>UNIT V</b>	<b>ACTIONS AND PLANNING</b>				<b>9</b>
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					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**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
<b>CO1</b>	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2
<b>CO5</b>	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 &IT)		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To become familiar with digital image fundamentals</li> <li>To get exposed to simple image enhancement techniques in Spatial and Frequency domain.</li> <li>To learn concepts of degradation function and restoration techniques.</li> <li>To study the image segmentation and representation techniques.</li> <li>To become familiar with image compression and recognition methods</li> </ul>						
<b>UNIT I</b>	<b>DIGITAL IMAGE FUNDAMENTALS</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>IMAGE ENHANCEMENT</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>IMAGE RESTORATION</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>IMAGE SEGMENTATION</b>					<b>9</b>
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.					<b>CO4</b>	
<b>UNIT V</b>	<b>IMAGE COMPRESSION AND RECOGNITION</b>					<b>9</b>
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.					<b>CO5</b>	
<b>TOTAL: 45 PERIODS</b>						

**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 R.M. 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
<b>CO1</b>	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
<b>CO3</b>	3	3	3	3	2	-	-	-	1	2	2	2	3	2	3
<b>CO4</b>	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2
<b>CO5</b>	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
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• To impart knowledge on fuzzy logic principles</li> <li>• To understand models of ANN</li> <li>• To use the fuzzy logic and neural network for application related to design and manufacture</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO FUZZY LOGIC PRINCIPLES</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>ADVANCED FUZZY LOGIC APPLICATIONS</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>OTHER ANN ARCHITECTURES</b>	<b>9</b>			
Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive resonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – kohonen self-organizing maps – learning vector quantization – counter propagation networks – industrial applications..					<b>CO4</b>
<b>UNIT V</b>	<b>RECENT ADVANCES</b>	<b>9</b>			
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**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 conductor 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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2

IT1612	SOFTWARE TESTING AND QUALITY ASSURANCE	L	P	T	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To understand software testing and quality assurance as a fundamental component of software life cycle</li> <li>To define the scope of SW T &amp; QA projects</li> <li>To efficiently perform T &amp; QA activities using modern software tools</li> <li>To estimate cost of a T &amp; QA project and manage budgets</li> <li>To prepare test plans and schedules for a T&amp;QA project</li> <li>To develop T &amp; QA project staffing requirements</li> <li>To effectively manage a T &amp; QA project.</li> </ul>					
<b>UNIT I</b>	<b>SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES</b>				<b>9</b>
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					<b>CO1</b>
<b>UNIT II</b>	<b>SYSTEM TESTING</b>				<b>9</b>
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.					<b>CO2</b>
<b>UNIT III</b>	<b>SYSTEM TEST CATEGORIES</b>				<b>9</b>
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>SOFTWARE QUALITY</b>				<b>9</b>
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.					<b>CO4</b>
<b>UNIT V</b>	<b>SOFTWARE QUALITY ASSURANCE</b>				<b>9</b>
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**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
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• To explore the fundamental concepts of Natural Language Processing</li> <li>• To learn the different data pre-processing steps in lexical analysis</li> <li>• To understand the working of syntactic and semantic analysis using NLTK</li> <li>• To familiar with text classification and topic modeling methods</li> <li>• To work with sentiment analysis and machine translation using python</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO NLP</b>	<b>9</b>			
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		<b>CO1</b>			
<b>UNIT II</b>	<b>LEXICAL ANALYSIS USING NLTK</b>	<b>9</b>			
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		<b>CO2</b>			
<b>UNIT III</b>	<b>SYNTACTIC AND SEMANTIC ANALYSIS USING NLTK</b>	<b>9</b>			
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		<b>CO3</b>			
<b>UNIT IV</b>	<b>TEXT CLASSIFICATION AND TOPIC MODELING</b>	<b>9</b>			
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.		<b>CO4</b>			
<b>UNIT V</b>	<b>SENTIMENT ANALYSIS AND MACHINE TRANSLATION</b>	<b>9</b>			
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		<b>CO5</b>			
<b>TOTAL : 45 PERIODS</b>					

**TEXT BOOKS**

1. Ela Kumar, "Natural Language Processing", I.K International, New Delhi 2011.
2. Sohom Ghosh, 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, 1<sup>st</sup> Edition, 2009.

**REFERENCE BOOKS**

1. Tanveer Siddiqui, 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 Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press, 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
<b>CO1</b>	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	3	-	2	2	2	3	3	2

GE1614	ENGINEERING ETHICS AND HUMAN VALUES	L	P	T	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ol style="list-style-type: none"> <li>Students will understand the importance of Values and Ethics in their Personal lives and professional careers</li> <li>The students will learn the rights and responsibilities</li> <li>Responsibilities of employee, team member and a global citizen.</li> </ol>						
<b>UNIT I</b>	<b>HUMAN VALUES</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>ENGINEERING ETHICS</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>ENGINEERING AS SOCIAL EXPERIMENTATION</b>					<b>9</b>
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study					<b>CO3</b>	
<b>UNIT IV</b>	<b>SAFETY, RESPONSIBILITIES AND RIGHTS</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>GLOBAL ISSUES</b>					<b>9</b>
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					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2nd Edition, 2009.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.</li> <li>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</li> <li>John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003</li> </ol>						

4. Edmund G Seebauer and Robert L Barry, "Fundamentals 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 Engineer 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

DS1611	IMAGE AND VIDEO ANALYTICS	L	T	P	C
Common to IT & AI-DS		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To provide a basic foundation towards digital image processing and video processing.</li> <li>❖ To learn about image and video enhancement and restoration techniques.</li> <li>❖ To provide Compression methods for image analytics applications.</li> <li>❖ To Understand Compression methods for video analytics applications</li> <li>❖ To learn about feature detection and description</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO DIGITAL IMAGE AND VIDEO PROCESSING</b>				<b>9</b>
Digital image representation, Sampling and Quantization, Types of Images, Basic Relations between Pixels - Neighbors, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations, Introduction to Digital Video, Sampled Video, Video Transmission. Gray-Level Processing: Image Histogram, Linear and Non-linear point operations on Images, Arithmetic Operations between Images, Geometric Image Operations. Binary Image Processing: Image Thresholding, Region labeling, Binary Image Morphology					<b>CO1</b>
<b>UNIT II</b>	<b>IMAGE AND VIDEO ENHANCEMENT AND RESTORATION</b>				<b>9</b>
Spatial domain - Linear and Non-linear Filtering, Morphological filtering, Frequency domain – Homomorphic Filtering, Blotch Detection and Removal - Blotch Detection, Motion Vector Repair and Interpolating Corrupted Intensities, Intensity Flicker Correction - Flicker Parameter Estimation, Brief introduction towards Wavelets, Wavelet based image denoising, Basic methods for image restoration using deconvolution filters					<b>CO2</b>
<b>UNIT III</b>	<b>IMAGE ANALYSIS</b>				<b>9</b>
Image Compression: Huffman coding, Run length coding, LZW coding, Lossless Coding, Wavelets based image compression					<b>CO3</b>
<b>UNIT IV</b>	<b>VIDEO ANALYSIS</b>				<b>9</b>
Video Compression: Basic Concepts and Techniques of Video Coding and the H.264 Standard, MPEG-1 and MPEG-2 Video Standards					<b>CO4</b>
<b>UNIT V</b>	<b>FEATURE DETECTION AND DESCRIPTION</b>				<b>9</b>
Introduction to feature detectors, descriptors, matching and tracking, Basic edge detectors – canny, sobel, prewitt etc., Image Segmentation - Region Based Segmentation – Region Growing and Region Splitting and Merging, Thresholding – Basic global thresholding, optimum global thresholding using Otsu's Method					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOK</b>					
<ol style="list-style-type: none"> <li>1. Alan Bovik, Handbook of Image and Video Processing, Second Edition, Academic Press, 2005.</li> <li>2. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Edition, Pearson Education, 2008.</li> <li>3. Richard Szeliski, Computer Vision – Algorithms and Applications, Springer, 2011</li> </ol>					
<b>REFERENCE BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Anil K Jain, Fundamentals of Digital Image Processing, PHI, 2011.</li> <li>2. Oge Marques, Practical Image and Video Processing Using MatLab, Wiley, 2011.</li> <li>3. John W. Woods, Multidimensional Signal, Image, Video Processing and Coding, Academic Press, 2006</li> </ol>					

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

<b>CO1</b>	Understand the fundamental principles of image and video analysis
<b>CO2</b>	Apply different filters for enhancement of image and video
<b>CO3</b>	Investigate different coding techniques.
<b>CO4</b>	Comprehend different compression techniques for video.
<b>CO5</b>	Apply the image and video analysis approaches to solve 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
<b>CO1</b>	3	2	1	3	3	-	-	-	-	2	2	2	3	3	3
<b>CO2</b>	2	3	2	3	3	-	-	-	-	2	2	2	3	3	3
<b>CO3</b>	1	2	2	3	3	-	-	-	-	2	2	2	3	3	3
<b>CO4</b>	3	2	1	3	3	-	-	-	-	2	2	2	3	3	3
<b>CO5</b>	1	2	3	3	3	-	-	-	-	2	2	2	3	3	3

**SEMESTER VII**  
**PROFESSIONAL ELECTIVE – III**

IT1711	WEB DEVELOPMENT FRAMEWORKS	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ol style="list-style-type: none"> <li>1. Understand the fundamentals of web framework</li> <li>2. Know the concept of the Java web framework</li> <li>3. Learn the technologies of the Python web framework</li> <li>4. Be exposed to the concepts of the Web framework</li> <li>5. Be familiar with the Web framework.</li> </ol>						
<b>UNIT I</b>	<b>FUNDAMENTALS OF WEB FRAMEWORK</b>					<b>9</b>
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					<b>CO1</b>	
<b>UNIT II</b>	<b>JAVA WEB FRAMEWORK</b>					<b>9</b>
Java Web Frameworks-Struts-The Struts Framework- The Struts Tag Libraries- – Struts Configuration Files- Applying Struts					<b>CO2</b>	
<b>UNIT III</b>	<b>STRUTS</b>					<b>9</b>
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 Conversion Exceptions and Logging-Getting Started with JavaScript-Advanced JavaScript, the DOM, and CSS Themes and Templates-Rich Internet Applications.					<b>CO3</b>	
<b>UNIT IV</b>	<b>PYTHON WEB FRAMEWORKS</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>TURBOGEARS WEB FRAMEWORK</b>					<b>9</b>
Introduction to Turbo Gears- Turbo Gears History-Main Turbo Gears 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					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. James Holmes, Struts The Complete Reference, 2nd Edition, Mc.Graw Hill Professional 2006</li> <li>2. Donald Brown, Chad Michael Davis, Scott Stanlick ,Struts 2 In Action Dreamtech press 2008</li> <li>3. Dana Moore, Raymond Budd, William Wright, Professional Python Frameworks Web 2.0 John wiley and sons, 2008</li> <li>4. Programming with Django and TurboGears, Wiley Publishing</li> <li>5. Carlos De La Guardia,Python Web Frameworks, OReilly</li> </ol>						

**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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	2	2	3	3	2

IT1712	<b>MANAGEMENT INFORMATION SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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. □

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
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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.	<b>CO1</b>
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<b>UNIT II</b>	<b>SYSTEM ANALYSIS AND DESIGN</b>	<b>9</b>
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Case tools - System flow chart, Decision table, Data flow Diagram (DFD), Entity Relationship (ER), Object Oriented Analysis and Design(OOAD), UML diagram.	<b>CO2</b>
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<b>UNIT III</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>9</b>
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DBMS – HDBMS, NDBMS, RDBMS, OODBMS, Query Processing, SQL, Concurrency Management, Data warehousing and Data Mart	<b>CO3</b>
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<b>UNIT IV</b>	<b>SECURITY, CONTROL AND REPORTING</b>	<b>9</b>
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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	<b>CO4</b>
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<b>UNIT V</b>	<b>NEW IT INITIATIVES</b>	<b>9</b>
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Role of information management in ERP, e-business, e-governance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM.	<b>CO5</b>
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**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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	2	3	3	3	2

IT1714	PARALLEL ALGORITHMS	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To understand different parallel architectures and models of computation.</li> <li>To introduce the various classes of parallel algorithms.</li> <li>To study parallel algorithms for basic problems.</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
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					<b>CO1</b>	
<b>UNIT II</b>	<b>PRAM ALGORITHMS</b>					<b>9</b>
Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching -Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring - Graph Searching					<b>CO2</b>	
<b>UNIT III</b>	<b>SIMD ALGORITHMS -I</b>					<b>9</b>
2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication					<b>CO3</b>	
<b>UNIT IV</b>	<b>SIMD ALGORITHMS -II</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>MIMD ALGORITHMS</b>					<b>9</b>
UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Michael J. Quinn, "Parallel Computing : Theory &amp; Practice", Tata McGraw Hill Edition, Second edition, 2017.</li> <li>2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition , 2011.</li> <li>3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. AnanthGrame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.</li> <li>2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel</li> </ol>						

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	TECHNIQUES AND APPLICATIONS OF MIXED REALITY	L	P	T	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>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</li> <li>To understand virtual reality, augmented reality and using them to build Biomedical engineering applications</li> <li>To know the intricacies of these platform to develop PDA applications with better optimality</li> </ul>					
<b>UNIT I</b>	<b>VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS</b>	<b>9</b>			
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					<b>CO1</b>
<b>UNIT II</b>	<b>3D USER INTERFACE INPUT HARDWARE</b>	<b>9</b>			
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					<b>CO2</b>
<b>UNIT III</b>	<b>SOFTWARE TECHNOLOGIES</b>	<b>9</b>			
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					<b>CO3</b>
<b>UNIT IV</b>	<b>3D INTERACTION TECHNIQUES</b>	<b>9</b>			
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, Gestural 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.					<b>CO4</b>
<b>UNIT V</b>	<b>AUGMENTED AND MIXED REALITY</b>	<b>9</b>			
Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality,					<b>CO5</b>

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.

**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: Merging 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
<b>CO1</b>	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
<b>CO2</b>	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
<b>CO3</b>	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
<b>CO4</b>	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2
<b>CO5</b>	2	2	2	2	1	-	-	1	1	1	1	1	2	2	2

CS1712	VIRTUALIZATION TECHNIQUES	L	T	P	C	
(Common to CSE & IT)		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To understand the concept of virtualization.</li> <li>❖ To understand the various issues in virtualization.</li> <li>❖ To be familiar with the virtualization of various components/functionalities.</li> <li>❖ To compare and analyze various virtual machines products.</li> <li>❖ To work with virtualization platforms</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines – Taxonomy of Virtual Machines – Emulation: Basic Interpretation – Threaded Interpretation – Pre-Coded & Direct Interpretation – Binary Translation – Full and Para- Virtualization – Types of Hypervisor – Types of Virtualization					<b>CO1</b>	
<b>UNIT II</b>	<b>SERVER VIRTUALIZATION</b>					<b>9</b>
Server Virtualization – Partitioning Techniques – Hardware Virtualization – Virtual Hardware – Types of Server Virtualization – Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform					<b>CO2</b>	
<b>UNIT III</b>	<b>NETWORK VIRTUALIZATION</b>					<b>9</b>
Design of Scalable Enterprise Networks – Virtualizing the Campus – WAN Design – WAN Architecture – WAN virtualization – Virtual Enterprise Transport Virtualization – VLANs and Scalability – Theory Network Device Virtualization Layer 2 – VLANs Layer 3 VRF Instances Layer 2 – VFI Virtual Firewall Contexts Network Device Virtualization – Datapath Virtualization Layer 2: 802.1q – Trunking Generic Routing Encapsulation – IPsec L2TPv3 Label Switched Paths – Control-Plane Virtualization – Routing Protocols – VRF- Aware Routing – Multi- Topology Routing					<b>CO3</b>	
<b>UNIT IV</b>	<b>STORAGE VIRTUALIZATION</b>					<b>9</b>
Hardware Devices – SCSI – SCSI Communication – Using SCSI Buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI SAN Backup & Recovery Techniques – RAID – Classic Storage Model – SNIA Shared Storage Model Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual Tape Libraries					<b>CO4</b>	
<b>UNIT V</b>	<b>APPLYING VIRTUALIZATION</b>					<b>9</b>
Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level – Shared Kernel – Enterprise Solutions: Vmware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box – Server Virtualization: Configuring Server with Server Virtualization, Adjusting & Tuning Virtual Servers, VM Backup and Migration – Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions, Localized Virtualized Desktop – Network and Storage Virtualization: VPN, VLAN, SAN and VSAN, NAS					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress, 2005.</li> <li>2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.</li> <li>3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and</li> </ol>						

Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

### REFERENCE BOOKS

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

### COURSE OUTCOMES

Upon completion of the course, students will be able to

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

### MAPPING OF COs WITH POs AND PSOs

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

**SEMESTER VII  
PROFESSIONAL ELECTIVE – IV**

IT1721	STORAGE AREA NETWORKS	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• To Identify key challenges in managing information and analyze different storage networking technologies and virtualization</li> <li>• To Know about components and the implementation of NAS</li> <li>• Understand CAS architecture and types of archives and forms of virtualization</li> <li>• Understand the storage infrastructure and management activities</li> <li>• Understand the Securing Infrastructure.</li> </ul>						
<b>UNIT I</b>	<b>STORAGE SYSTEM</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>STORAGE NETWORKING TECHNOLOGIES</b>					<b>9</b>
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.					<b>CO2</b>	
<b>UNIT III</b>	<b>BACKUP, ARCHIVE AND REPLICATION</b>					<b>9</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>CLOUD COMPUTING AND VIRTUALIZATION</b>					<b>9</b>
Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Outof-Band Virtualization Appliances, High					<b>CO4</b>	

Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications.

<b>UNIT V</b>	<b>SECURING AND MANAGING STORAGE INFRASTRUCTURE</b>	<b>9</b>
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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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2

IT1722	UI/UX APPLICATION DEVELOPMENT	L	P	T	C
		3	0	0	3
<b>OBJECTIVES</b>					
<p>To make the students conversant with</p> <ul style="list-style-type: none"> <li>• To understand the fundamental principles of User Interface (UI) and User Experience (UX) design.</li> <li>• To learn various tools and techniques used for creating intuitive and aesthetically pleasing interfaces.</li> <li>• To develop the ability to conduct user research and usability testing.</li> <li>• To gain practical experience in designing and prototyping user interfaces for web and mobile applications.</li> <li>• To understand the integration of UI/UX design principles with software development processes.</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO UI/UX DESIGN</b>	<b>9</b>			
<p>Fundamentals of UI Design: Principles of UI, importance of UI in application development. - Fundamentals of UX Design: Principles of UX, user-centered design, difference between UI and UX - Design Thinking: Introduction to design thinking, stages of design thinking. - UI/UX Design Process: Steps in the UI/UX design process, from research to implementation.-Human-Computer Interaction (HCI): Basics of HCI, user behavior, interaction models.-Usability Principles: Usability heuristics, designing for usability.-Visual Design Basics: Color theory, typography, and layout principles.- Accessibility in Design: Importance of accessibility, designing for all users.</p>					<b>CO1</b>
<b>UNIT II</b>	<b>USER RESEARCH AND ANALYSIS</b>	<b>9</b>			
<p>Understanding Users: Types of users, user personas, and scenarios.-User Research Methods: Interviews, surveys, focus groups, and observational studies. -Empathy Mapping: Building empathy maps to understand user needs.-User Journey Mapping: Creating user journey maps to visualize user interactions.-Competitor Analysis: Analyzing competitor products, identifying strengths and weaknesses.-Information Architecture (IA): Principles of IA, creating sitemaps and navigation.-Wireframing: Basics of wireframing, low-fidelity vs. high-fidelity wireframes.- Prototyping Tools: Introduction to prototyping tools (e.g., Figma, Sketch, Adobe XD).</p>					<b>CO2</b>
<b>UNIT III</b>	<b>UI DESIGN PRINCIPLES AND TECHNIQUES</b>	<b>9</b>			
<p>UI Components: Buttons, forms, icons, and other UI elements.-Design Systems: Creating and using design systems for consistency.-Responsive Design: Principles of responsive web design, media queries.-Grid Systems and Layouts: Using grids for layout, common layout patterns.-Typography in UI Design: Choosing fonts, text hierarchy, readability.-Color Theory in UI Design: Choosing color schemes, color psychology.-Designing for Different Devices: Desktop, tablet, and mobile design considerations.-Micro interactions: Importance of micro interactions, designing subtle interactions.</p>					<b>CO3</b>

<b>UNIT IV</b>	<b>UX DESIGN PRINCIPLES AND USABILITY TESTING HEURISTIC EVALUATION</b>	<b>9</b>
<p>Conducting heuristic evaluations, common heuristics.-Usability Testing Methods: Types of usability tests, planning and conducting tests.-Analyzing Test Results: Interpreting usability test results, identifying usability issues.-User Feedback: Gathering and incorporating user feedback.-UX Metrics: Measuring UX success, key performance indicators (KPIs).Interaction Design: Principles of interaction design, designing interactive elements.-Emotional Design: Designing for emotional impact, creating engaging experiences.-Cognitive Load: Understanding cognitive load, designing to minimize cognitive load.</p>		<b>CO4</b>
<b>UNIT V</b>	<b>ADVANCED TOPICS IN UI/UX AND INTEGRATION WITH DEVELOPMENT</b>	<b>9</b>
<p>Advanced Prototyping: High-fidelity prototypes, interactive prototypes.-Animation in UI Design: Adding animations, transitions, and effects (Figma).-Design for Emerging Technologies-Designing for AR/VR(spline 3d), voice interfaces, and IoT.-Agile and UX: Integrating UX design with agile development processes.-Collaboration Tools and Technique*: Tools for collaboration, design handoff.-UI/UX Case Studies: Analyzing successful UI/UX projects (Figma), lessons learned.-Future Trends in UI/UX: Keeping up with the latest trends and innovations.-Portfolio Development: Creating a UI/UX design portfolio, showcasing projects.</p>		<b>CO5</b>

**TOTAL : 45 PERIODS**

**TEXT BOOKS**

1. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability" by Steve Krug, Edition: 3rd Edition (Latest), Publisher: New Riders, ISBN: 978-0321965516
2. The Design of Everyday Things: Revised and Expanded Edition" by Don Norman, Edition: Revised and Expanded Edition, Publisher: Basic Books, ISBN: 978-0465050659
3. About Face: The Essentials of Interaction Design" by Alan Cooper, Robert Reimann, David Cronin, and Christopher Noessel, Edition: 4th Edition (Latest), Publisher: Wiley, ISBN: 978-1118766576.

**REFERENCE BOOKS**

1. Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines" by Jeff Johnson, Edition: 2nd Edition (Latest), Publisher: Morgan Kaufmann, ISBN: 978-0124079143.
2. A Project Guide to UX Design: For User Experience Designers in the Field or in the Making" by Russ Unger and Carolyn Chandler, Edition: 2nd Edition (Latest), Publisher: New Riders, ISBN: 978-0321815385
3. Sketching User Experiences: The Workbook" by Saul Greenberg, Sheelagh Carpendale, Nicolai Marquardt, and Bill Buxton, Publisher: Morgan Kaufmann, ISBN: 978-0123819598

**COURSE OUTCOMES**

Upon completion of the course, the students will gain knowledge on

CO1	Students will be able to understand the basic concepts of UI/UX design principles to create user-friendly applications.
CO2	Students will be able to conduct user research and interpret usability testing results.
CO3	Students will be able to understand principles, design application using UI techniques.
CO4	Students will be able to understand principles, design application using UX techniques
CO5	Students will understand how to integrate UI/UX in advanced levels of applications.

**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
<b>CO1</b>	3	2	3	2	3	1	-	-	-	-	-	2	3	2	2
<b>CO2</b>	3	3	3	2	3	2	-	-	-	-	-	1	2	2	1
<b>CO3</b>	3	3	2	2	2	1	-	-	-	-	-	2	2	1	1
<b>CO4</b>	3	3	2	2	2	1	-	-	-	-	-	3	3	2	2
<b>CO5</b>	3	3	3	3	2	1	-	-	-	-	-	3	3	2	1

IT1723	SOFTWARE AGENTS	L	T	P	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• Understand the how software agents reduce information overhead</li> <li>• gain knowledge in use of software agents for cooperative learning and personal assistance,</li> <li>• to know how agent can communicate and share knowledge using agent communication language</li> <li>• gain knowledge in design of an agent interpreter and intelligent agent</li> <li>• understand the concept of mobile technology and mobile agents and its security</li> </ul>					
<b>UNIT I</b>	<b>AGENT AND USER EXPERIENCE</b>				<b>9</b>
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					<b>CO1</b>
<b>UNIT II</b>	<b>AGENTS FOR LEARNING AND ASSISTANCE</b>				<b>9</b>
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.					<b>CO2</b>
<b>UNIT III</b>	<b>AGENT COMMUNICATION AND COLLABORATION</b>				<b>9</b>
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>AGENT ARCHITECTURE</b>				<b>9</b>
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.					<b>CO4</b>
<b>UNIT V</b>	<b>MOBILE AGENTS</b>				<b>9</b>
Mobile agent paradigm - Mobile agent concepts -Mobile agent technology – programming mobile agents –application of mobile agents- Teleshopping. Mobile agent security- trust, reliability and reputation.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2

IT1724	5G NETWORKS	L	P	T	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
To make the students conversant with						
<ul style="list-style-type: none"> <li>Understand Increased Data Rates</li> <li>Analyse Reduced Latency &amp; Evaluate Enhanced Capacity</li> <li>Ensure Improved Reliability - Ensure Scalability and Flexibility</li> </ul>						
<b>UNIT I</b>	<b>Overview of 5G Broadband Wireless</b>					<b>9</b>
3G and 4G(LTE) overview- Introduction to 5G – Use Cases - Evolving LTE to 5G Capability- 5G NR and 5G core network (5GCN) - 5G Standardization - 3GPP and IMT2020 - Spectrum for 5G – 5G deployment - Options, Challenges and Applications.					<b>CO1</b>	
<b>UNIT II</b>	<b>5G CHANNEL ACCESS METHODS</b>					<b>9</b>
OFDM and OFDMA – MIMO OFDM – Generalized Frequency Division Multiplexing (GFDM) – Non-Orthogonal Multiple Access (NOMA) - Universal Filtered OFDM -Filter bank multicarrier (FBMC)- Sparse Code Multiple Access (SCMA) –Comparison of multiple access methods.					<b>CO2</b>	
<b>UNIT III</b>	<b>WIRELESS SENSOR NETWORKS</b>					<b>9</b>
Introduction to wireless sensor network (WSN), WSN-Architecture -Coverage and placement - Topology management in WSN - Applications Mobile WSN - Technologies for sensor nodes & networks - operating environment - Under water WSN - Security of WSN MAC Routing and Transport protocols for WSN.					<b>CO3</b>	
<b>UNIT IV</b>	<b>WIRELESS ROUTING PROTOCOLS</b>					<b>9</b>
Medium access problems in wireless networks - Traditional routing - Mobile network layer Mobile IP - Introduction to IPv4 and IPv6 - Data forwarding procedure in Mobile IP (IPv4 and IPv6) - Mobility management Protocol trade-offs - Congestion window management - Mobile transport layer- Traditional TCP - mobile TCP Indirect TCP Reno New-Reno, Tahoe Vegas. UDP.					<b>CO4</b>	
<b>UNIT V</b>	<b>INTERNET OF THINGS (IOT) AND GPS SYSTEMS</b>					<b>9</b>
IoT architecture - Main design principles and needed capabilities. <b>IoT Devices and gateways</b> <b>Case studies</b> : Sensor body area network - Control of a smart home - Smart vehicles Smart manufacturing and smart factory. Emerging IoT standards - IoT-protocols IoT Local and wide area networking - IEEE 802.15 WPAN Bluetooth – pico - net scatter net - Protocol stack Interface between 802.11 and Bluetooth - Geolocation service techniques and standards - Introduction to GPS-aided GEO augmented navigation (GAGAN) - E.911 ZigBee UWB and RFID.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>Robert Schultheis and Mary Summer, Management Information Systems – The Managers View, Tata McGraw Hill, 2008.</li> <li>R. Vannithamby and S. Talwar, “Towards 5G: Applications, Requirements and Candidate Technologies”, John Willey &amp; Sons, 1st Edition, 2017.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>Communications Technology 5G Mobile And Wireless, Afif Osseiran, Jose Fmonserrat, Patrick Marsch, Cambridge University Press, 2<sup>nd</sup> Edition 2011.</li> <li>Fundamentals of 5G Mobile Networks, Jonathan Rodriguez, Wiley, 1<sup>st</sup> Edition 2010.</li> <li>Long Zhao, Hui Zhao, Kan Zheng, Wei Xiang, “Massive MIMO in 5G Networks: Selected Applications”, Springer, 1<sup>st</sup> Edition, 2018.</li> <li>Robert W. Heath Jr., Angel Lozano, “Foundations of MIMO Communication”, Cambridge University Press, 1<sup>st</sup> Edition, 2019.</li> </ol>						

**COURSE OUTCOMES**

Upon completion of the course, the students will gain knowledge on

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

<b>DS1723</b>	<b>SOCIAL NETWORK ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
(Common to IT & AI-DS)		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To understand the concept of semantic web and related applications.</li> <li>❖ To learn knowledge representation using ontology.</li> <li>❖ To detect communities in social networks.</li> <li>❖ To understand human behaviour in social web and related communities.</li> <li>❖ To learn visualization of social networks.</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Statistical properties of social Networks-Definitions-Data Descriptions-Static properties- Dynamic properties- Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.					<b>CO1</b>	
<b>UNIT II</b>	<b>MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION</b>					<b>9</b>
Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.					<b>CO2</b>	
<b>UNIT III</b>	<b>EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS</b>					<b>9</b>
Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.					<b>CO3</b>	
<b>UNIT IV</b>	<b>PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES</b>					<b>9</b>
Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.					<b>CO4</b>	
<b>UNIT V</b>	<b>VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS</b>					<b>9</b>
Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks-Random Walk based Proximity Measures -Clustering with random walk based					<b>CO5</b>	

measures-Algorithms for Computing Personalized PageRank and Sim Rank – Application-Computer Vision - Text Analysis -Collaborative Filtering - Combating Web Spam.

**TOTAL : 45 PERIODS**

**TEXT BOOKS**

1. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1st Edition, Springer, 2010.
3. Charu C. Aggarwal, “Social Network Data Analytics”, First Edition, Springer 2011.

**REFERENCE BOOKS**

1. David Camacho,Angel, Gema Bello and Antonio,”The Four Dimensions of Social Network Analysis: An Overview of Research Methods, Applications, and Software Tools” Feb 2020.
2. Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition, Springer, 2011.
3. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

<b>CO1</b>	Develop semantic web related applications.
<b>CO2</b>	Represent knowledge using ontology.
<b>CO3</b>	Detect communities in social networks.
<b>CO4</b>	Predict human behavior in social web and related communities.
<b>CO5</b>	Visualize social networks.

**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
<b>CO1</b>	2	2	2	2	2	-	-	-	-	2	2	2	2	2	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	2	2	2	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	2	2	2	3	2
<b>CO4</b>	2	2	3	3	2	-	-	-	-	2	2	2	2	3	2
<b>CO5</b>	2	2	2	2	2	-	-	-	-	2	2	2	2	2	2

**SEMESTER VIII**  
**PROFESSIONAL ELECTIVE – V**

IT1811	INFORMATION THEORY AND CODING	L	T	P	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• Understand error–control coding.</li> <li>• Understand encoding and decoding of digital data streams.</li> <li>• Be familiar with the methods for the generation of these codes and their decoding techniques.</li> <li>• Be aware of compression and decompression techniques.</li> <li>• Learn the concepts of multimedia communication.</li> </ul>					
<b>UNIT I</b>	<b>INFORMATION THEORY</b>				<b>9</b>
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.					<b>CO1</b>
<b>UNIT II</b>	<b>SOURCE CODING: TEXT, AUDIO AND SPEECH</b>				<b>9</b>
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					<b>CO2</b>
<b>UNIT III</b>	<b>SOURCE CODING: IMAGE AND VIDEO</b>				<b>9</b>
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					<b>CO3</b>
<b>UNIT IV</b>	<b>ERROR CONTROL CODING: BLOCK CODES</b>				<b>9</b>
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					<b>CO4</b>
<b>UNIT V</b>	<b>ERROR CONTROL CODING: CONVOLUTIONAL CODES</b>				<b>9</b>
Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
1. R Bose, “Information Theory, Coding and Crptography”, TMH 2007					

2. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson 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
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• Discuss fundamentals of e-commerce, types and applications.</li> <li>• Evaluate the role of the major types of information systems in a business environment and their relationship to each other</li> <li>• Assess the impact of the Internet and Internet technology on business electronic commerce and electronic business</li> <li>• Identify the major management challenges for building and using information systems and learn how to find appropriate solutions to those challenges.</li> <li>• Learn strategies for e-commerce, Mobile Commerce, Wireless Application Protocol, WAP technology and Mobile Information devices.</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION</b>				<b>9</b>
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.					<b>CO1</b>
<b>UNIT II</b>	<b>NETWORK INFRASTRUCTURE FOR E- COMMERCE</b>				<b>9</b>
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.					<b>CO2</b>
<b>UNIT III</b>	<b>WEB SECURITY</b>				<b>9</b>
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>ENCRYPTION</b>				<b>9</b>
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.					<b>CO4</b>
<b>UNIT V</b>	<b>ELECTRONIC PAYMENTS</b>				<b>9</b>
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To learn emotional recognition techniques.</li> <li>To gain a broader knowledge and understanding of the various affective computing models.</li> <li>To learn about various machines developed using human emotion.</li> </ul>						
<b>UNIT I</b>	<b>Introduction</b>					<b>9</b>
Affective Computing and the Challenge of mood measurement and forecasting. Affective phenomena: emotion, mood, attitude/sentiment, personality. Computers, robots, smartphones with emotional intelligence.					<b>CO1</b>	
<b>UNIT II</b>	<b>Emotion Theory</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>Emotion and Perception</b>					<b>9</b>
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,					<b>CO3</b>	
<b>UNIT IV</b>	<b>Affect Recognition</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>Ethical Implications of Affective Computing</b>					<b>9</b>
Philosophical, Social, Ethical Implications of Affective Computing, Machine/Mobile Empathy and Emotional Support, Lie Detection and Stress Detection.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
1. Affective Computing and Interaction: Psychological, Cognitive and Neuroscientific Perspectives by Didem Gökçay and Gülsen Yıldırım, IGI Global. 2. The Encyclopedia of Human-Computer Interaction by Jonas Lowgren, John M. Carroll, Marc Hassenzahl, and Thomas 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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2

IT1814	SOCIAL MEDIA MINING	L	T	P	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To implement Basics of Text Processing over Social Data</li> <li>To understand various Characteristics of OSNs</li> <li>To understand Fundamentals of Social Data Analytics</li> <li>To Apply the concepts of Social Data Analytics</li> <li>Able to properly handle Online experiments for Computational Social Science.</li> </ul>					
<b>UNIT I</b>	<b>ONLINE SOCIAL NETWORKS (OSNS)</b>	<b>9</b>			
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					<b>CO1</b>
<b>UNIT II</b>	<b>STUDYING CHARACTERISTICS OF OSNS</b>	<b>9</b>			
Information Diffusion, Experimental studies over OSNs, Sampling					<b>CO2</b>
<b>UNIT III</b>	<b>FUNDAMENTALS OF SOCIAL DATA ANALYTICS</b>	<b>9</b>			
Topic Models, Random Walks, Heterogeneous Information Networks					<b>CO3</b>
<b>UNIT IV</b>	<b>APPLIED SOCIAL DATA ANALYTICS</b>	<b>9</b>			
Recommendation Systems, Community identification and link prediction					<b>CO4</b>
<b>UNIT V</b>	<b>ADVANCED TOPICS</b>	<b>9</b>			
Online experiments for Computational Social Science, Big Data Sampling					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
1. Matthew A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, Github, and More, 2nd Edition, O'Reilly Media, 2013.					
<b>REFERENCE BOOKS</b>					
1. Jennifer Golbeck, Analyzing the social web, Morgan Kaufmann, 2013.					
2. Charu Aggarwal (ed.), Social Network Data Analytics, Springer, 2011.					
<b>COURSE OUTCOMES</b>					
<b>Upon completion of the course, students will be able to</b>					
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

DS1812	SPEECH PROCESSING AND SYNTHESIS	L	T	P	C
(Common to IT & AI-DS)		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To understand the mathematical foundations needed for speech processing</li> <li>❖ To understand the basic concepts and algorithms of speech processing and synthesis</li> <li>❖ To familiarize the students with the various speech signal representation, coding and recognition techniques</li> <li>❖ To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing</li> </ul>					
<b>UNIT I</b>	<b>FUNDAMENTALS OF SPEECH PROCESSING</b>	<b>9</b>			
Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.					<b>CO1</b>
<b>UNIT II</b>	<b>SPEECH SIGNAL REPRESENTATIONS AND CODING</b>	<b>9</b>			
Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder.					<b>CO2</b>
<b>UNIT III</b>	<b>SPEECH RECOGNITION</b>	<b>9</b>			
Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.					<b>CO3</b>
<b>UNIT IV</b>	<b>TEXT ANALYSIS</b>	<b>9</b>			
Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation					<b>CO4</b>
<b>UNIT V</b>	<b>SPEECH SYNTHESIS</b>	<b>9</b>			
Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>REFERENCE BOOKS</b>					
<ol style="list-style-type: none"> <li>1. James Whitaker, John Liu, and Uday Kamath, Deep learning for NLP and Speech Recognition, Springer, 2019.</li> <li>2. Joseph Mariani, —Language and Speech Processing, Wiley, 2009.</li> <li>3. Lawrence Rabiner and Biing-Hwang Juang, —Fundamentals of Speech Recognition, Prentice Hall Signal Processing Series, 1993.</li> <li>4. Sadaoki Furui, —Digital Speech Processing: Synthesis, and Recognition, Second Edition, (Signal Processing and Communications), Marcel Dekker, 2000.</li> <li>5. Thomas F. Quatieri, —Discrete-Time Speech Signal Processing, Pearson Education, 2002.</li> <li>6. Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, —Spoken Language Processing – A guide to Theory, Algorithm and System Development, Prentice Hall PTR, 2001.</li> </ol>					

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

CO1	Identify the various temporal, spectral and cepstral features required for identifying speech units – phoneme, syllable and word
CO2	Determine and apply Mel-frequency cepstral coefficients for processing all types of signals
CO3	Justify the use of formant and concatenative approaches to speech synthesis
CO4	Identify the apt approach of speech synthesis depending on the language to be processed
CO5	Determine the various encoding techniques for representing speech.

**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
<b>CO1</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	2	2	2	-	-	-	2	2	2	3	3	2

**SEMESTER VIII**  
**PROFESSIONAL ELECTIVE – VI**

<b>IT1821</b>	<b>INTRODUCTION TO DIGITAL CURRENCIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• To study the concepts of Bitcoins</li> <li>• To study Bitcoin Client and Transactions</li> <li>• To understand Bitcoin Network and Blockchain</li> <li>• To understand Storage and Mining</li> <li>• To study Alternative Chains.</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
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					<b>CO1</b>	
<b>UNIT II</b>	<b>THE BITCOIN CLIENT AND TRANSACTIONS</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>BITCOIN NETWORK AND BLOCKCHAIN</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>BITCOIN STORAGE AND MINING</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>ALTCOINS</b>					<b>9</b>
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					<b>CO5</b>	

**TOTAL : 45 PERIODS**

**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

IT1822	TRUST NETWORKS	L	P	T	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>Understand how block chain systems (mainly Bitcoin and Ethereum) work</li> <li>To securely interact with them</li> <li>Design, build, and deploy smart contracts and distributed applications</li> <li>Integrate ideas from block chain technology into their own projects.</li> </ul>					
<b>UNIT I</b>	<b>Block chain</b>				<b>9</b>
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) .					<b>CO1</b>
<b>UNIT II</b>	<b>Crypto Currency</b>				<b>9</b>
cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography					<b>CO2</b>
<b>UNIT III</b>	<b>Crypto Currency Regulation</b>				<b>9</b>
Bitcoin - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.					<b>CO3</b>
<b>UNIT IV</b>	<b>Ethereum</b>				<b>9</b>
Ethereum Virtual Machine ( EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts					<b>CO4</b>
<b>UNIT V</b>	<b>Trends and Topics</b>				<b>9</b>
Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge ( SNARK) - pairing on Elliptic curves - Zcash.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
1. 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)					
<b>REFERENCE BOOKS</b>					
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) { certain 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 VOI 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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To provide an introduction to the basic principles, techniques, and applications of Artificial Intelligence.</li> <li>To know about Lisp and Prolog and use of these languages in AI.</li> </ul>						
<b>UNIT I</b>	<b>Scope of AI</b>					<b>9</b>
Games theorem, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction					<b>CO1</b>	
<b>UNIT II</b>	<b>Problem solving</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>Knowledge Representation</b>					<b>9</b>
Predicate Logic: unification, modus ponens, 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					<b>CO3</b>	
<b>UNIT IV</b>	<b>Handling uncertainty and learning</b>					<b>9</b>
Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, genetic algorithm, learning by inductions, neural network.					<b>CO4</b>	
<b>UNIT V</b>	<b>Robotics and its application</b>					<b>9</b>
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 Robot Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>Elaine Rich, Kevin Knight, Artificial Intelligence TMH (Any Edition).</li> <li>S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009</li> <li>Max Braber, Logic Programming with Prolog, Springer, 2005.</li> <li>E. Rich and K. Knight, "Artificial intelligence", MH, 2nd ed., 1992.</li> <li>N.J. Nilsson, "Principles of AI", Narosa Publ. House, 2000.</li> </ol>						

**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
<b>CO1</b>	3	3	3	3	2	-	1	-	-	2	2	2	3	3	2
<b>CO2</b>	3	3	3	3	2	-	1	-	-	2	2	2	3	3	2
<b>CO3</b>	3	3	3	3	2	-	1	-	-	2	2	2	3	3	2
<b>CO4</b>	3	3	3	3	2	-	1	-	-	2	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	-	1	-	-	2	2	2	3	3	2

IT1824	IOT PLATFORM FOR SMART CITY PLANNING	L	T	P	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• Concepts of Internet of Things.</li> <li>• IoT Architecture and Terminologies.</li> <li>• IoT working platform for different system.</li> <li>• IoT standards for smart city planning.</li> <li>• IoT applications on different sectors.</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO IOT</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>IOT ARCHITECTURE</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>IOT PLATFORMS DESIGN METHODOLOGY</b>	<b>9</b>			
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					<b>CO3</b>
<b>UNIT IV</b>	<b>IOT STANDARDS</b>	<b>9</b>			
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					<b>CO4</b>
<b>UNIT V</b>	<b>IOT APPLICATIONS</b>	<b>9</b>			
Lighting as service – Smart Parking -Smart metering – Smart water management- Smart energy– Smart solid waste management - Smart mobility – Smart governance- Challenges in IoT Management.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Olivier Hersent, David Boswarthick and Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, Second Edition, Wiley Publisher, 2012.</li> <li>2. Uckelmann, Dieter, Mark Harrison, and Florian Michahelles, “Architecting the Internet of Things”. SpringerScience &amp; Business Media, 2011.</li> </ol>					

## REFERENCE BOOKS

1. ArshdeepBahga, Vijay Madiseti, "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

<b>CS1824</b>	<b>BLOCKCHAIN TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>(Common to CSE &amp; IT)</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### OBJECTIVES

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

<b>UNIT I</b>	<b>BASICS</b>	<b>9</b>
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Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

**CO1**

<b>UNIT II</b>	<b>BLOCKCHAIN</b>	<b>9</b>
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Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

**CO2**

<b>UNIT III</b>	<b>DISTRIBUTED CONSENSUS</b>	<b>9</b>
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Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

**CO3**

<b>UNIT IV</b>	<b>CRYPTOCURRENCY</b>	<b>9</b>
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History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin

**CO4**

<b>UNIT V</b>	<b>CRYPTOCURRENCY REGULATION</b>	<b>9</b>
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Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

**CO5**

**TOTAL : 45 PERIODS**

### TEXT BOOKS

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

### REFERENCE BOOKS

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

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

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

**MAPPING OF COs WITH POs AND PSOs**

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

## OPEN ELECTIVES – I & II

OBT101	INDUSTRIAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3
<b>OBJECTIVE</b>					
<p>❖ 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</p>					
<b>UNIT I</b>	<b>OVERVIEW OF THE CELL</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>MICROBIAL GROWTH: PURE CULTURE TECHNIQUES</b>	<b>9</b>			
Enrichment culture techniques for isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microorganisms. The definition of growth, mathematical expression of growth, Growth curve, availability of oxygen, culture collection and maintenance of cultures. Media formulation: principles of microbial nutrition, formulation of culture medium, selective media, factors influencing the choice of various carbon and nitrogen sources, vitamins, minerals, precursors and antifoam agents. Importance of pH.					<b>CO2</b>
<b>UNIT III</b>	<b>MANAGEMENT OF WASTE</b>	<b>9</b>			
Management of Contaminated land, lake sediments and Solid Waste, Anaerobic digestion, Biostimulation, Bioaugmentation, Phytoremediation, Natural attenuation, Vermicomposting					<b>CO3</b>
<b>UNIT IV</b>	<b>BIOREMEDIATION</b>	<b>9</b>			
Definition, constraints and priorities of Bioremediation, Types of bioremediation, In-situ and Ex-situ bioremediation techniques, Factors affecting bioremediation. Bioremediation of Hydrocarbons. Lignocellulosic Compounds.					<b>CO4</b>
<b>UNIT V</b>	<b>BIOENERGY AND BIOMINING</b>	<b>9</b>			
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Molecular Biology of cell, Alberts. B et al. Developmental Biology, SF Gilbert, Sinauer Associates Inc.</li> <li>2. AVN Swamy, Industrial Pollution Control Engineering, 2006, Galgotia Publication</li> </ol>					
<b>REFERENCE BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Environmental Biotechnology - Allan Stagg.</li> </ol>					

**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

<b>OBT104</b>	<b>BIOSENSORS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

### OBJECTIVE

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

<b>UNIT I</b>	<b>PROTEIN BASED BIOSENSORS</b>	<b>9</b>
	Nano structure for enzyme stabilization - Single enzyme nano particles - Nanotubes microporous silica - Protein based nanocrystalline Diamond thin film for processing	<b>CO1</b>
<b>UNIT II</b>	<b>DNA BASED BIOSENSOR</b>	<b>9</b>
	Heavy metal complexing with DNA and its determination water and food samples - DNA zymo biosensors	<b>CO2</b>
<b>UNIT III</b>	<b>ELECTRO CHEMICAL APPLICATION</b>	<b>9</b>
	Detection in biosensors - Fluorescence - Absorption - Electrochemical. Integration of various techniques - Fibre optic biosensors	<b>CO3</b>
<b>UNIT IV</b>	<b>FABRICATION OF BIOSENSORS</b>	<b>9</b>
	Techniques used for microfabrication - Microfabrication of electrodes - On chip analysis	<b>CO4</b>
<b>UNIT V</b>	<b>BIOSENSORS IN RESEARCH</b>	<b>9</b>
	Future direction in biosensor research - Designed protein pores-as components of biosensors - Molecular design -Bionanotechnology for cellular biosensing - Biosensors for drug discovery - Nanoscale biosensors	<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>		

### TEXT 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 nanochip analyzer
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
<b>CO1</b>	2	1	3	2	1	2	2	4	2	1	1	1	2	1	1
<b>CO2</b>	3	2	1	2	2	1	2	1	3	4	1	2	1	1	2
<b>CO3</b>	1	2	4	3	1	2	4	3	1	2	4	5	1	2	2
<b>CO4</b>	1	2	2	4	2	1	1	1	2	1	3	2	1	2	2
<b>CO5</b>	2	1	3	1	2	4	3	2	1	2	3	1	1	2	2

<b>OBT105</b>	<b>INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

### OBJECTIVE

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

<b>UNIT I</b>	<b>BASICS OF NANOTECHNOLOGY</b>	<b>9</b>
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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.

<b>UNIT II</b>	<b>DIFFERENT CLASSES OF NANOMATERIALS</b>	<b>9</b>
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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.

<b>UNIT III</b>	<b>SYNTHESIS OF NANOMATERIALS</b>	<b>9</b>
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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).

<b>UNIT IV</b>	<b>CHARACTERIZATION OF NANOSTRUCTURES</b>	<b>9</b>
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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).

<b>UNIT V</b>	<b>APPLICATIONS</b>	<b>9</b>
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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

**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 nanostructured 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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To introduce the fundamentals and components of Geographic Information System</li> <li>❖ To provide details of spatial data models.</li> <li>❖ To know the details of data input and topology</li> <li>❖ To know the knowledge on data management and output processes</li> <li>❖ To know the data quality and standards</li> </ul>						
<b>UNIT I</b>	<b>FUNDAMENTALS OF GIS</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>SPATIAL DATA MODELS</b>					<b>9</b>
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.					<b>CO2</b>	
<b>UNIT III</b>	<b>DATA INPUT AND TOPOLOGY</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>DATA QUALITY AND STANDARDS</b>					<b>9</b>
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure					<b>CO4</b>	
<b>UNIT V</b>	<b>DATA MANAGEMENT AND OUTPUT</b>					<b>9</b>
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.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Kang - TsungChang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition,2011.</li> <li>2. Ian Heywood, Sarah Cornelius, SteveCarver,Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2ndEdition,2007.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers,2006</li> </ol>						
<b>COURSE OUTCOMES</b>						

**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
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To understand the fundamentals of hospital administration and management.</li> <li>❖ To know the market related research process and its HRM</li> <li>❖ To understand the recruitment and training processes in hospitals</li> <li>❖ To explore various information management systems and relative supportive services.</li> <li>❖ To learn the quality and safety aspects in hospital.</li> </ul>					
<b>UNIT I</b>	<b>OVERVIEW OF HOSPITAL ADMINISTRATION</b>	<b>9</b>			
Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning					<b>CO1</b>
<b>UNIT II</b>	<b>HUMAN RESOURCE MANAGEMENT IN HOSPITAL</b>	<b>9</b>			
Principles of HRM – Functions of HRM – Profile of HRD Manager –Human Resource Inventory – Manpower Planning.					<b>CO2</b>
<b>UNIT III</b>	<b>RECRUITMENT AND TRAINING</b>	<b>9</b>			
Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer.					<b>CO3</b>
<b>UNIT IV</b>	<b>SUPPORTIVE SERVICES</b>	<b>9</b>			
Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services.					<b>CO4</b>
<b>UNIT V</b>	<b>COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL</b>	<b>9</b>			
Purposes – Planning of Communication, Modes of Communication – Telephone, ISDN, Public Address and Piped Music – CCTV.Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. R.C.Goyal, “Hospital Administration and Human Resource Management”, PHI – Fourth Edition, 2006.</li> <li>2. G.D.Kunders, “Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.</li> </ol>					
<b>REFERENCE BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Cesar A.Caceres and Albert Zara, “The Practice of Clinical Engineering, Academic Press, New York, 1977.</li> <li>2. Norman Metzger, “Handbook of Health Care Human Resources Management”, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.</li> <li>3. Peter Berman “Health Sector Reform in Developing Countries” - Harvard University Press, 1995.</li> <li>4. William A. Reinke “Health Planning For Effective Management” - Oxford University Press.1988</li> <li>5. Blane, David, Brunner, “Health and SOCIAL Organization: Towards a Health Policy for the 21st Century”, Eric Calrendon Press 2002.</li> <li>6. Arnold D. Kalcizony&amp; Stephen M. Shortell, “Health Care Management”, 6<sup>th</sup> Edition Cengage Learning, 2011.</li> </ol>					
<b>COURSE OUTCOMES</b>					

**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
<b>OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>Understand the concepts of embedded system design and analysis</li> <li>Learn the architecture and programming of ARM processor</li> <li>Be exposed to the basic concepts of embedded programming</li> <li>Learn the concepts of IOT</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTION TO EMBEDDED SYSTEM</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>INTRODUCTION TO EMBEDDED PROCESSORS</b>	<b>9</b>			
Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485- Inter Integrated Circuits (I2C), Serial Peripheral Interface (SPI), CAN Bus, – USB- Wi-Fi- Bluetooth- Zigbee - need for Device Drivers.					<b>CO2</b>
<b>UNIT III</b>	<b>INTRODUCTION TO IoT</b>	<b>9</b>			
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					<b>CO3</b>
<b>UNIT IV</b>	<b>IoT PROTOCOLS</b>	<b>9</b>			
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					<b>CO4</b>
<b>UNIT V</b>	<b>EMBEDDED And IoT CASE STUDIES</b>	<b>9</b>			
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					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS:</b>					
<ol style="list-style-type: none"> <li>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)</li> <li>Arshdeep Bahga, Vijay Madiseti, "Internet of Things, A Hands-on-Approach", 1st Edition, Universities press Pvt. Ltd., India, 2015.</li> <li>Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6, 1st Edition, John Wiley &amp; Sons", Inc, USA, 2013</li> </ol>					
<b>REFERENCES:</b>					
<ol style="list-style-type: none"> <li>Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", 1st Edition, John Wiley &amp; Sons Ltd, UK, 2014</li> <li>Peter Waher, "Learning Internet of Things", 1st Edition, Packt Publishing Ltd, UK, 2015.</li> <li>Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi" , 1st Edition, Apress Publishers, USA, 2013.</li> </ol>					

**COURSE OUTCOMES:**

By the end of this course, the student should be able to:

<b>CO1</b>	Understand the Embedded System Design Process
<b>CO2</b>	Describe the architecture and programming of ARM processor
<b>CO3</b>	Outline the concepts of embedded system programming
<b>CO4</b>	Explain the basic concepts of IOT
<b>CO5</b>	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
<b>CO1</b>	3	3	2	3	-	2	1	2	-	1	2	2	3	3	2
<b>CO2</b>	3	3	2	3	-	3	1	2	-	1	2	2	3	3	2
<b>CO3</b>	3	3	2	3	3	3	1	2	1	1	2	2	3	3	2
<b>CO4</b>	3	3	3	3	-	2	1	2	-	1	2	2	3	3	2
<b>CO5</b>	3	3	3	3	2	3	1	2	1	1	2	2	3	3	2

OOE101	BASIC CIRCUIT THEORY	L	P	T	C
		3	0	0	3
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To introduce electric circuits and its analysis</li> <li>❖ To impart knowledge on solving circuit equations using network theorems</li> <li>❖ To introduce the phenomenon of resonance in coupled circuits.</li> <li>❖ To introduce Phasor diagrams and analysis of three phase circuits</li> </ul>					
<b>UNIT I</b>	<b>BASIC CIRCUITS ANALYSIS</b>	<b>9</b>			
Resistive elements - Resistors in series and parallel circuits; Ohm's Law; Kirchoffs laws – methods of analysis-Mesh current and node voltage.					<b>CO1</b>
<b>UNIT II</b>	<b>NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>ANALYSIS OF AC CIRCUITS</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>THREE PHASE CIRCUITS</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>RESONANCE AND COUPLED CIRCUITS</b>	<b>9</b>			
Series and parallel resonance – frequency response, Quality factor and Bandwidth; Self and mutual inductance; Coefficient of coupling; Tuned circuits – Single tuned circuits.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.</li> <li>2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013.</li> <li>3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.</li> </ol>					

**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
<b>CO1</b>	3	1	1	1	1	3	3	3	1	1	1	3	1	1	1
<b>CO2</b>	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3	3	2	3	3	1	2	3	3	3	3
<b>CO5</b>	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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ About the stand alone and grid connected renewable energy systems.</li> <li>❖ Design of power converters for renewable energy applications.</li> <li>❖ Wind electrical generators and solar energy systems.</li> <li>❖ Power converters used for renewable energy systems.</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION</b>					<b>9</b>
Reference theory fundamentals-principle of operation and analysis: IG and PMSG					<b>CO2</b>	
<b>UNIT III</b>	<b>POWER CONVERTERS</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>ANALYSIS OF WIND AND PV SYSTEMS</b>					<b>9</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>HYBRID RENEWABLE ENERGY SYSTEMS</b>					<b>9</b>
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.</li> <li>2. B.H.Khan, "Non-conventional Energy Sources", Tata McGraw-hill Publishing Company, New Delhi, 2017.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Muhammad H. Rashid, "Power Electronics Hand Book", Third Edition, Butterworth- Heinemann, 2015.</li> <li>2. Ion Boldea, "Variability Speed Generators", Second Edition, CRC Press, 2015.</li> <li>3. Rai. G.D, "Non- conventional Energy Sources", Khanna Publishers, 2004.</li> <li>4. Gray, L. Johnson, "Wind Energy Systems", Prentice Hall, 2006.</li> <li>5. Andrzej M. Trzynadlowski, "Introduction to Modern Power Electronics", Third Edition, WileyIndia Pvt. Ltd, 2016.</li> </ol>						

**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
<b>OBJECTIVE</b>					
<ul style="list-style-type: none"> <li>❖ To understand the functions of the basic components of a Robot.</li> <li>❖ To study the use of various types of End of Effectors and Sensors</li> <li>❖ To impart knowledge in Robot Kinematics and Programming</li> <li>❖ To learn Robot safety issues and economics.</li> </ul>					
<b>UNIT I</b>	<b>FUNDAMENTALS OF ROBOT</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>ROBOT DRIVE SYSTEMS AND END EFFECTORS</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>SENSORS AND MACHINE VISION</b>	<b>9</b>			
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 Servoing and Navigation.					<b>CO3</b>
<b>UNIT IV</b>	<b>ROBOT KINEMATICS AND ROBOT PROGRAMMING</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>IMPLEMENTATION AND ROBOT ECONOMICS</b>	<b>9</b>			
RGV, AGV; Implementation of Robots in Industries-Variou Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.</li> <li>2. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.</li> </ol>					

**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

<b>OMB101</b>	<b>TOTAL QUALITY MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	
<b>OBJECTIVES</b>						
❖ To learn the quality philosophies and tools in the managerial perspective.						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>STATISTICAL PROCESS CONTROL</b>					<b>9</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT</b>					<b>9</b>
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.					<b>CO4</b>	
<b>UNIT V</b>	<b>QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION</b>					<b>9</b>
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.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						

**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. Montgomery, 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
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To provide exposure to the students about safety and health provisions related to hazardous processes as laid out in Factories act 1948</li> <li>❖ To familiarize students with powers of inspectorate of factories</li> <li>❖ To help students to learn about Environment act 1986 and rules framed under the act.</li> <li>❖ To provide wide exposure to the students about various legislations applicable to an industrial unit.</li> <li>❖ To prepare onsite and offsite emergency plan.</li> </ul>					
<b>UNIT I</b>	<b>FACTORIES ACT – 1948</b>	<b>9</b>			
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					<b>CO1</b>
<b>UNIT II</b>	<b>ENVIRONMENT ACT – 1986</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>OTHER ACTS AND RULES</b>	<b>9</b>			
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 cylinder rules-Explosives Act 1983-Pesticides Act					<b>CO4</b>
<b>UNIT V</b>	<b>INTERNATIONAL ACTS AND STANDARDS</b>	<b>9</b>			
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).					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**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

**OPEN ELECTIVE COURSES OFFERED BY CSE, IT, AI-ML & AI-DS**

<b>OCS101</b>	<b>INTRODUCTION TO C PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>❖ To understand the basic concepts in C Programming Language.</li> <li>❖ To understand Input and Output Statements.</li> <li>❖ To enhance analyzing and problem solving skills and use the same for writing programs in C.</li> <li>❖ To familiarize the basic syntax in arrays and pointers</li> <li>❖ To provide exposure to problem-solving through programming</li> </ul>					
<b>UNIT I</b>	<b>INTRODUCTORY CONCEPTS &amp; C FUNDAMENTALS</b>	<b>9</b>			
Introduction to Computers - Computer Characteristics - Modes of Operation - Types of Programming Languages - Introduction to C - Some Simple C Programs - Desirable Program Characteristics - The C Character Set - Identifiers and Keywords - Data Types - Constants - Variables and Arrays - Declarations - Expressions - Statements - Symbolic Constants.					<b>CO1</b>
<b>UNIT II</b>	<b>OPERATORS, EXPRESSIONS, DATA INPUT &amp; OUTPUT AND CONTROL STATEMENTS</b>	<b>9</b>			
Arithmetic Operators - Unary Operators - Relational and Logical Operators - Assignment Operators - The Conditional Operator - Library Functions - getchar, putchar, scanf, printf, gets and puts Functions - Preliminaries - Branching: The if else Statement - Looping: The while Statement - do while Statement - for Statement - Nested Control Structures - The switch Statement - The break Statement - The continue Statement - The Comma Operator - The goto Statement					<b>CO2</b>
<b>UNIT III</b>	<b>FUNCTIONS &amp; PROGRAM STRUCTURE</b>	<b>9</b>			
Defining a Function - Accessing a Function - Function Prototypes - Passing Arguments to a Function — Recursion - Storage Classes - Automatic Variables - External (Global) Variables - Static Variables - Multifile Programs - More About Library Functions					<b>CO3</b>
<b>UNIT IV</b>	<b>ARRAYS &amp; POINTERS</b>	<b>9</b>			
Defining an Array - Processing an Array - Passing Arrays to Functions - Multidimensional Arrays - Arrays and Strings - Fundamentals - Pointer Declarations - Passing Pointers to Functions - Pointers and One-Dimensional Arrays - Dynamic Memory Allocation - Operations on Pointers - Pointers and Multidimensional Arrays - Arrays of Pointers - Passing Functions to Other Functions					<b>CO4</b>
<b>UNIT V</b>	<b>STRUCTURES, UNIONS &amp; DATA FILES</b>	<b>9</b>			
Defining a Structure - Processing a Structure - User-Defined Data Types (typedef) - Structures and Pointers - Passing Structures to Functions - Self-Referential Structures — Unions - Opening and Closing a Data File - Creating a Data File - Processing a Data File - Unformatted Data Files					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>TEXT BOOKS</b>					
1. Byron Gottfried - Schaum's Outline of Programming with C, 2 <sup>nd</sup> Edition, McGraw-Hill, 1996.					
<b>REFERENCE BOOKS</b>					
1. The C Programming Language by Brian Kernighan and Dennis Ritchie 2 <sup>nd</sup> Edition.					

2. Let Us C Yashavant kanetkar, BPB

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

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

**MAPPING OF COs WITH POs AND PSOs**

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

OCS102	PROGRAMMING AND DATA STRUCTURES	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To learn the basics of C Programming</li> <li>❖ To learn the advanced features of C Programming</li> <li>❖ To explore the applications of linear data structures</li> <li>❖ To learn about how to represent and implement non-linear data structure</li> </ul> <p>To learn about the basics of sorting, searching and Hash Table</p>						
<b>UNIT I</b>	<b>C PROGRAMMING BASICS</b>					<b>9</b>
Structure of C program — Data Types — Storage classes — Variables— Constants — Keywords — Operators — Input/Output statements, Assignment statements — Decision making statements — Switch statement — Looping statements — Introduction to Arrays: Declaration, Initialization — One dimensional array — Two dimensional arrays.					<b>CO1</b>	
<b>UNIT II</b>	<b>FUNCTIONS, POINTERS AND STRUCTURES</b>					<b>9</b>
Introduction to functions: Function prototype, function definition, function call, Recursion — Pointers — Pointer operators — Pointer arithmetic — Array of pointers — Parameter passing: Pass by value, Pass by reference. Structure – Nested structures — Pointer and Structures — Array of structures — Self-referential structures — Dynamic memory allocation.					<b>CO2</b>	
<b>UNIT III</b>	<b>LINEAR DATA STRUCTURES</b>					<b>9</b>
List — Singly Linked lists — Application of List - Polynomial addition - Linked list implementation of Stacks — Applications of Stack - Evaluating arithmetic expressions - Linked list implementation of Queues – Application of Queue.					<b>CO3</b>	
<b>UNIT IV</b>	<b>NON-LINEAR DATA STRUCTURES</b>					<b>9</b>
Trees — Binary Trees – Binary tree representation and traversals –Binary Search Trees — Applications of trees. Graph and its representations – Graph Traversals – Topological Sort – Applications of graphs.					<b>CO4</b>	
<b>UNIT V</b>	<b>SEARCHING, SORTING AND HASH TABLE</b>					<b>9</b>
Linear Search — Binary Search. Bubble Sort — Insertion sort — Merge sort — Quick sort — Hashing functions - Hash tables – Introduction to Overflow handling.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
1. Reema Thareja, “Data Structures Using C, Second Edition, Oxford University Press, 2014.						
<b>REFERENCE BOOKS</b>						
1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Fourth Edition, Pearson Education, 2013.						
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C, Second Edition, University Press, 2008.						

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

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

**MAPPING OF COs WITH POs AND PSOs**

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

OCS103	INTRODUCTION TO CLOUD COMPUTING	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To have the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability, benefits, as well as current and future challenges</li> <li>❖ To have knowledge on the various virtualization techniques that serve in computation and storage services on the cloud</li> <li>❖ To understand the technologies, architecture and applications of cloud computing To understand the key security and compliance challenges of cloud computing</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
Introduction to Cloud Computing — Roots of Cloud Computing- Parallel and Distributed Computing, Mainframe and Grid Computing, Desired Features and benefits of Cloud Computing — Challenges and Risks of Cloud Computing					<b>CO1</b>	
<b>UNIT II</b>	<b>VIRTUALIZATION</b>					<b>9</b>
Introduction to Virtualization Technology — Load Balancing and Virtualization — Understanding Hypervisor and its types, Types of Virtualizations — Hardware, OS, Memory, Application Virtualization, Levels of Virtualization					<b>CO2</b>	
<b>UNIT III</b>	<b>CLOUD ARCHITECTURE, SERVICES AND STORAGE</b>					<b>9</b>
NIST Cloud Computing Reference Architecture, Layered Cloud Architecture, Architectural Design Challenges — Deployment models of cloud, Services of cloud — Cloud Storage.					<b>CO3</b>	
<b>UNIT IV</b>	<b>RESOURCE MANAGEMENT AND SECURITY IN CLOUD</b>					<b>9</b>
Inter Cloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Architecture-Cloud Security Challenges – Data Security –Application Security — Virtual Machine Security.					<b>CO4</b>	
<b>UNIT V</b>	<b>CASE STUDIES</b>					<b>9</b>
Google App Engine (GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services (AWS) – GAE Applications – Cloud Software Environments – Bio-data Platform & Bio Cloud					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, First Edition, John Wiley &amp; Sons, 2011.</li> <li>2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.</li> <li>3. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management, And Security”, CRC Press, 2017.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013.</li> <li>2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.</li> <li>3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.</li> </ol>						

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

CO1	Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
CO2	Understanding of fundamentals and technological aspects of virtualization along with various terminologies used in Cloud Computing
CO3	Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
CO4	Enlighten the core issues of cloud computing such as security, privacy, and interoperability.
CO5	Be familiarization with areas of cloud technologies and working experience in several of them

**MAPPING OF COs WITH POs AND PSOs**

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

OCS104	FUNDAMENTALS OF DATABASE DESIGN	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To learn the fundamentals of data models and to represent a database system using ER diagrams.</li> <li>❖ To study the database design and SQL</li> <li>❖ To make the students to understand the fundamentals of Transaction Processing and concurrency</li> <li>❖ To have an basic knowledge about the Storage implementation and query processing To understand database security concepts and database programming</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
Purpose of Database System — Views of data — Data Models — Database System Architecture — Introduction to relational databases — Relational Model — Keys — Relational Algebra — SQL fundamentals — DDL-DML-DCL-TCL- Advanced SQL features - Embedded SQL-Static Vs Dynamic SQL					<b>CO1</b>	
<b>UNIT II</b>	<b>DATABASE DESIGN</b>					<b>9</b>
Entity-Relationship model — E-R Diagrams — Enhanced-ER Model — ER-to-Relational Mapping — Functional Dependencies — Non-loss Decomposition — First, Second, Third Normal Forms, Dependency Preservation — Boyce/Codd Normal Form — Multi-valued Dependencies and Fourth Normal Form — Join Dependencies and Fifth Normal Form					<b>CO2</b>	
<b>UNIT III</b>	<b>TRANSACTION CONCEPTS AND CONCURRENCY CONTROL</b>					<b>9</b>
Introduction-Properties of Transaction- Serializability- Concurrency Control — Locking Mechanisms- Two Phase Locking -Two Phase Commit Protocol-Dead lock- SQL Facilities for Concurrency and Recovery					<b>CO3</b>	
<b>UNIT IV</b>	<b>IMPLEMENTATION TECHNIQUES</b>					<b>9</b>
RAID — File Organization — Organization of Records in Files — Indexing and Hashing — Ordered Indices — B+ tree Index Files — B tree Index Files — Static Hashing — Dynamic Hashing — Query Processing Overview –Query optimization using Heuristics and Cost Estimation					<b>CO4</b>	
<b>UNIT V</b>	<b>ADVANCED TOPICS AND DATABASE PROGRAMMING</b>					<b>9</b>
Database security issues — Discretionary access control — role based access — Encryption and public key infrastructures — challenges. Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems. Implementing functions, views, and triggers in MySQL / Oracle. ODBC/JDBC connectivity with front end tools					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
1. RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson.						

2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill.

### REFERENCE BOOKS

4. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education.
5. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill College Publications.

### COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To understand relational data model, evolve conceptual model of a given problem and SQL
CO2	To understand Relational model and normalization to perform database design effectively
CO3	Apply and relate the concept of transaction, concurrency control and recovery in database
CO4	To understand the implementation technique and query processing
CO5	To understand the concepts of database security and database programming

### MAPPING OF COs WITH POs AND PSOs

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

OCS105	DATA ANALYTICS WITH R PROGRAMMING	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ Students will learn R. Programming language, data analytics, data visualization and statistical model for data analytics</li> <li>❖ By completion of this course, students will be able to become data analyst</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION TO DATA ANALYSIS</b>					<b>9</b>
Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics					<b>CO1</b>	
<b>UNIT II</b>	<b>R PROGRAMMING BASICS</b>					<b>9</b>
Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages					<b>CO2</b>	
<b>UNIT III</b>	<b>DATA VISUALIZATION USING R</b>					<b>9</b>
<b>Reading and getting data into R (External Data):</b> Using CSV files, XML files, Web Data, JSON files, Databases, Excel files.  <b>Working with R Charts and Graphs:</b> Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts					<b>CO3</b>	
<b>UNIT IV</b>	<b>STATISTICS WITH R</b>					<b>9</b>
Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression					<b>CO4</b>	
<b>UNIT V</b>	<b>PRESCRIPTIVE ANALYTICS</b>					<b>9</b>
Creating data for analytics through designed experiments, Creating data for analytics through active learning, Creating data for analytics through reinforcement learning					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team.  URL: <a href="https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf">https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf</a>						
<b>REFERENCE BOOKS</b>						
1. Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education, 2013 Dunlop, Dorothy D., and Ajit C. Tamhane. Statistics and data analysis: from elementary to intermediate. Prentice Hall, 2000.  2. G Casella and R.L. Berger, Statistical Inference, Thomson Learning 2002.						

3. P. Dalgaard. Introductory Statistics with R, 2nd Edition. (Springer 2008)
4. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
5. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: Springer, 2009.
6. Montgomery, Douglas C., and George C. Runger. Applied Statistics and Probability for Engineers. John Wiley & Sons, 2010
7. Joseph F Hair, William C Black et al, "Multivariate Data Analysis", Pearson Education, 7th edition, 2013.
8. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
9. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013

### COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basics of data analytics
CO2	Understand and apply the R-Programming concepts
CO3	Apply R-Programming for data visualization
CO4	Implement various classification techniques using R
CO5	Apply R programming to perform perspective analytics on data

### MAPPING OF COs WITH POs AND PSOs

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

OCS106	DATA COMMUNICATIONS AND NETWORKING	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>❖ To understand the protocol layering and physical level communication and to analyze the performance of a network.</li> <li>❖ To analyze the contents of Data Link layer packet, based on the layer concept.</li> <li>❖ To learn the functions of network layer and the various routing protocols.</li> <li>❖ To familiarize the functions and protocols of the Transport layer.</li> <li>❖ To know about different application layer protocols</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION AND PHYSICAL LAYER</b>					<b>9</b>
Networks — Network Types — Protocol Layering — TCP/IP Protocol suite — OSI Model — Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks — Packet Switching.					<b>CO1</b>	
<b>UNIT II</b>	<b>DATA-LINK LAYER &amp; MEDIA ACCESS</b>					<b>9</b>
Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.					<b>CO2</b>	
<b>UNIT III</b>	<b>NETWORK LAYER</b>					<b>9</b>
Network Layer Services — IPV4 Addresses — Forwarding of IP Packets — Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing — IPV6 Protocol.					<b>CO3</b>	
<b>UNIT IV</b>	<b>TRANSPORT LAYER</b>					<b>9</b>
Introduction — Transport Layer Protocols — Services — Port Numbers — User Datagram Protocol – Transmission Control Protocol-Congestion Control Mechanisms- Streaming Control Transmission Protocol.					<b>CO4</b>	
<b>UNIT V</b>	<b>APPLICATION LAYER</b>					<b>9</b>
WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP- Internet Multimedia.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013</li> <li>2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2014.</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012</li> <li>2. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.</li> <li>3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011</li> <li>4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.</li> </ol>						

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

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

**MAPPING OF COs WITH POs AND PSOs**

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

OCS107	MACHINE LEARNING FOR INTELLIGENT SYSTEMS	L	T	P	C	
		3	0	0	3	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To introduce basic machine learning techniques such as regression, classification</li> <li>To learn about introduction of clustering, types and segmentation methods</li> <li>To learn about fuzzy logic, fuzzification and defuzzification</li> <li>To learn about basics of neural networks and neuro fuzzy networks.</li> <li>To learn about Recurrent neural networks and Reinforcement learning.</li> </ul>						
<b>UNIT - I</b>	<b>INTRODUCTION TO MACHINE LEARNING</b>					<b>9</b>
Philosophy of learning in computers, Overview of different forms of learning, Classifications vs. Regression, Evaluation metrics and loss functions in Classification, Evaluation metrics and loss functions in Regression, Applications of AI in Robotics.					<b>CO1</b>	
<b>UNIT - II</b>	<b>CLUSTERING AND SEGMENTATION METHODS</b>					<b>9</b>
Introduction to clustering, Types of Clustering, Agglomerative clustering, K-means clustering, Mean Shift clustering, K-means clustering application study, Introduction to recognition, K-nearest neighbor algorithm, KNN Application case study, Principal component analysis (PCA), PCA Application case study in Feature Selection for Robot Guidance.					<b>CO2</b>	
<b>UNIT - III</b>	<b>FUZZY LOGIC</b>					<b>9</b>
Introduction to Fuzzy Sets, Classical and Fuzzy Sets, Overview of Classical Sets, Membership Function, Fuzzy rule generation, Fuzzy rule generation, Operations on Fuzzy Sets, Numerical examples, Fuzzy Arithmetic, Numerical examples, Fuzzy Logic, Fuzzification, Fuzzy Sets, Defuzzification, Application Case Study of Fuzzy Logic for Robotics Application					<b>CO3</b>	
<b>UNIT - IV</b>	<b>NEURAL NETWORKS</b>					<b>9</b>
Mathematical Models of Neurons, ANN architecture, Learning rules, Multi-layer Perceptrons, Back propagation, Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, Application Case Study of Neural Networks in Robotics					<b>CO4</b>	
<b>UNIT - V</b>	<b>RNN AND REINFORCEMENT LEARNING</b>					<b>9</b>
Unfolding Computational Graphs, Recurrent neural networks, Application Case Study of recurrent networks in Robotics, Reinforcement learning, Examples for reinforcement learning, Markov decision process, Major components of RL, Q-learning. Application Case Study of reinforcement learning in Robotics					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
1. Micheal Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, 3rd Edition, Addison Wesley, England, 2011						
<b>REFERENCE BOOKS</b>						
1. Bruno Siciliano, Oussama Khatib, "Handbook of Robotics", 2016 2nd Edition, Springer						
2. Simon Haykin, "Neural Networks and Learning Machines: A Comprehensive Foundation", Third Edition, Pearson, Delhi 2016.						

6. Timothy J Ross, "Fuzzy Logic with Engineering Applications", 4th Edition, Chichester, 2011, Sussex Wiley.

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

CO1	Understand basic machine learning techniques such as regression, classification
CO2	Understand about clustering and segmentation
CO3	Model a fuzzy logic system with fuzzification and defuzzification
CO4	Understand the concepts of neural networks and neuro fuzzy networks.
CO5	Gain knowledge on Reinforcement learning.

**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
<b>CO1</b>	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
<b>CO2</b>	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
<b>CO3</b>	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
<b>CO4</b>	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3
<b>CO5</b>	3	2	3	2	1	0	0	0	0	0	1	3	3	2	3

<b>OCS109</b>	<b>FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	
<ul style="list-style-type: none"> <li>❖ To learn the fundamentals of data models</li> <li>❖ To learn conceptual modeling using ER diagrams.</li> <li>❖ To study SQL queries and database programming</li> <li>❖ To learn proper designing of relational database.</li> <li>❖ To understand database security concepts</li> <li>❖ To understand Information retrieval techniques</li> </ul>						
<b>UNIT - I</b>	<b>DBMS AND CONCEPTUAL DATAMODELING</b>					<b>9</b>
Purpose of Database System – Data independence - Data Models – Database System Architecture – Conceptual Data modeling: ER models - Enhanced-ER Model. Introduction to relational databases – Relational Model – Keys – ER-to-Relational Mapping. Modeling of a library management system.					<b>CO1</b>	
<b>UNIT - II</b>	<b>DATABASE QUERYING</b>					<b>9</b>
Relational Algebra – SQL: fundamentals – DDL – Specifying integrity constraints - DML – Basic retrieval queries in SQL - Complex SQL retrieval queries – nested queries – correlated queries – joins aggregate functions. Creating a table, populating data, adding integrity constraints, querying tables with simple and complex queries.					<b>CO2</b>	
<b>UNIT – III</b>	<b>DATABASE PROGRAMMING</b>					<b>9</b>
Database programming with function calls, stored procedures - views – triggers. Embedded SQL. ODBC connectivity with front end tools. Implementation using ODBC/JDBC and SQL/PSM, implementing functions, views, and triggers in MySQL / Oracle					<b>CO3</b>	
<b>UNIT – IV</b>	<b>DATABASE DESIGN</b>					<b>9</b>
Functional Dependencies – Design guidelines – Normal Forms: first, second, third – Boyce/Codd Normal Form – Normalization algorithms. Design of a banking database system/ university database system.					<b>CO4</b>	
<b>UNIT – V</b>	<b>ADVANCED TOPICS</b>					<b>9</b>
Database security issues – Discretionary access control – role based access – Encryption and public key infrastructures – challenges. Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>TEXT BOOKS</b>						
<ol style="list-style-type: none"> <li>1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition , Pearson,2011.</li> <li>2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill,2011</li> </ol>						
<b>REFERENCE BOOKS</b>						
<ol style="list-style-type: none"> <li>1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education,2006.</li> <li>2. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill</li> </ol>						

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

CO1	Ability to understand relational data model, evolve conceptual model of a given problem.
CO2	Understand query the relational database and write programs with database connectivity
CO3	Ability to understand the DBMS programming
CO4	Ability to understand the DBMS Design
CO5	Ability to understand the database security and information retrieval concepts

**MAPPING 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
<b>CO1</b>	3	3	3	1	1	1	1	1	3	3	1	1	3	2	2
<b>CO2</b>	3	3	3	1	1	1	1	1	3	3	1	1	3	3	2
<b>CO3</b>	3	3	3	1	1	1	1	2	3	3	1	1	3	3	2
<b>CO4</b>	3	3	3	1	1	2	1	2	3	3	1	1	3	3	2
<b>CO5</b>	3	3	3	1	1	1	1	2	3	3	1	1	3	2	2

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

<b>VAC001</b>	<b>INDUSTRIAL INTERNET OF THINGS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>
<b>OBJECTIVES</b>					
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 students1.					
<b>UNIT I</b>	<b>INTRODUCTION TO INDUSTRIAL IOT (IIOT) SYSTEMS</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>IMPLEMENTATION SYSTEMS FOR IIOT</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>IIOT DATA MONITORING &amp; CONTROL</b>	<b>9</b>			
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					<b>CO3</b>
<b>UNIT IV</b>	<b>IIOT Sensors &amp; Networks</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>INDUSTRIAL IOT- APPLICATIONS</b>	<b>9</b>			
Healthcare Power Plants – Inventory Management & Quality Control – Plant Safety and Security Oil – Chemical and Pharmaceutical industry – Applications of UAVs in Industries.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>REFERENCE:</b>					
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	PSO3
<b>CO1</b>	2	2	1	1	2	2	-	-	-	2	2	2	2	2	3
<b>CO2</b>	1	1	1	1	2	2	-	-	1	2	2	2	1	2	2
<b>CO3</b>	3	2	2	2	2	2	-	-	1	1	1	1	2	2	2
<b>CO4</b>	1	1	2	1	2	2	-	-	3	2	2	1	1	2	2
<b>CO5</b>	1	1	1	2	1	2	1	1	2	2	2	2	2	2	2

VAC002	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
		1	0	2	2
<b>OBJECTIVES</b>					
The main learning objective of this course is to make the students an appreciation for:					
<ol style="list-style-type: none"> <li>To provide students with good depth of knowledge of Augmented Reality and Virtual Reality</li> <li>Knowledge on Tools and Applications of Augmented Reality and Virtual Reality</li> </ol>					
<b>UNIT I</b>	<b>Introduction to Augmented Reality and Virtual Reality (VR)</b>	<b>9</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>Computer Graphics and Geometric Modeling</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>Need of technologies for Augmented Reality &amp; Virtual Reality</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>Tools and Applications of Augmented Reality &amp; Virtual Reality</b>	<b>9</b>			
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.					<b>CO4</b>
<b>UNIT V</b>	<b>Augmented Realities and Virtual Reality for Micro Learning</b>	<b>9</b>			
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					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>REFERENCE:</b>					
<ol style="list-style-type: none"> <li>Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018</li> <li>Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles &amp; Practice", Addison Wesley, 2016</li> </ol>					
<b>COURSE OUTCOMES</b>					
<b>Upon completion of the course, students will be able to</b>					
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	P O6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	1	1	1	1	-	-	-	2	1	1	1	2	3
<b>CO2</b>	2	2	2	1	1	1	-	-	-	-	1	1	1	2	2
<b>CO3</b>	2	2	2	1	1	1	-	-	-	-	1	1	2	2	2
<b>CO4</b>	2	2	2	1	1	2	-	-	-	-	1	1	2	2	3
<b>CO5</b>	2	2	2	1	1	2	1	1	1	2	1	1	2	2	3

VAC003	ETHICAL HACKING - CYBER SECURITY	L	T	P	C
		1	0	2	2
<b>OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To learn the fundamentals of Cyber Security and Ethical Hacking</li> <li>To learn the Foot printing &amp; Reconnaissance and Scanning Networks</li> <li>To understand Enumeration and Vulnerability Analysis</li> <li>To understand Exploitation on Network</li> <li>To learn the Web Attacks and Report Writing</li> </ul>					
<b>UNIT I</b>	<b>FUNDAMENTALS OF CYBER SECURITY AND ETHICAL HACKING</b>	<b>9</b>			
Introduction to Cyber Security - Cyber Security & Ethical Hacking - Domains of Cyber Security - Principles of Cyber security (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					<b>CO1</b>
<b>UNIT II</b>	<b>FOOTPRINTING RECONNAISSANCE AND SCANNING NETWORKS</b>	<b>9</b>			
Introduction to Foot printing Reconnaissance - Types of Reconnaissance (Passive & Active) - Active Reconnaissance (Ping, Traceroute, Telnet, Whatweb, Wappalyzer, Netcraft) - Passive Reconnaissance (nslookup, whois, dig, DNS Dumpster, 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.					<b>CO2</b>
<b>UNIT III</b>	<b>ENUMERATION AND VULNERABILITY ANALYSIS</b>	<b>9</b>			
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.					<b>CO3</b>
<b>UNIT IV</b>	<b>EXPLOITATION ON NETWORK</b>	<b>9</b>			
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 Access - Gaining Root Shell Access 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.					<b>CO4</b>
<b>UNIT V</b>	<b>WEB ATTACKS AND REPORT DOCUMENTATION</b>	<b>9</b>			
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					
<b>REFERENCE:</b>					
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

VAC004	BLOCKCHAIN AND CRYPTO CURRENCIES	L	T	P	C	
		1	0	2	2	
<b>OBJECTIVES</b>						
<ol style="list-style-type: none"> <li>1. To understand Blockchain's fundamental components, and examine decentralization using blockchain.</li> <li>2. To understand Cryptocurrency and its background concepts.</li> <li>3. To learn smart contract programming language solidity.</li> <li>4. To understand public blockchain application development platform and develop distributed applications.</li> <li>5. To understand enterprise blockchain application development platform and develop distributed enterprise applications</li> </ol>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
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.					<b>CO1</b>	
<b>UNIT II</b>	<b>CRYPTOCURRENCY BASICS</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>SOLIDITY WALKTHROUGH</b>					<b>9</b>
Introduction to Ethereum blockchain – Ethereum Virtual Machine – remix IDE - MetaMask wallet – running simple smart contract – voting application – Lottery application – File sharing application					<b>CO3</b>	
<b>UNIT IV</b>	<b>PUBLIC BLOCKCHAIN APPLICATION DEVELOPMENT</b>					<b>9</b>
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file					<b>CO4</b>	
<b>UNIT V</b>	<b>ENTERPRISE BLOCKCHAIN APPLICATION DEVELOPMENT</b>					<b>9</b>
Introduction to Hyperledger – Hyperledger Fabric architecture– language supports for hyperledger fabric – setting up hyperledger fabric - Building application in hyperledger fabric.					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						
<b>REFERENCES:</b>						
<ol style="list-style-type: none"> <li>1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.</li> <li>2. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.</li> <li>3. Alex Leverington, "Ethereum Programming" Packt Publishing, 2017.</li> <li>4. <a href="https://hyperledger-fabric.readthedocs.io/en/latest/tutorials.html">https://hyperledger-fabric.readthedocs.io/en/latest/tutorials.html</a></li> </ol>						

**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 programming 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
<b>CO1</b>	3	3	2	-	2	1	-	-	1	-	-	1	2	2	3
<b>CO2</b>	3	3	2	-	2	2	-	-	1	-	-	1	2	2	3
<b>CO3</b>	3	3	2	1	2	-	-	-	1	-	-	1	2	2	3
<b>CO4</b>	3	3	2	1	2	-	-	-	1	-	-	1	2	2	3
<b>CO5</b>	3	3	2	1	2	-	-	-	1	-	-	1	2	2	3

VAC005	INDUSTRIAL PRACTICES WITH DEVOPS	L	T	P	C	
		1	0	2	2	
<b>OBJECTIVES</b>						
<ol style="list-style-type: none"> <li>To introduce DevOps terminology, definition &amp; concepts</li> <li>To understand the Maven, Profiles and Plugins</li> <li>To understand the concepts of Continuous Integration/ Continuous Testing/ ContinuousDeployment using Jenkins</li> <li>To understand to leverage Cloud-based DevOps tools using Azure DevOps</li> <li>Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems</li> </ol>						
<b>UNIT I</b>	<b>INTRODUCTION TO DEVOPS</b>					<b>9</b>
Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github					<b>CO1</b>	
<b>UNIT II</b>	<b>COMPILE AND BUILD USING MAVEN &amp; GRADLE</b>					<b>9</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>CONTINUOUS INTEGRATION USING JENKINS</b>					<b>9</b>
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					<b>CO3</b>	
<b>UNIT IV</b>	<b>BUILDING DEVOPS PIPELINES USING AZURE</b>					<b>9</b>
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file					<b>CO4</b>	
<b>UNIT V</b>	<b>DEVOPS PRACTICALS</b>					<b>9</b>
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					<b>CO5</b>	
<b>TOTAL : 45 PERIODS</b>						

**REFERENCES:**

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Mitesh Soni, Hands-On Azure Devops: CICD Implementation for Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for .DevOps and Microsoft Azure (English Edition) , 2020
3. Mariot Tsitoara, " Beginning Git and GitHub: A Comprehensive Guide to Version Control Management, and Teamwork for the New Developer", Second Edition, 2019.
4. <https://www.jenkins.io/user-handbook.pdf>
5. <https://maven.apache.org/guides/getting-started>

**COURSE OUTCOMES**

**Upon completion of the course, students will be able to**

CO1	Understand different actions performed through Version control tools like Git.
CO2	Compile and Build using Maven & Gradle applications
CO3	Ability to Perform Continuous Integration using Jenkins.
CO4	Understand to leverage Cloud-based DevOps tools using Azure DevOps
CO5	Develop various Devops applications

**MAPPING OF COs WITH POs AND PSOs**

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

VAC006	APPLIED MACHINE LEARNING WITH PYTHON	L	T	P	C
		1	0	2	2
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To provide a basic understanding of data manipulation.</li> <li>To understand scikit learn for model evaluation.</li> <li>To provide a comprehensive understanding of neural networks and computer vision.</li> </ul>					
<b>UNIT I</b>	<b>DATA MANIPULATION WITH PYTHON LIBRARIES</b>	<b>9</b>			
Overview of Data Manipulation with Python-Introduction to Pandas and NumPy-Data Cleaning and Preprocessing-Handling Missing Data-Data Exploration and Analysis					<b>CO1</b>
<b>UNIT II</b>	<b>MACHINE LEARNING BASICS WITH SCIKIT-LEARN</b>	<b>9</b>			
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.					<b>CO2</b>
<b>UNIT III</b>	<b>LINEAR REGRESSION AND BEYOND</b>	<b>9</b>			
Linear Regression Fundamentals-Implementing Linear Regression from Scratch-Logistic Regression for Classification-Introduction to Support Vector Machines (SVM)-Hands-on Exercises with Scikit-Learn.					<b>CO3</b>
<b>UNIT IV</b>	<b>ADVANCED MACHINE LEARNING TECHNIQUES</b>	<b>9</b>			
Introduction to Gradient Boosting-Implementation of Gradient Boosting with XGBoost-Neural Networks Basics with PyTorch-Deep Learning Fundamentals-Applications of Neural Networks.					<b>CO4</b>
<b>UNIT V</b>	<b>COMPUTER VISION AND TRANSFER LEARNING</b>	<b>9</b>			
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.					<b>CO5</b>
<b>TOTAL : 45 PERIODS</b>					

**REFERENCES:**

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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• Teach history and philosophy of Indian Constitution.</li> <li>• Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.</li> <li>• Summarize powers and functions of Indian government.</li> <li>• Explain emergency rule.</li> <li>• Explain structure and functions of local administration.</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>6</b>
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features					<b>CO1</b>	
<b>UNIT II</b>	<b>CONTOURS OF CONSTITUTIONAL RIGHTS &amp; DUTIES</b>					<b>6</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>ORGANS OF GOVERNANCE</b>					<b>6</b>
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions					<b>CO3</b>	
<b>UNIT IV</b>	<b>EMERGENCY PROVISIONS</b>					<b>6</b>
Emergency Provisions - National Emergency, President Rule, Financial Emergency					<b>CO4</b>	
<b>UNIT V</b>	<b>LOCAL ADMINISTRATION</b>					<b>6</b>
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					<b>CO5</b>	
<b>TOTAL : 30 PERIODS</b>						

**TEXT BOOKS**

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.
3. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government 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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• Develop knowledge of self-development</li> <li>• Explain the importance of Human values</li> <li>• Develop the overall personality through value education</li> <li>• Overcome the self-destructive habits with value education</li> <li>• Interpret social empowerment with value education</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION TO VALUE EDUCATION</b>					<b>6</b>
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					<b>CO1</b>	
<b>UNIT II</b>	<b>IMPORTANCE OF VALUES</b>					<b>6</b>
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					<b>CO2</b>	
<b>UNIT III</b>	<b>INFLUENCE OF VALUE EDUCATION</b>					<b>6</b>
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.					<b>CO3</b>	
<b>UNIT IV</b>	<b>REINCARNATION THROUGH VALUE EDUCATION</b>					<b>6</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>VALUE EDUCATION IN SOCIAL EMPOWERMENT</b>					<b>6</b>
Equality, Non-violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.					<b>CO5</b>	
<b>TOTAL : 30 PERIODS</b>						
<b>REFERENCE:</b>						
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
<b>OBJECTIVES</b>							
<ul style="list-style-type: none"> <li>Understand the methodology of pedagogy.</li> <li>Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.</li> <li>Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.</li> <li>Illustrate the factors necessary for professional development.</li> <li>Identify the Research gaps in pedagogy.</li> </ul>							
<b>UNIT I</b>	<b>INTRODUCTION AND METHODOLOGY</b>						<b>6</b>
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions – Overview of methodology and Searching.							<b>CO1</b>
<b>UNIT II</b>	<b>THEMATIC OVERVIEW</b>						<b>6</b>
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.							<b>CO2</b>
<b>UNIT III</b>	<b>EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES</b>						<b>6</b>
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.							<b>CO3</b>
<b>UNIT IV</b>	<b>REINCARNATION THROUGH VALUE EDUCATION</b>						<b>6</b>
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							<b>CO4</b>
<b>UNIT V</b>	<b>RESEARCH GAPS AND FUTURE DIRECTIONS</b>						<b>6</b>
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.							<b>CO5</b>
<b>TOTAL : 30 PERIODS</b>							
<b>REFERENCE:</b>							
<ol style="list-style-type: none"> <li>Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.</li> <li>Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.</li> <li>Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.</li> </ol>							

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
<b>OBJECTIVES</b>							
<ul style="list-style-type: none"> <li>Develop healthy mind in a healthy body thus improving social health also improve efficiency</li> <li>Invent Do's and Don't's in life through Yam</li> <li>Categorize Do's and Don't's in life through Niyam</li> <li>Develop a healthy mind and body through Yog Asans</li> <li>Invent breathing techniques through Pranayam</li> </ul>							
<b>UNIT I</b>	<b>INTRODUCTION TO YOGA</b>						<b>6</b>
	Definitions of Eight parts of yog.( Ashtanga )						<b>CO1</b>
<b>UNIT II</b>	<b>YAM</b>						<b>6</b>
	Do's and Don't's in life.Shaucha, santosh, tapa, swadhyay, ishwarpranidhan						<b>CO2</b>
<b>UNIT III</b>	<b>NIYAM</b>						<b>6</b>
	Do's and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha						<b>CO3</b>
<b>UNIT IV</b>	<b>ASAN</b>						<b>6</b>
	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						<b>CO4</b>
<b>UNIT V</b>	<b>RESEARCH GAPS AND FUTURE DIRECTIONS</b>						<b>6</b>
	Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.						<b>CO5</b>
<b>TOTAL : 30 PERIODS</b>							
<b>REFERENCE:</b>							
1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata							
2. 'Yogic Asanas for Group Training-Part-I' : Janardan Swami Yogabhyasi Mandal, Nagpur							
<b>COURSE OUTCOMES</b>							
<b>Upon completion of the course, students will be able to</b>							
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														
<b>MAPPING OF COs WITH POs AND PSOs</b>															
COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO2	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO3	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-
CO5	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-

<b>AD1005</b>	<b>PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

### OBJECTIVES

- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind

<b>UNIT I</b>	<b>NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I</b>	<b>6</b>
	Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)	<b>CO1</b>
<b>UNIT II</b>	<b>NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II</b>	<b>6</b>
	Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)	<b>CO2</b>
<b>UNIT III</b>	<b>ORGANS OF GOVERNANCE</b>	<b>6</b>
	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	<b>CO3</b>
<b>UNIT IV</b>	<b>EMERGENCY PROVISIONS</b>	<b>6</b>
	Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter12 -Verses 13, 14, 15, 16,17, 18	<b>CO4</b>
<b>UNIT V</b>	<b>LOCAL ADMINISTRATION</b>	<b>6</b>
	Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	<b>CO5</b>

**TOTAL : 30 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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To engage the students in understanding rural realities</li> <li>To identify and select existing innovative technologies, enable customization of technologies, or devise implementation method for innovative solutions, as per the local needs.</li> <li>To leverage the knowledge base of the institutions to devise processes for effective implementation of various government programmes</li> <li>To understand causes for rural distress and poverty and explore solutions for the same</li> <li>To apply classroom knowledge of courses to field realities and thereby improve quality of learning</li> </ul>						
<b>UNIT I</b>	<b>QUALITY OF RURAL LIFE IN VILLAGES AND UNNAT BHARAT ABHIYAN</b>					<b>6</b>
<p>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.</p> <p>Assignment: Prepare a map (Physical , visual and digital) of the village you visited and write an essay about inter-family relation in that village.</p>					<b>CO1</b>	
<b>UNIT II</b>	<b>RURAL ECONOMY AND LIVELIHOOD</b>					<b>6</b>
<p>Agriculture, farming, land ownership pattern, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural market .</p> <p>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.</p>					<b>CO2</b>	
<b>UNIT III</b>	<b>RURAL INSTITUTIONS</b>					<b>6</b>
<p>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.</p> <p>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.</p>					<b>CO3</b>	
<b>UNIT IV</b>	<b>RURAL DEVELOPMENT PROGRAMMES</b>					<b>6</b>
<p>National programmes - Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc.</p>					<b>CO4</b>	

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**

**6**

Each student selects one programme for field visit Field based practical activities:

- Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities
- Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the work site
- Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures
- Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan(GPDP)
- Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization
- Visit Rural Schools I mid-day meal centres, study Academic and infrastructural resources and gaps
- Participate in Gram Sabha meetings, and study community participation
- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries
- Attend Parent Teacher Association meetings, and interview school drop outs
- Visit local Anganwadi Centre and observe the services being provided
- Visit local NGOs, civil society organisations and interact with their staff and beneficiaries.
- Organize awareness programmes, health camps, Disability camps and cleanliness camps o Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys
- Raise understanding of people's impacts of climate change, building up community's disaster preparedness
- Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants • Formation of committees for common property resource management, village pond maintenance and fishing.

**CO5**

**TOTAL : 30 PERIODS**

**Text Books:**

1. . Singh, Katar, Rural Development Principles, Policies and Management, Sage Publications, New Delhi, 2015
- 2.A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002
- 3.United Nations, Sustainable Development Goals, 2015 un.org/sdgs

**Reference Books:**

1. M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers
2. Unnat Bharat Abhiyan Website : [www.unnatbharatabhiyan.gov.in](http://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	
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>• Get a knowledge about Indian Culture</li> <li>• Know Indian Languages and Literature religion and philosophy and the fine arts in India</li> <li>• Explore the Science and Scientists of Ancient, Medieval and Modern India</li> <li>• Understand education systems in India</li> </ul>						
<b>UNIT I</b>	<b>INTRODUCTION TO CULTURE</b>					<b>6</b>
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India					<b>CO1</b>	
<b>UNIT II</b>	<b>INDIAN LANGUAGES AND LITERATURE</b>					<b>6</b>
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature					<b>CO2</b>	
<b>UNIT III</b>	<b>RELIGION AND PHILOSOPHY</b>					<b>6</b>
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)					<b>CO3</b>	
<b>UNIT IV</b>	<b>FINE ARTS IN INDIA (ART, TECHNOLOGY&amp; ENGINEERING)</b>					<b>6</b>
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					<b>CO4</b>	
<b>UNIT V</b>	<b>EDUCATION SYSTEM IN INDIA</b>					<b>6</b>
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					<b>CO5</b>	
<b>TOTAL : 30 PERIODS</b>						
<b>REFERENCE:</b>						
<ol style="list-style-type: none"> <li>1. . Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005</li> <li>2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007</li> <li>3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450 494-X, 200</li> <li>4. Narain, "Examinations in ancient India", Arya Book Depot, 1993</li> <li>5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989</li> <li>6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN 13: 978-</li> </ol>						

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	-	-	-

AD1008	SANGA TAMIL LITERATURE APPRECIATION	L	T	P	C
		2	0	0	0
<p><b>OBJECTIVES</b></p> <p>The main learning objective of this course is to make the students an appreciation for:</p> <ul style="list-style-type: none"> <li>1. Introduction to Sanga Tamil Literature.</li> <li>2. 'Agathinai' and 'Purathinai' in Sanga Tamil Literature.</li> <li>3. 'Attruppadai' in Sanga Tamil Literature.</li> <li>4. 'Puranaanuru' in Sanga Tamil Literature.</li> <li>5. 'Pathitru Paththu' in Sanga Tamil Literature.</li> </ul>					
<b>UNIT I</b>	<b>SANGA TAMIL LITERATURE – AN INTRODUCTION</b>	<b>6</b>			
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.					<b>CO1</b>
<b>UNIT II</b>	<b>‘AGATHINAI’ AND ‘PURATHINAI’</b>	<b>6</b>			
Tholkappiyar’s Meaningful Verses–Three literature materials–Agathinai’s message- History of Culture from Agathinai– Purathinai–Classification–Mesaage to Society from Purathinai.					<b>CO2</b>
<b>UNIT III</b>	<b>‘ATTRUPPADAI’.</b>	<b>6</b>			
Attruppadai Literature–Attruppadai in 'Puranaanuru'-Attruppadai in 'Pathitru Paththu'-Attruppadai in 'Paththupaattu'.					<b>CO3</b>
<b>UNIT IV</b>	<b>‘PURANAANURU’</b>	<b>6</b>			
Puranaanuru on Good Administration, Ruler and Subjects–Emotion & its Effect in Puranaanuru.					<b>CO4</b>
<b>UNIT V</b>	<b>‘PATHITRUPATHTHU’</b>	<b>6</b>			
Pathitru Paththu in 'Ettuthogai'–Pathitru Paththu’s Parables–Tamil dynasty: Valor, Administration, Charity in Pathitru Paththu- Mesaage to Society from Pathitru Paththu.					<b>CO5</b>
<b>TOTAL : 30 PERIODS</b>					
<b>REFERENCE:</b>					
<ol style="list-style-type: none"> <li>1. . Sivaraja Pillai, The Chronology of the Early Tamils, Sagwan Press, 2018.</li> <li>2. Hank Heifetz and George L. Hart, The Purananuru, Penguin Books, 2002.</li> <li>3. Kamil Zvelebil, The Smile of Murugan: On Tamil Literature of South India, Brill Academic Pub, 1997.</li> <li>4. George L. Hart, Poets of the Tamil Anthologies: Ancient Poems of Love and War, Princeton University Press, 2015.</li> <li>5. Xavier S. Thani Nayagam, Landscape and poetry: a study of nature in classical Tamil poetry, Asia Pub. House, 1967.</li> </ol>					

**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 'Pathitruopaththu' 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	-	-	-

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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 திருவள்ளூர் 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, ஓயிலாட்டம், 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, கையெழுத்துப்படிக்கள் - 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)

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

**UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**

**3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III FOLK AND MARTIAL ARTS**

**3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV THINAI CONCEPT OF TAMILS**

**3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**

**3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**TOTAL : 15 PERIODS**

**TEXT-CUM-REFERENCE BOOKS**

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

**அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3**  
சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

**அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3**  
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

**அலகு III உற்பத்தித் தொழில் நுட்பம்: 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 - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3**  
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

**அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3**  
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - 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. சந்திரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை – 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 Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**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 Specific Society.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING****3**

Development of Scientific Tamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software - Tamil Virtual Academy - Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.

**TOTAL : 15 PERIODS**

## TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு 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. பொருறை– 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.
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8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

## Minutes of 4th Meeting of Board of Studies



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



### FACULTY OF COMPUTER SCIENCE AND ENGINEERING AND INFORMATION TECHNOLOGY

#### Minutes of the Fourth Meeting of the Board of Studies

The Fourth meeting of the Board of Studies for the Faculty of Computer Science and Engineering and Information Technology was held virtually on 23.05.24 (Thursday), at 10 A.M

***The following Members were present for the meeting:***

1.	<b>Chairman</b>	<b>Dr. A. Chandra Sekar,</b> Dean-Research & Faculty Head Faculty of Computer Science and Engineering and Information Technology, St. Joseph's College of Engineering, OMR, Chennai – 600 119.
2.	<b>University Nominee</b>	<b>Dr. J. C. Miraclin Joyce Pamila,</b> Professor and Head, Department of Computer Science and Engineering Government College of Technology Coimbatore – 641 013.
3.	<b>Subject Expert</b>	<b>Dr. Krishna Moorthy Sivalingam,</b> Professor, Department of Computer Science and Engineering, Indian Institute of Technology (IIT) Madras, Chennai – 600 036.
4.	<b>Subject Expert</b>	<b>Dr. G. Zayaraz,</b> Professor & Head, Department of Computer Science and Engineering, Puducherry Technological University Puducherry – 605 014.

**Faculty of Computer Science and Engineering and Information Technology,  
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## Minutes of 4th Meeting of Board of Studies

5.	<b>Industrial Expert</b>	<b>Mr. Abdul Muthalif</b> , Director Cognizant, Chennai.
6.	<b>Post Graduate Meritorious Alumnus</b>	<b>Ms. S.Ram Lakshmi</b> , Specialist Programmer Infosys, Techno Park, SEZ, Mahindra World City, Paranur, Chennai.
7.	<b>Dr.Muthu Lakshmi V</b> ,Professor & Head, Department of Computer Science and Engineering, St. Joseph's College of Engineering, OMR, Chennai – 119.	
8.	<b>Ms Latha Selvi G</b> , Professor & Head, Department of Information Technology , St.Joseph's College of Engineering, OMR, Chennai – 119.	
9.	<b>Dr. Pugalenth R</b> , Professor & Head, Department of Artificial Intelligence and Data Science, St. Joseph's College of Engineering, OMR, Chennai – 119.	
10.	<b>Dr. Lilly Raamesh</b> , Professor & Head, Department of Artificial Intelligence and Machine Learning, St. Joseph's College of Engineering, OMR, Chennai – 119.	
11.	<b>Faculty Members of Computer Science and Engineering, Information Technology, Artificial Intelligence and Data Science and Artificial Intelligence and Machine Learning</b>	
<b>Special Invitees</b>		
12.	<b>Principal</b> , St. Joseph's College of Engineering, OMR, Chennai – 119.	
13.	<b>Dean Academics</b> , St. Joseph's College of Engineering, OMR, Chennai – 119.	
14.	<b>Dean Student Affairs</b> , St. Joseph's College of Engineering, OMR, Chennai – 119.	
15.	<b>Dean Industrial Collaborations &amp; IQAC</b> , St. Joseph's College of Engineering, OMR, Chennai – 119.	
16.	<b>The Controller of Examinations</b> , St. Joseph's College of Engineering, OMR, Chennai – 119.	

**Faculty of Computer Science and Engineering and Information Technology,  
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## **Minutes of 4th Meeting of Board of Studies**

### **Minutes:**

#### **BOS 04. 01            WELCOME ADDRESS AND BRIEF INTRODUCTION OF THE MEMBERS OF BOARD OF STUDIES**

The Fourth meeting of Board of studies of Faculty of Computer Science and Engineering and Information Technology was commenced with welcome address by the Faculty Head. It was followed by a brief introduction of members of Board of studies such as University Representative, Subject Experts, Industrial Expert and Alumnus and Internal Faculty Members.

#### **BOS 04. 02            BRIEF REPORT ON THE PROGRESS OF THE DEPARTMENT**

The Faculty Head has made a brief presentation to the members of the Board of Studies, highlighting the current intake, the Academic Progress and Achievements of the Departments

#### **BOS 04. 03            TO CONSIDER AND APPROVE THE NEW CURRICULA AND SYLLABI OF B.E COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY) OF THE FIRST TO EIGHT SEMESTERS**

**RESOLVED TO APPROVE** the curricula and syllabi of B.E Computer Science and Engineering (Cyber Security) of the FIRST to EIGHT semesters for the programmes with the Choice Based Credit System (CBCS) under R-2021 with effect from the Academic Year 2024-2025 onwards

## **Minutes of 4th Meeting of Board of Studies**

**BOS 04. 04            TO CONSIDER AND APPROVE THE REVISIONS IN THE CURRICULUM FOR THE INTRODUCTION OF EMPLOYABILITY ENHANCEMENT SKILL BASED COURSES (As per the directions of Anna University)**

**RESOLVED TO APPROVE** Introduction of Employability Skill Based Courses to be followed as per the following guidelines

- Skill based experiential learning courses will be offered in two categories as purely Laboratory Based Courses and Theory Integrated Laboratory Courses. One such course will be offered in every semester from V to VII.
- A student may accumulate up to 6 credits through such courses, and such credits will be considered in lieu of the Professional Elective and/or Open Elective Courses.

**BOS 04. 05            TO CONSIDER AND APPROVE THE CHANGES IN THE SYLLABUS OF B.E / B.TECH PROGRAMMES OFFERED UNDER FACULTY OF COMPUTER SCIENCE ENGINEERING AND INFORMATION TECHNOLOGY**

**RESOLVED TO APPROVE** the changes in the syllabi of B.E / B.TECH Programmes under the faculty of Computer Science and Engineering and Information Technology for the academic year 2024-2025 onwards in accordance with the Choice Based Credit System (CBCS) under R-2021.

## Minutes of 4th Meeting of Board of Studies

### Common to all branches

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	Theory/Lab	Sub. Code	Subject Name	Year/Sem	Theory/Lab	Sub. Code	Subject Name
I / I	Theory	GE1105	Problem Solving and Python Programming	I / I	Theory	GE1109	Problem Solving and Programming in C
I / I	Lab	GE1107	Python Programming Laboratory	I / I	Lab	GE1110	Programming in C Laboratory

### Artificial Intelligence and Machine Learning

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	Theory/Lab	Sub. Code	Subject Name	Year/Sem	Theory/Lab	Sub. Code	Subject Name
I / II	Theory	CS1206	Programming in C	I / II	Theory	DS1209	Python Programming
I / II	Lab	CS1208	Programming in C Laboratory	I / II	Lab	DS1210	Python Programming Laboratory
II / III	Theory	DS1303	Introduction to Artificial Intelligence	II / III	Theory	ML1304	Foundations of Artificial Intelligence and Machine Learning
II / III	Theory	ML1301	Data Foundation	II / III	Theory	ML1305	Computer Networks and Security
II / III	Lab	DS1308	Artificial Intelligence Laboratory	II / III	Lab	ML1306	Artificial Intelligence and Machine Learning Laboratory
II / IV	Theory	CS1402	Operating Systems	II / IV	Theory	ML1403	Data Analytics Tools and Techniques
II / IV	Theory	ML1401	Foundations of Machine Learning	II / IV	Theory	ML1404	Principles of Operating Systems
II / IV	Theory	CS1403	Database Design and Management (Lab Integrated)	II / IV	Theory	ML1405	Database Design and Security (Lab Integrated)

## Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	Theory/ Lab	Sub. Code	Subject Name	Year/Sem	Theory/ Lab	Sub. Code	Subject Name
II / IV	Theory	ML1402	Statistics for Machine Learning	II / IV	Theory	ML1402	Statistical Learning
II / IV	Lab	ML1408	Machine Learning Laboratory	II / IV	Lab	ML1409	Data Analytics Laboratory
II / IV	Lab	CS1407	Operating Systems Laboratory	II / IV	Lab	ML1410	Statistical Learning Laboratory
III / V	Theory	DS1502	Advanced Artificial Intelligence	III / V	Theory	ML1504	Applied Deep Learning
III / V	Theory	ML1502	Nature Inspired Computing Techniques	III / V	Theory	ML1505	Foundations of IoT: Sensors, Networks, and Applications
III / V	Lab	ML1507	Applied Reinforce ment Laboratory	III / V	Lab	ML1508	IoT Laboratory
III / V	Lab	DS1508	Advanced Artificial Intelligence Laboratory	III / V	Lab	ML1509	Deep RL Laboratory
III / VI	Theory	ML1602	Autonomous Mobile Robot	III / VI	Theory	ML1605	Intelligent Robots and Drone Technology
III / VI	Theory	ML1601	Deep Learning	III / VI	Theory	ML1606	Theory of Automata and Formal Languages
III / VI	Theory	ML1604	Big Data Analytics	III / VI	Theory	ML1607	Cloud and Big Data Architecture
III / VI	Lab	ML1607	Deep Learning Laboratory	III / VI	Lab	ML1609	Intelligent Robots and Drone Technology Laboratory
IV / VII	Theory	ML1702	Formal Languages and Automata Theory	IV / VII	Theory	ML1704	Edge AI

## Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	Theory /Lab	Sub. Code	Subject Name	Year/Sem	Theory/ Lab	Sub. Code	Subject Name
IV / VII	Theory	ML1704	Machine intelligence for network sciences	IV / VII	Theory	ML1705	Generative AI
IV / VII	Lab	ML1707	NLP Laboratory	IV / VII	Lab	ML1709	Industrial AI Applications Laboratory
				IV / VII	Lab	CT1701	Credit Course on Advanced Data Management and Machine Intelligence by Cognizant

### Information Technology

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	Theory/Lab	Sub. Code	Subject Name	Year/Sem	Theory/Lab	Sub. Code	Subject Name
I / II	Theory	CS1206	Programming in C (Common to CSE & IT, AI-DS & AI-ML)	I / II	Theory	IT1201	Object Oriented Programming Admitted in 2024
I / II	Lab	CS1208	Programming in C Laboratory (Common to CSE & IT, AI-DS & AI-ML)	I / II	Lab	IT1207	Object Oriented Programming Laboratory Admitted in 2024
II / III	Theory	CS1301	Digital Principles and Logic Design (Lab Integrated) (Common to CSE & IT)	II / III	Theory	IT1303	Digital Principles and Computer Architecture Admitted in 2023 onwards
II / III	Theory	CS1304	Computer Architecture (Common to CSE & IT)	II / III	Theory	IT1302	Data Exploration and Visualization (Lab Integrated) Admitted in 2023 onwards

## Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	Theory/Lab	Year/ Sem	Theory/Lab	Year/ Sem	Theory/ Lab	Year/ Sem	Theory/Lab
II / III	Theory	CS1305	Software Engineering (Common to CSE & IT)	II / III	Theory	CS1309	Agile Software Engineering (Common to CSE & IT) Admitted in 2023 onwards
II / IV	Theory	IT1401	Computer Communication	II / IV	Theory	CS1404	Computer Networks (Common to CSE & IT) Admitted in 2023 onwards
II / IV	Theory	ML1401	Foundations of Machine Learning (Common to IT, AI-DS & AI-ML)	II / IV	Theory	IT1402	Fundamentals of Data Science and Analytics Admitted in 2023 onwards
II / IV	Lab	ML1408	Machine Learning Laboratory (Common to IT, AI-DS & AI-ML)	II / IV	Lab	IT1408	Fundamentals of Data Science and Analytics Laboratory Admitted in 2023 onwards
III / V	Theory	IT1502	Computational Intelligence (Lab Integrated)	III / V	Theory	IT1503	Artificial Intelligence and Machine Learning (Lab Integrated) Admitted in 2023 onwards
III / VI	Theory	IT1604	Data Science and Big Data Analytics	III / VI	Theory	IT1605	Big Data Analytics Admitted in 2023 onwards

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## Minutes of 4th Meeting of Board of Studies

### Artificial Intelligence and Data Science

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	Theory/Lab	Sub.Code	Sub. Name	Year/Sem	Theory/Lab	Sub. Code	Sub. Name
I / II	Theory	CS1206	Programming in C	I / II	Theory	CS1209	Problem Solving and Python Programming
I / II	Lab	CS1208	Programming in C Laboratory	I / II	Lab	CS1210	Python Programming Laboratory
II / III	Theory	DS1302	Object Oriented Programming(Lab Integrated)	II / III	Theory	CS1309	Java Programming
II / III	Lab	DS1307	Data Structures Laboratory using Python	II / III	Lab	CS1307	Data Structures Laboratory using C
II / III	-	-	-	II / III	Lab	CS1310	Java Programming Laboratory
II / IV	Theory	DS1401	Python Programming for Data Science	II / IV	Theory	DS1401	Fundamentals of Digital Image Processing
II / IV	Lab	DS1407	Data Science Laboratory using Python	II / IV	Lab	DS1407	Digital Image Processing Laboratory
III / V	Theory	DS1501	Optimization in Data Analysis	III / V	Theory	DS1501	Deep Learning
III / V	Lab	DS1507	Data Preparation and Analysis Laboratory	III / V	Lab	DS1507	Deep Learning Laboratory
III / VI	Theory	DS1603	Data Visualization	III / VI	Theory	DS1603	Data Visualization using Tableau

## Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	Theory/Lab	Sub. Code	Sub. Name	Year/Sem	Theory/Lab	Sub. Code	Sub. Name
III / VI	Theory	DS1604	Data Analytics	III / VI	Theory	DS1604	Data Analytics using R
III / VI	Lab	DS1607	Data Visualization Laboratory	III / VI	Lab	DS1607	Data Visualization using Tableau Laboratory
III / VI	Lab	-	-	III / VI	Lab	DS1608	Data Analytics using R Laboratory
III / VI	Lab	DS1608	Mini Project - I	III / VI	Lab	DS1609	Mini Project - I

## Computer Science and Engineering

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/Sem	Theory/Lab	Sub. Code	Subject Name	Year/ Sem	Theory/Lab	Sub. Code	Subject Name
I / II	Theory	CS1206	Programming in C (Common to CSE & IT)	I / II	Theory	CS1209	Object Oriented Java Programming <b>Admitted in 2024 only</b>
I / II	Lab	CS1208	Programming in C Laboratory (Common to CSE & IT)	I / II	Lab	CS1210	Object Oriented Java Programming Laboratory <b>Admitted in 2024 only</b>
II / III	Theory	CS1301	Digital Principles and Logic Design (Lab Integrated)	II / III	Theory	CS1306	Digital Principles and Logic Design <b>Admitted from 2023 onwards</b>

## Minutes of 4th Meeting of Board of Studies

PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	Theory/Lab	Sub. Code	Subject Name	Year/ Sem	Theory/ Lab	Sub. Code	Subject Name
II / III	Theory	CS1305	Software Engineering (Common to CSE & IT)	II / III	Theory	CS1309	Agile Software Engineering (Common to CSE & IT) Admitted from 2023 onwards
II / III	Theory	CS1303	Object Oriented Programming (Common to CSE & IT)	II / III	Theory	CS1310	Advanced Java Programming Admitted in 2024
II / III	Lab	CS1307	Data Structures Laboratory using C (Common to CSE & IT)	II / III	Lab	CS1311	Data Structures Laboratory Admitted from 2024 onwards
II / III	Lab	CS1308	Object Oriented Programming Laboratory (Common to CSE & IT)	II / III	Lab	CS1312	Advanced Java Programming Laboratory Admitted in 2024
II / V	Theory	EC1601	Microprocessors and Microcontrollers (Common to CSE and ECE Semester VI)	II/IV	Theory	CS1410	Fundamentals of Data Science Admitted from 2023 onwards
II / V	Lab	CS1408	Networks Laboratory	II/IV	Lab	CS1411	Data Science Laboratory Admitted from 2023 onwards
III / V	Theory	CS1501	Internet Programming	III / V	Theory	CS1509	Full Stack Development Admitted from 2023 onwards
III / V	Lab	CS1507	Internet Programming Laboratory	III / V	Lab	CS1510	Full Stack Development Laboratory Admitted from 2023 onwards

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PRESENT CURRICULUM				UPDATED CURRICULUM FOR 2024 – 2028 BATCH			
Year/ Sem	Theory/Lab	Sub. Code	Theory/Lab	Year/ Sem	Theory/ Lab	Sub. Code	Theory/Lab
III / VI	Theory	CS1603	Distributed Systems	III / VI	Theory	CS1609	Introduction to Quantum Computing Admitted from 2023 onwards
III / VI	Lab	CS1608	Mini Project I	III / V	Lab	CS1610	Design Thinking and Innovations Admitted from 2022 onwards
III/VI	Professional Elective-II	CS1613	Advanced Java Programming	III/VI	Professional I Elective-II	CS1615	Generative AI for Software Development Admitted from 2024 onwards
IV/VII	Professional Elective-IV	CS1722	Quantum Computing	IV/VII	Professional Elective-IV	CS1726	Business Analytics Admitted from 2023 onwards

### BOS 04. 06

### VOTE OF THANKS

The meeting came to end, with the Vote of Thanks proposed by the Faculty Head to all the external and internal members for having spared their time and participated in the Third Board of Studies of Faculty of Computer Science and Engineering and Information Technology, St. Joseph's College of Engineering, Chennai - 119.

## Minutes of 4th Meeting of Board of Studies

 <p><b>Chairman</b> <b>Dr. A.Chandra Sekar,</b> Dean Research &amp; Faculty Head, Faculty of Computer Science and Engineering, and Information Technology, St. Joseph's College of Engineering, OMR, Chennai – 119.</p>	 <p><b>University Nominee</b> <b>Dr. J. C. Miraclin Joyce Pamila,</b> Professor and Head, Department of Computer Science and Engineering, Government College of Technology, Coimbatore - 641013.</p>	<p>-</p> <p><b>Subject Expert</b> <b>Dr. Krishna Moorthy Sivalingam,</b> Professor, Department of Computer Science and Engineering, Indian Institute of Technology (IIT) Madras, Chennai – 600036.</p>
 <p><b>Subject Expert</b> <b>Dr. G. Zayaraz,</b> Professor &amp; Head, Department of Computer Science and Engineering, Puducherry Technological University Puducherry – 605 014.</p>	 <p><b>Industrial Expert</b> <b>Mr. Abdul Muthalif,</b> Director Cognizant, Chennai.</p>	 <p><b>Post Graduate Meritorious Alumnus</b> <b>Ms. S.Ram Lakshmi,</b> Specialist Programmer Infosys, Techno Park, SEZ, Mahindra World City, Paranur, Chennai.</p>