We Make You Shine

St. JOSEPH'S INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

St. Joseph's Group of Institutions

OMR, Chennai - 119

FACULTY OF COMPUTER SCIENCE AND ENGINEERING, INFORMATION TECHNOLOGY & ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

B.E Computer Science and Engineering

Choice Based Credit System (CBCS)

Curriculum

Regulations R-2022

I-VIII Semesters

Vision of the Department:

To develop a competent professional, a leader and an innovator in the field of ever-changing technologies by inculcating knowledge with ethical standards thereby contributing to a global society.

Mission of the Department

The department endeavours to

- Aspire for academic excellence by imparting knowledge of Computer Science and Engineering.
- Provide a learning environment that helps students to be lifelong learners and pioneers.
- Motivate and facilitate to learn, unlearn and relearn and to bring out the best from each and every individual.
- Inculcate moral values and empower the students to attain administrative and leadership skills for the betterment of the society.
- Promote quality research and development in emerging trends to meet the industrial requirements.

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I-VIII Semester

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Knowledge competence

- The graduates will be fortified with mathematical foundation, algorithmic principles and designing concepts to analyze and solve current problems in the field of computer science and engineering.

Professionalism and leadership

- The graduates will be equipped with logical and reasoning skills to communicate effectively with a range of audience to accomplish common goal.

Global Engineer

- The graduates will flourish to adapt and respond to new technologies and methodologies by innovating ideas for betterment of the society.

PROGRAM OUTCOMES (POs)

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)

Core Oriented

- Proficient in the field of meta logic, hardware, software computing, to meet the desired needs and to solve various problems.

Continuous improvement

- To sustain in transitional environment of computer science & engineering to develop algorithms & projects using open-source tools and efficient data structures

Intra - disciplinary

- Apply Knowledge in different domains like data management science and cognitive technologies.

Focusing growth

- Exalt in innovative world by applying state –of-art methodologies with focus on optimization and quality related activities.

MAPPING OF PROGRAM OUTCOMES (POs) WITH PROGRAM EDUCATIONAL OBJECTIVES (PEOs) & PROGRAM SPECIFIC OUTCOMES (PSOs)

PROGRAM OUTCOMES (POs)	PROGRAM EDUCATIONAL OBJECTIVES (PEOs)			PROGRAM SPECIFIC OUTCOMES (PSOs)			
	Knowledge Competence	Professionalism and leadership	Global Engineer	Core Oriented	Continuous Improvement	Intra-disciplinary	Focusing growth
PO1: Engineering knowledge	3	3	3	3	3	3	3
PO2: Problem analysis	3	3	3	3	3	2	3
PO3: Design/development of solutions	3	3	3	2	2	2	2
PO4: Conduct investigations of complex problems	3	2	2	3	3	2	2
PO5: Modern tool usage	3	2	2	3	3	3	3
PO6: The engineer and society	2	2	2	2	2	2	2
PO7: Environment and sustainability	2	2	2	1	1	1	1
PO8: Ethics	2	2	2	2	2	2	2
PO9: Individual and team work	2	2	2	2	2	2	2
PO10: Communication	2	2	2	2	2	2	2
PO11: Project management and finance	3	3	2	3	3	3	3
PO12: Life-long learning	2	2	2	3	3	3	3

Correlation Level 1, 2 or 3 as defined below

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

SEMESTER I

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
	IP4151	Induction Programme		-	-	-	-	0
Theory								
1.	HS4101	Communicative English **(Common to all Branches of B.E/B.Tech Programmes)**	HSMC	3	0	0	3	3
2.	MA4102	Engineering Mathematics **(Common to all Branches of B.E/B.Tech Programmes)**	BSC	3	1	0	4	4
3.	PH4103	Engineering Physics **(Common to all Branches of B.E/B.Tech Programmes)**	BSC	3	0	0	3	3
4.	CY4104	Engineering Chemistry **(Common to all Branches of B.E/B.Tech Programmes)**	BSC	3	0	0	3	3
5.	GE4105	Problem Solving and Python Programming **(Common to all Branches of B.E/B.Tech Programmes)**	ESC	3	0	0	3	3
6.	GE4106	Engineering Graphics **(Common to all Branches of B.E/B.Tech Programmes)**	ESC	2	0	4	6	4
7.	GE4151	தமிழர்மரபு/Heritage of Tamils **(Common to all Branches of B.E/B.Tech Programmes)**	HSMC	1	0	0	1	1

Practicals								
8.	GE4107	Python Programming Laboratory **(Common to all Branches of B.E/B.Tech Programmes)**	ESC	0	0	4	4	2
9.	BS4108	Physics and Chemistry Laboratory **(Common to all Branches of B.E/B.Tech Programmes)**	BSC	0	0	4	4	2
			Total	**17**	**1**	**12**	**30**	**25**

SEMESTER II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	HS4201	Professional English **(Common to all Branches of B.E/B.Tech Programmes)**	HSMC	3	0	0	3	3
2.	MA4202	Statistics and Numerical Methods **(Common to all Branches of B.E/B.Tech Programmes)**	BSC	3	1	0	4	4
3.	PH4251	Physics for Information Science **(Common to IT & ADS)**	BSC	3	0	0	3	3
4.	BE4251	Basic Electrical, and Electronics Engineering **(Common to IT, ADS & MECHANICAL)**	ESC	3	0	0	3	3
5.	GE4204	Environmental Science and Engineering	BSC	3	0	0	3	3

		(Common to all Branches of B.E/B.Tech Programmes)						
6.	CS4206	Programming in C **(Common to IT & ADS)**	PCC	3	0	0	3	3
7.	GE4251	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology **(Common to all Branches of B.E/B.Tech Programmes)**	HSMC	1	0	0	1	1
Practicals								
8.	GE4207	Engineering Practices Laboratory **(Common to all Branches of B.E/B.Tech Programmes)**	ESC	0	0	4	4	2
9.	CS4208	Programming Laboratory **(Common to IT & ADS)**	PCC	0	0	4	4	2
			Total	**18**	**1**	**8**	**27**	**24**

Note: *For Personality Development course, the grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

SEMESTER III

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	MA4351	Discrete Mathematics **(Common to all Branches of B.E/B.Tech Programmes)**	BSC	3	1	0	4	4
2.	CS4351	Digital Logic and Computer Organization **(Common to IT & ADS)**	PCC	3	0	0	4	3
3.	CS4301	Data Structures and Algorithms-I	PCC	3	0	0	3	3
4.	CS4352	Java Programming **(Common to IT & ADS)**	PCC	3	0	0	3	3
5.	AD4351	Foundations of Data Science **(Common to IT & ADS)**	PCC	3	0	0	3	3
Practicals								
6.	CS4306	Data Structures and Algorithms Laboratory	PCC	0	0	4	4	2
7.	CS4357	Java Programming Laboratory **(Common to IT & ADS)**	PCC	0	0	4	4	2
8.	AD4358	Data Science Laboratory **(Common to IT)**	PCC	0	0	4	4	2
9.	HS4310	Professional Skills Laboratory **(Common to all Branches of B.E/B.Tech Programmes)**	EEC	0	0	2	2	1
			Total	**15**	**1**	**14**	**30**	**23**

SEMESTER IV

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	MA4401	Probability and Statistics **(Common to all Branches of B.E/B.Tech Programmes)**	BSC	3	1	0	4	4
2.	CS4451	Database Management Systems **(Common to IT & ADS)**	PCC	3	0	0	3	3
3.	CS4452	Operating Systems **(Common to IT & ADS)**	PCC	3	0	0	3	3
4.	CS4401	Data Structures and Algorithms-II	PCC	3	0	0	3	3
5.	CS4402	Computer Architecture	PCC	3	0	0	3	3
6.	CS4453	Artificial Intelligence and Basics of Machine Learning **(Common to IT)**	PCC	3	0	0	3	3
Practical								
7.	CS4457	Database Management Systems Laboratory **(Common to IT & ADS)**	PCC	0	0	4	4	2
8.	CS4458	Operating Systems Laboratory **(Common to IT & ADS)**	PCC	0	0	4	4	2
9.	CS4459	Artificial Intelligence and Machine Learning Laboratory **(Common to IT)**	PCC	0	0	4	4	2
			Total	**18**	**1**	**12**	**31**	**25**

SEMESTER V

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	CS4551	Software Engineering and Design **(Common to IT & ADS)**	PCC	3	0	0	3	3
2.	CS4552	Theoretical Computation and Compiler Design **(Common to IT)**	PCC	3	0	0	3	3
3.	CS4553	Computer Networks and Security Basics **(Common to IT& ADS)**	PCC	3	0	0	3	3
4.	CS4502	Soft Computing and its applications	PCC	3	0	0	3	3
5.	CS4554	Fundamentals of Digital Image Processing **(Common to IT)**	PCC	3	0	0	3	3
6.		Professional Elective-I	PEC	3	0	0	3	3
7.		Mandatory Course I	MC	3	0	0	3	0
Practicals								
8.	CS4508	Software Design Methodologies Laboratory	PCC	0	0	4	4	2
9.	CS4559	Digital Image Processing Laboratory **(Common to IT)**	PCC	0	0	4	4	2
			Total	**21**	**0**	**8**	**29**	**22**

SEMESTER VI

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	IT4651	Big Data Analytics **(Common to IT & ADS)**	PCC	3	0	0	3	3
2.	CS4601	Internet Programming	PCC	3	0	0	3	3
3.		Open Elective –I	OEC	3	0	0	3	3
4.		Professional Elective-II	PEC	3	0	0	3	3
5.		Professional Elective-III	PEC	3	0	0	3	3
6.		Mandatory Course II	MC	3	0	0	3	0
Practicals								
7.	IT4657	Big Data Analytics Laboratory **(Common to IT & ADS)**	PCC	0	0	4	4	2
8.	CS4608	Internet Programming Laboratory	PCC	0	0	4	4	2
9.	CS4609	Mini Project	EEC	0	0	4	4	2
Total				**18**	**0**	**12**	**30**	**21**

***Mandatory Course I and II is a Non-credit Course (Student shall select one course from the list given under Mandatory Courses I and II)**

SEMESTER VII

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	MB4751	Principles of Management	HSMC	3	0	0	3	3
2.	CS4701	Cyber Security and Ethical Hacking	PCC	3	0	0	3	3
3.	CS4702	Virtualization and cloud Computing	PCC	3	0	0	3	3
4.		Open Elective –II	OEC	3	0	0	3	3
5.		Professional Elective-IV	PEC	3	0	0	3	3
Practicals								
6.	CS4707	Cyber Security and Ethical Hacking Laboratory	PCC	0	0	4	4	2
7.	CS4708	Virtualization and cloud Computing Laboratory	PCC	0	0	4	4	2
Total				**15**	**0**	**8**	**23**	**19**

***Open Elective – I & II Shall be chosen from the list of open electives offered by other Programmes**

SEMESTER VIII

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	GE4791	Human Values and Ethics	HSMC	3	0	0	2	2
2.		Professional Elective-V	PEC	3	0	0	3	3
Practicals								
3.	CS4803	Practical Work	EEC	0	0	20	20	10
Total				**6**	**0**	**20**	**25**	**15**

Total Credits: 174

HUMANITIES SCIENCE AND MANAGEMENT COURSES (HSMC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS4101	Communicative English	HSMC	3	3	0	0	3
2.	HS4201	Professional English	HSMC	3	3	0	0	3
3.	MB4751	Principles of Management	HSMC	3	3	0	0	3
4.	GE4151	தமிழர்மரபு/Heritage of Tamils	HSMC	1	0	0	1	1
5.	GE4251	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	1	0	0	1	1
6.	GE4791	Human Values and Ethics	HSMC	3	0	0	2	2

BASIC SCIENCE COURSES (BSC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA4102	Engineering Mathematics	BSC	4	3	1	0	4
2.	PH4103	Engineering Physics	BSC	3	3	0	0	3
3.	CY4104	Engineering Chemistry	BSC	3	3	0	0	3
4.	BS4108	Physics and Chemistry Laboratory	BSC	4	0	0	4	2
5.	MA4202	Statistics & Numerical Methods	BSC	4	3	1	0	4
6.	PH4251	Physics for Information Science	BSC	3	3	0	0	3
7.	MA4351	Discrete Mathematics	BSC	4	3	1	0	4
8.	MA4401	Probability & Statistics	BSC	3	3	1	0	4
9.	GE4204	Environmental Science and Engineering	BSC	3	3	0	0	3

ENGINEERING SCIENCE COURSES (ESC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE4105	Problem Solving and Python Programming	ESC	3	3	0	0	3
2.	GE4106	Engineering Graphics	ESC	6	2	0	4	4
3.	GE4107	Python Programming Laboratory	ESC	4	0	0	4	2
4.	BE4251	Basic Electrical and Electronics Engineering	ESC	3	3	0	0	3
5.	GE4207	Engineering Practices Laboratory	ESC	4	0	0	4	2

PROFESSIONAL CORE COURSES (PCC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS4206	Programming in C	PCC	3	3	0	0	3
2.	CS4208	Programming in C Laboratory	PCC	4	0	0	4	2
3.	CS4301	Data Structures and Algorithms-I	PCC	3	3	0	0	3
4.	CS4352	Java Programming	PCC	3	3	0	0	3
5.	AD4351	Foundations of Data Science	PCC	3	3	0	0	3
6.	CS4351	Digital Logic and Computer Organization	PCC	3	3	0	0	3
7.	CS4306	Data Structures and AlgorithmsLaboratory	PCC	4	0	0	4	2
8.	CS4357	Java Programming Laboratory	PCC	4	0	0	4	2
9.	AD4358	Data Science Laboratory	PCC	4	0	0	4	2
10.	CS4451	Database Management Systems	PCC	3	3	0	0	3
11.	CS4452	Operating Systems	PCC	3	3	0	0	3
12.	CS4401	Data Structures and Algorithms-II	PCC	3	3	0	0	3
13.	CS4402	Computer Architecture	PCC	3	3	0	0	3
14.	CS4453	Artificial Intelligence and Basics of Machine Learning	PCC	3	3	0	0	3

15.	CS4457	Database Management Systems Laboratory	PCC	4	0	0	4	2
16.	CS4458	Operating Systems Laboratory	PCC	4	0	0	4	2
17.	CS4459	Artificial Intelligence and Machine Learning Laboratory	PCC	4	0	0	4	2
18.	CS4551	Software Engineering & Design	PCC	3	3	0	0	3
19.	CS4552	Theoretical Computation and Compiler Design	PCC	3	3	0	0	3
20.	CS4553	Computer Networks and Security Basics	PCC	3	3	0	0	3
21.	CS4502	Soft Computing and its applications	PCC	3	3	0	0	3
22.	CS4554	Fundamentals of Digital Image Processing	PCC	3	3	0	0	3
23.	CS4508	Software Design Methodologies Laboratory	PCC	4	0	0	4	2
24.	CS4559	Digital Image Processing Laboratory	PCC	4	0	0	4	2
25.	IT4651	Big Data Analytics	PCC	3	3	0	0	3
26.	CS4601	Internet Programming	PCC	3	3	0	0	3
27.	IT4657	Big Data Analytics	PCC	4	0	0	4	2

		Laboratory						
28.	CS4608	Internet Programming Laboratory	PCC	4	0	0	4	2
29.	CS4701	Cyber Security and Ethical Hacking	PCC	3	3	0	0	3
30.	CS4702	Virtualization and cloud Computing	PCC	3	3	0	0	3
31.	CS4707	Cyber Security and Ethical Hacking Laboratory	PCC	4	0	0	4	2
32.	CS4708	Virtualization and cloud Computing Laboratory	PCC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS4310	Professional Skills Lab	EEC	2	0	0	2	1
2	CS4609	Mini Project	EEC	4	0	0	4	2
3	CS4803	Project	EEC	20	0	0	20	10

Professional Elective Courses:Verticals

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

	Vertical 1 Full Stack Development	**Vertical 2 Cloud Computing & Data Centre Technologies**	**Vertical 3 Cyber Security and Data Privacy**	**Vertical 4 AI & ML**	**Vertical 5 Data Science & Emerging Technologies**
PE1	CS4511 Semantic Web	CS4512 Distributed Systems	CS4513 Social Network Security	CS4514 Advance machine Learning	IT4511 IoT Essentials
PE2	CS4521 App Development	CS4522 Software Definition Network	CS4523 Information Security	CS4524 Intelligence Fuzzy	CS4525 Introduction to Virtual Reality and Augmented Reality
PE3	CS4631 Full Stack Software Development	CS4632 Data Warehousing & Data Mining	CS4633 Cyber Forensics	IT4524 Information Retrieval	CS4635 R Programming in Data Science
PE4	CS4741 Software Testing & QA	CS4742 Information Management	CS4743 Cybercrime and Computer Ethics	CS4744 Software Agents	CS4745 NLP Tools and Applications
PE5	CS4851 UI/UX Design	CS4852 Social Media Mining	CS4853 Big Data Security	CS4854 Text and Speech Analysis	CS4855 Predictive Analytics
PE6	CS4861 Principles of Programming Languages	CS4862 Security & Privacy in Cloud	CS4863 Blockchain and its applications	CS4864 Artificial Intelligence and Robotics	CS4865 Digital Marketing

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also

PROFESSIONAL ELECTIVE COURSES (PEC)

SEMESTER V

Vertical 1: Full Stack Development

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	CS4511	Semantic Web **(Common to IT & ADS)**	PEC	3	0	0	3	3
2.	CS4521	App Development **(Common to IT & ADS)**	PEC	2	0	2	3	3
3.	CS4631	Full Stack Software Development	PEC	2	0	2	3	3
4.	CS4741	Software Testing & QA **(Common to IT)**	PEC	2	0	2	3	3
5.	CS4851	UI/UX Design	PEC	2	0	2	3	3
6.	CS4861	Principles of Programming Languages	PEC	3	0	0	3	3

SEMESTER VI

Vertical 2: Cloud Computing and Data Centre Technologies

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	CS4512	Distributed Systems **(Common to IT & ADS)**	PEC	3	0	0	3	3
2.	CS4522	Software Defined Network **(Common to IT & ADS)**	PEC	2	0	2	3	3
3.	CS4632	Data Warehousing & Data Mining **(Common to IT & ADS)**	PEC	3	0	0	3	3
4.	CS4742	Information Management **(Common to IT & ADS)**	PEC	3	0	0	3	3
5.	CS4852	Social Media Mining	PEC	3	0	0	3	3
6.	CS4862	Security and Privacy	PEC	2	0	2	3	3

		in Cloud						

SEMESTER VII

Vertical 3: Cyber Security and Data Privacy

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	CS4513	Social Network Security **(Common to IT & ADS)**	PEC	2	0	2	3	3
2.	CS4523	Information Security **(Common to IT & ADS)**	PEC	3	0	0	3	3
3.	CS4633	Cyber Forensics **(Common to IT & ADS)**	PEC	3	0	0	3	3
4.	CS4743	Cybercrime and Computer Ethics	PEC	2	0	2	3	3
5.	CS4853	Big Data Security	PEC	3	0	0	3	3
6.	CS4863	Blockchain and its applications	PEC	3	0	0	3	3

Vertical 4: Artificial Intelligence and Machine Learning

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	CS4514	Advanced Machine Learning	PEC	2	0	2	3	3
2.	CS4524	Intelligence Fuzzy	PEC	3	0	0	3	3
3.	IT4524	Information Retrieval **(Common to IT)**	PEC	3	0	0	3	3
4.	CS4744	Software Agents **(Common to IT)**	PEC	3	0	0	3	3
5.	CS4854	Text and Speech Analysis	PEC	2	0	2	3	3
6.	CS4864	Artificial Intelligence and Robotics	PEC	3	0	0	3	3

SEMESTER VIII

Vertical 5: Data Science and Emerging Technologies

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	IT4511	IOT Essentials **(Common to IT)**	PEC	3	0	0	3	3
2.	CS4525	Introduction to Virtual Reality and Augmented Reality **(Common to IT & ADS)**	PEC	3	0	0	3	3
3.	CS4635	R Programming in Data Science **(Common to IT & ADS)**	PEC	2	0	2	3	3
4.	CS4745	NLP Tools and Applications **(Common to IT)**	PEC	3	0	0	3	3
5.	CS4855	Predictive Analytics **(Common to IT & ADS)**	PEC	3	0	0	3	3
6.	CS4865	Digital Marketing **(Common to IT & ADS)**	PEC	3	0	0	3	3

MANDATORY COURSES I

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	MX4001	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX4002	Elements of Literature	MC	3	0	0	3	0
3.	MX4003	Personality Development through Life Enlightment skills	MC	3	0	0	3	0
4.	MX4004	Disaster Management	MC	3	0	0	3	0

MANDATORY COURSES II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	MX4005	Well Being with traditional practices (Yoga, Ayurveda and Siddha)	MC	3	0	0	3	0
2.	MX4006	History of Science and Technology in India	MC	3	0	0	3	0
3.	MX4007	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
4.	MX4008	Industrial Safety	MC	3	0	0	3	0

Open Elective I

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	OEE411	Introduction to Renewable Energy Systems	OEC	3	0	0	3	3
2.	OMA411	Graph Theory and its Applications	OEC	3	0	0	3	3
3.	OEC412	Foundation of Robotics	OEC	3	0	0	3	3
4.	OEC413	Embedded Systems	OEC	3	0	0	3	3
5.	OEC414	Basics of Biomedical Instrumentation	OEC	3	0	0	3	3
6.	OMB415	Design Thinking	OEC	3	0	0	3	3
7.	OMB416	Entrepreneurship Skill Development	OEC	3	0	0	3	3
8.	OME417	Introduction to	OEC	3	0	0	3	3

		Industrial Engineering						
9.	OCY418	Climate Change and its Impact	OEC	3	0	0	3	3

Open Elective II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
Theory								
1.	OEC421	Fundamentals of Remote Sensing	OEC	3	0	0	3	3
2.	OEE421	Electric and Hybrid Vehicle	OEC	3	0	0	3	3
3.	OEE422	Basic Circuit Theory	*OEC*	3	0	0	3	3
4.	OMB423	Hospital Management	OEC	3	0	0	3	3
5.	OME424	Sustainable Manufacturing	OEC	3	0	0	3	3
6.	OEN425	English for Research Paper Writing	OEC	3	0	0	3	3
7.	OMA426	Resource Management Techniques	OEC	3	0	0	3	3
8.	OME427	Reverse Engineering	OEC	3	0	0	3	3
9.	OME428	Industrial Safety Engineering	OEC	3	0	0	3	3

CREDIT SUMMARY

Name of the Programme: B.E. Computer Science and Engineering										
S.No	**Subject Area**	**Credits per Semester**							**Total Credits**	**Credit %**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	
1	**HSMC**	4	4					3	**2**	**13**	**7.47**
2	**BSC**	12	10	4	4					**30**	**17.24**
3	**ESC**	9	5							**14**	**8**
4	**PCC**		5	18	21	19	10	10		**83**	**47.7**
5	**PEC**					3	6	3	3	**15**	**8.62**
6	**OEC**						3	3		**6**	**3.44**
7	**EEC**			1			2		10	**13**	**7.47**
8	**Non Credit / (Mandatory)**		√			√	√				
Total		**25**	**24**	**23**	**25**	**22**	**21**	**19**	**15**	**174**	**100**

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE(OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

VERTICALS FOR MINOR DEGREE
(In addition to all the verticals of other programmes)

Vertical I Fintech and Block Chain Vertical	**Vertical II Entrepreneurship**	**Vertical III Public Administration**	**Vertical IV Business Data Analytics**	**Vertical V Environment and Sustainability**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Datamining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
				Integrated Energy Planning for Sustainable Development
				Energy Efficiency for Sustainable Development

HS4101	COMMUNICATIVE ENGLISH	L	T	P	C
	Common for all Branches of B.E. / B. Tech Programmes	3	0	0	3

OBJECTIVES

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

UNIT I	SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS	9
Reading — critical reading — finding key information in a given text — shifting facts from opinions - Writing - autobiographical writing - developing hints. Listening- short texts- short formal and informal conversations. Speaking- basics in speaking - introducing oneself - exchanging personal information- speaking on given topics & situations Language development– voices- Wh- Questions- asking and answering-yes or no questions– parts of speech. Vocabulary development-- prefixes- suffixes- articles - Polite Expressions.		CO1
UNIT II	**GENERAL READING AND FREE WRITING**	**9**
Reading: Short narratives and descriptions from newspapers (including dialogues andconversations; Reading Comprehension Texts with varied question types - Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –. Listening - long texts - TED talks - extensive speech on current affairs and discussions Speaking — describing a simple process – asking and answering questions - Language development – prepositions, clauses. Vocabulary development- guessing meanings of words in context – use of sequence words.		CO2
UNIT III	**GRAMMAR AND LANGUAGE DEVELOPMENT**	**9**

Reading- short texts and longer passages (close reading) & making a critical analysis of the given text Writing — types of paragraphs and writing essays — rearrangement of jumbled sentences. Listening: Listening to ted talks and long speeches for comprehension. Speaking- role plays - asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- Direct vs. Indirect Questions. Vocabulary development – idioms and phrases- cause & effect expressions, adverbs.		**CO3**
UNIT IV	**READING AND LANGUAGE DEVELOPMENT**	**9**
Reading- comprehension-reading longer texts- reading different types of texts- magazines. Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening: Listening comprehension (IELTS, TOEFL and others). Speaking -Speaking about friends/places/hobbies - Language development- Tenses- simple present-simple past- present continuous and past continuous- conditionals — if, unless, in case, when and others Vocabulary development- synonyms-antonyms- Single word substitutes-Collocations.		**CO4**
UNIT V	**EXTENDED WRITING**	**9**
Reading: Reading for comparisons and contrast and other deeper levels of meaning–Writing- brainstorming -writing short essays — developing an outline- identifying main and subordinate ideas-dialogue writing- Listening - popular speeches and presentations -Speaking - impromptu speeches & debates Language development-modal verbs- present/ past perfect tense - Vocabulary Development-Phrasal verbs- fixed and semi-fixed expressions.		**CO5**
		TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011. Means, L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
2. Redston, Chris &Gillies Cunningham Face 2 Face (Pre-

intermediate Student s Book& Workbook) Cambridge University Press, New Delhi: 2005
3. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
4. Dutt P. Kiranmai and Rajeevan Geeta Basic Communication Skills, Foundation Books: 2013.
5. John Eastwood et al: Be Grammar Ready: The Ultimate Guide to English Grammar, OxfordUniversity 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 usingappropriate communicative strategies.
CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a widevocabulary 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	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	-	-	-	2	3	-	-	1	-	-	1
CO2	-	1	-	2	-	-	-	-	-	3	-	-	1	-	-	1
CO3	-	2	-	3	-	-	-	-	-	2	-	-	1	-	-	1
CO4	-	-	-	-	-	-	-	-	2	2	-	-	1	-	-	1
CO5	-	2	1	1	2	-	2	-	-	3	-	-	2	-	-	2

MA4102	ENGINEERING MATHEMATICS –I	L	T	P	C
	Common for all branches of B.E. / B. Tech Programmes	4	0	0	4

OBJECTIVES

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

UNIT I	MATRICES	12
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms		**CO1**
UNIT II	**CALCULUS OF ONE VARIABLE**	**12**
Limit of a function - Continuity - Derivatives - Differentiation rules – Interval of increasing anddecreasing functions – Maxima and Minima - Intervals of concavity and convexity.		**CO2**
UNIT III	**CALCULUS OF SEVERAL VARIABLES**	**12**
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.		**CO3**
UNIT IV	**INTEGRAL CALCULUS**	**12**
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.		**CO4**

UNIT V	MULTIPLE INTEGRALS	12
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Change of variables from Cartesian to polar in double integrals-Triple integrals – Volume of solids		CO5
		TOTAL : 60 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., ―Advanced Engineering Mathematics‖, Narosa Publications,New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., ―Calculus" Volume I and II, S. ViswanathanPublishers 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 additiondealing 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. Multivariablefunctions 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 andintegration 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 areapplied in engineering field.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	2	3	-	-	3	2	3	3	3	3	3	2
CO2	3	3	3	2	2	1	-	-	-	-	1	2	2	3	2	3
CO3	3	3	3	2	2	1	-	-	-	-	1	2	2	3	2	3
CO4	3	3	3	2	2	1	-	-	-	-	1	2	2	1	1	2
CO5	3	3	3	2	1	1	-	-	-	-	1	2	2	1	1	2

H4103	ENGINEERING PHYSICS	L	T	P	C
	Common for all branches of B.E. / B. Tech Programmes	3	0	0	3

OBJECTIVES

- To make the students to understand about the elastic property and stress strain diagram.
- To educate the students about principle of laser and its role in optical fibers and its applicationsas sensors and communication.
- To teach the students about the heat transfer through solids and liquids.
- To educate the students about the quantum concepts and its use to explain black body radiation, Compton effect, tunnelling electron microscopy and its applications.
- To make the students to understand the importance of various crystal structures and various growth techniques.

UNIT I	**PROPERTIES OF MATTER**	**9**
Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – Practical applications of modulus of elasticity-I-shaped girders - stress due to bending in beams.		**CO1**
UNIT II	**LASER AND FIBER OPTICS**	**9**
Lasers : population of energy levels, Einstein's A and B coefficients derivation — resonant cavity, optical amplification (qualitative) – Nd-YAG Laser-Semiconductor lasers: homojunction and heterojunction — Industrial and medical applications of Laser– Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) — losses associated with optical fibers — Fabrication of Optical fiber-Double crucible method-fibre optic sensors: pressure and displacement-Industrial and medical applications of optical fiber - Endoscopy-Fiber optic communication system.		**CO2**
UNIT III	**THERMAL PHYSICS**	**9**
Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity – Rectilinear flow of heat- Lee's disc method: theory and experiment - conduction through compound media (series and parallel)-Radial flow of heat– thermal insulation – applications: heat exchangers, refrigerators, oven, Induction furnace and solar water heaters.		**CO3**
UNIT IV	**QUANTUM PHYSICS**	**9**
Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – Electron microscope-tunnelling (qualitative) - scanning tunnelling microscope-Applications of electron microscopy.		**CO4**

UNIT V	CRYSTAL PHYSICS	9
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices — inter-planar distances coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures — Graphite structure-crystal imperfections: point defects, line defects — Burger vectors, stacking faults – growth of single crystals: solution and melt growth techniques- Epitaxial growth-Applications of Single crystal (Qualitative).		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2019.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2017.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2019.

REFERENCE BOOKS

1. Halliday, D., Resnick, R. & Walker, J. "Engineering 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, 2007.

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

CO1	Gain knowledge on the basics of properties of matter and its applications,
CO2	Acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics.
CO3	Have adequate knowledge on the concepts of thermal properties of materials and theirapplications in expansion joints and heat exchangers.
CO4	Get knowledge on advanced physics concepts of quantum theory and its applications intunneling microscopes and
CO5	Understand the basics of crystals, their structures and different crystal growth techniques.

MAPPING OF COs WITH POs AND PSOs																
COs	**Pos**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	2	2	1	3	2	1	2	3	1	2	2
CO2	3	3	3	2	3	2	2	1	2	2	2	1	2	1	3	3
CO3	3	3	2	2	2	1	2	1	2	1	1	2	2	2	2	2
CO4	3	3	2	2	2	1	1	1	1	1	1	3	3	1	3	3
CO5	3	3	3	3	2	1	2	1	3	1	1	3	3	1	3	3

CY4104	**ENGINEERING CHEMISTRY**	**L**	**T**	**P**	**C**
	Common for all branches of B.E. / B. Tech Programmes	3	0	0	3

OBJECTIVES

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

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

UNIT II	SURFACE CHEMISTRY AND CATALYSIS	9
Surface chemistry: Types of adsorptions – Adsorption of gases on solids – Adsorption of solute from solutions – Adsorption isotherms – Freundlich ‘s adsorption isotherm – Langmuir ‘s adsorption isotherm — Kinetics of uni-molecular surface reactions — Adsorption in chromatography – Applications of adsorption in pollution abatement using PAC. **Catalysis**: Catalyst – Types of catalysis – Criteria – Contact theory – Catalytic poisoning and catalytic promoters – Industrial applications of catalysts – Catalytic convertor – Auto catalysis – Enzyme catalysis – Michaelis-Menten equation.		**CO2**
UNIT III	**PHASE RULE AND ALLOYS**	**9**
Phase rule: Introduction – Definition of terms with examples – One component system – Water system – Reduced phase rule – Thermal analysis and cooling curves – Two component systems – Lead-silver system – Pattinson process. **Alloys**: Introduction – Definition – Properties of alloys – Significance of alloying – Functions and effect of alloying elements – Nichrome, Alnico, Stainless steel (18/8) – Heat treatment ofsteel – Non-ferrous alloys – Brass and bronze.		**CO3**
UNIT IV	**FUELS AND COMBUSTION**	**9**
Fuels: Introduction – classification of fuels – Comparison of solid, liquid, gaseous fuels – Coal – Analysis of coal (proximate and ultimate). – Carbonization – Manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – Cracking – Manufacture of synthetic petrol (Bergius process, Fischer Tropsch Process) — Knocking — Octane number — Diesel oil — Cetane number – Compressed natural gas (CNG) – Liquefied petroleum gases (LPG) – Poweralcohol and biodiesel. **Combustion of fuels**: Introduction – Calorific value – Higher and lower calorific values – Theoretical calculation of calorific value – Ignition temperature – Spontaneous ignitiontemperature – Explosive range – Flue gas analysis by Orsat Method.		**CO4**

UNIT V	NON–CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES	9
Nuclear energy – Fission and fusion reactions – Differences – Chain reactions – Nuclear reactors – Classification of reactors – Light water nuclear reactor for power generation – Breeder reactor — Solar energy conversion — Solar cells — Wind energy — Fuel cells — Hydrogen-oxygen fuel cell . Batteries – Types of batteries - Alkaline batteries – Lead-acid, Nickel-cadmium and Lithium batteries.		**CO5**
		TOTAL: 45 PERIODS

TEXT BOOKS

1. P.C.Jain, Monica Jain, "Engineering Chemistry" 17th Ed. Dhanpat Rai Pub. Co., NewDelhi,(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. NewDelhi, (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", CambridgeUniversity Press, Delhi, (2015).
5. A. Pahari, B. Chauhan, "Engineering chemistry", Firewall Media., New Delhi., (2010).
6. Sheik Mideen., Engineering Chemistry, Airwalk Publications, Chennai (2018).

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Able to understand impurities in industrial water, boiler troubles, internal and external treatment methods of purifying water.
CO2	Able to understand concepts of absorption, adsorption, adsorption isotherms, application ofadsorption 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. They should be acquainted with phase rule and reduced phase and its applications in alloying.
CO4	Able to identify various types of fuels, properties, uses and analysis of fuels. They should beable 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 variousbatteries.

MAPPING OF COs WITH POs AND PSOs

COs	**Pos**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	2	3	2	2	2	2	2	2	2	1	3
CO2	3	3	2	2	2	2	2	1	1	1	1	2	2	1	1	3
CO3	3	3	3	3	3	2	2	1	2	2	2	2	2	2	2	3
CO4	3	3	3	2	2	3	3	2	2	3	2	2	3	1	2	3
CO5	3	2	3	3	3	3	3	2	2	2	2	2	3	2	3	3

GE4105	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

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

UNIT I	ALGORITHMIC PROBLEM SOLVING	9
Algorithms, building blocks of algorithms: statements, state, control flow, functions, Notation: pseudo code, flow chart, programming language, Algorithmic problem solving: Basic algorithms, flowcharts and pseudocode for sequential, decision processing and iterative processing strategies, Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.		**CO1**
UNIT II	**INTRODUCTION TO PYTHON**	**9**
Python Introduction, Technical Strength of Python, Python interpreter and interactive mode, Introduction to colab , PyCharm and Jupiter idle(s) ,Values and types: int, float, boolean, string, and list; Built-in data types, variables, Literals, Constants, statements, Operators: Assignment, Arithmetic, Relational, Logical, Bitwise operators and their precedence, Expressions, tuple assignment, Accepting input from Console, printing statements, Simple Python programs.		**CO2**
UNIT III	**CONTROL FLOW, FUNCTIONS AND STRINGS**	**9**
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for; Loop manipulation using pass, break, continue,and else; Modules and Functions: function definition and use, flow of execution, parameters and arguments, local and global scope, return values, function composition, recursion. Strings: string slices, immutability, string functions and methods, string module; Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		**CO3**

UNIT IV	LISTS, TUPLES, DICTIONARIES	9
Lists: Defining list and list slicing, list operations, list slices, list methods, list loop, list Manipulation, mutability, aliasing, cloning lists, list parameters, lists as arrays. Tuples: tuple assignment, tuple as return value, tuple Manipulation; Dictionaries: operations and methods; advanced list processing — list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.		CO4
UNIT V	**FILES, MODULES, PACKAGES**	**9**
Files and exception: Concept of Files, Text Files; File opening in various modes and closing of a file, Format Operators, Reading from a file, Writing onto a file, File functions- open(), close(), read(),readline(), readlines(),write(), writelines(),tell(),seek(), Command Line arguments; Errors and exceptions: handling exceptions; modules, packages; introduction to numpy, matplotlib. Illustrative programs: word count, copy a file.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist ", 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, - An Introduction to Python – Revised andupdated for Python 3.2, Network Theory Ltd., 2011.
3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford UniversityPress, 2019.

REFERENCE BOOKS

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

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Develop algorithmic solutions to simple computational problems
CO2	Develop simple console application in python
CO3	Develop python program by applying control structure and decompose program into functions.
CO4	Represent compound data using python lists, tuples, and dictionaries.
CO5	Read and write data from/to files in Python.

MAPPING OF COs WITH POs AND PSOs

COs	**Pos**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3	3
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3	3
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3	3
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3	3
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3	3

GE4106	**ENGINEERING GRAPHICS**	**L**	**T**	**P**	**C**
	Common for all branches of B.E. / B. Tech Programmes	2	0	4	4

OBJECTIVES

- To develop in students, graphic skills for communication of concepts, ideas and design ofEngineering products
- To expose them to existing national standards related to technical drawings.

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

UNIT I	**PLANE CURVES AND FREEHAND SKETCHING**	**7+12**
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects		**CO1**
UNIT II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**6+12**
Orthographic projection- principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		**CO2**
UNIT III	**PROJECTION OF SOLIDS**	**5+12**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.		**CO3**
UNIT IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**6+12**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.		**CO4**
UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+12**
Principles of isometric projection — isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.		**CO5**
		TOTAL : 90 PERIODS

TEXT BOOKS

1. Natarajan K.V., ―A text book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai,Twenty Ninth Edition 2016
2. Venugopal K. and Prabhu Raja V., ―Engineering Graphics‖, New Age International (P) Limited, 2011.

REFERENCE BOOKS

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2018.
4. Luzzader, Warren.J. and Duff,John M., ―Fundamentals of Engineering Drawing with an introduction to Interactive Comput er Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphic", 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	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	3	3	3	-	-	-	-	3	3	3	-	-	-	-	3
CO2	-	3	3	3	-	-	-	-	3	3	3	-	-	-	-	3
CO3	-	3	3	3	-	-	-	-	3	3	3	-	-	-	-	3
CO4	-	3	3	3	-	-	-	-	3	3	3	-	-	-	-	3
CO5	-	3	3	3	-	-	-	-	3	3	3	-	-	-	-	3

GE4151	தமிழர் மரபு	L	T	P	C
		1	0	0	1

நோக்கங்கள்

- அனைவரும் கற்றுக்கொள்ள இந்திய மொழிக் குடும்பங்கள் திராவிட மொழிகள், சிற்றிலக்கியங்கள்.
- நவீன சிற்பங்கள் வரை மற்றும் தேர் செய்யும் கலை
- அனைவரும் தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு மற்றும் வளரி.
- அனைவரும் தமிழகத்தின் தாவரங்களும், விலங்குகளும்.
- தமிழர்களின் பங்கு கையெழுத்துப்படிகள் தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு

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 தாக்கம- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

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

TEXT-CUM REFERENCE BOOKS

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

பாடநெறி முடிவுகள்	
CO1	தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு
CO2	உருவாக்க நவீன சிற்பங்கள் வரை மற்றும் தேர் செய்யும் கலை
CO3	உருவாக்க தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு மற்றும் வளரி
CO4	உருவாக்க தமிழகத்தின் தாவரங்களும், விலங்குகளும், கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி
CO5	தமிழர்களின் பங்கு கையெழுத்துப்படிகள் தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO2	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO3	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO4	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO5	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3

GE4151	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

OBJECTIVES

- To learn tamil as a classical language, classical literature in tamil and impact of Buddhism & Jainism in tamil land.
- To develop bronze icons, tribes and their handicrafts and thiruvalluvar statue at kanyakumari
- To develop therukoothu, karagattam, villu pattu, kaniyan koothu, oyillattam
- To develop flora and fauna of tamils & aham and puram concept from tholkappiyam.
- Deploy the cultural influence of tamils over the other parts of india and self-respect movement

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, Leather puppetry, 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

UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIANCULTURE	3

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

TOTAL: 15 PERIODS

TEXT-CUM REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர் இல சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

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

Course Outcomes (CO)

CO1	Develop tamil as a classical language impact of Buddhism & Jainism in tamil land
CO2	Develop bronze icons, tribes and their handicrafts
CO3	Implement therukoothu, karagattam, villu pattu, kaniyan koothu, oyillattam
CO4	Implement flora and fauna of tamils & aham and puram concept from tholkappiyam
CO5	Develop the cultural influence of tamil over the other parts of india and self-respect movement

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO2	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO3	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO4	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO5	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3

GE4107	PYTHON PROGRAMMING LABORATORY	L	T	P	C
	Common for all branches of B.E. / B. Tech Programmes	0	0	4	2

OBJECTIVES

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

LIST OF EXPERIMENTS

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

TOTAL: 60 PERIODS

REFERENCE BOOKS

1. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford UniversityPress, 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 compounddata.
CO3	Read and write data from/to files in Python and applications of python.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	2	2	2
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	2	2	2
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	2	2	2

BS4108	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
	(Common to all branches of B.E. / B. Tech Programmes)	0	0	4	2

OBJECTIVES

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

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

LIST OF EXPERIMENTS – PHYSICS

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

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

DEMONSTRATION EXPERIMENT

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

LIST OF EXPERIMENTS – CHEMISTRY (A minimum of 6 experiments to be performed from the given list)	
1. Determination of chloride content of water sample by argentometric method.	**CO3**
2. Estimation of copper content of the given solution by Iodometry.	
3. Determination of strength of given hydrochloric acid using pH meter.	
4. Determination of strength of acids in a mixture of acids using conductivity meter.	**CO4**
5. Estimation of iron content of the given solution using potentiometer.	
6. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.	
7. Conductometric titration of strong acid vs strong base.	
8. Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.	**CO5**
9. Determination of total, temporary & permanent hardness of water by EDTA method.	
10. Determination of DO content of water sample by Winkler's method.	
DEMONSTRATION EXPERIMENTS	
1. Estimation of iron content of the water sample using spectrophotometer (1,10-Phenanthroline / thiocyanate method).	**CO3**
2. Estimation of sodium and potassium present in water using flame photometer.	**CO5**
TOTAL: 60 PERIODS	

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Able to understand the concept about the basic properties of matter like stress, strain and typesof moduli Able to understand the concept of optics like reflection, refraction, diffraction by using spectrometer grating.
CO2	Able to understand the thermal properties of solids, specific heat and some models for specific heat calculation. Able to understand the working principle of laser components and working of different lasersystem. Able to understand the phenomenon of light, applications of fibre optics.

CO3	Able to understand the concept of determining the pH value by using pH meter. Able to understand the concept about the amount of chloride present in the given sample ofwater.
CO4	Able to understand the concept of determining the emf values by using potentiometer Able to understand the concept about the measurement of conductance of strong acid andstrong base by using conductivity meter.
CO5	Able to understand the amount of dissolved oxygen present in the water. Able to understand the concept of estimation of hardness of water by EDTA method. Able to understand the concept of estimation of alkalinity in water sample.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	2	1	1	1	3	2	2	3	2	2	2	2
CO2	3	1	2	1	1	1	1	1	2	1	1	2	2	1	1	1
CO3	3	1	2	1	2	2	2	1	2	1	1	1	2	1	1	1
CO4	3	2	1	1	2	1	1	1	2	1	1	2	2	1	2	2
CO5	3	2	1	1	1	2	2	1	2	1	2	1	2	2	1	2

SEMESTER II

HS4201	PROFESSIONAL ENGLISH	L	T	P	C
(Common to all branches of B.E. / B. Tech. Programmes)		3	0	0	3

OBJECTIVES

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

UNIT I	**MAKING COMPARISONS**	**9**
Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison) Speaking – Marketing a product, Persuasive Speech Techniques. Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay - Writing definitions; Grammar – Prepositional phrases. Vocabulary – Contextual meaning of words		**CO1**
UNIT II	**EXPRESSING CASUAL RELATIONS IN SPEAKING AND WRITING**	**9**
Listening - Listening to longer technical talks and completing– gap filling exercises. Listening to technical information from podcasts – Listening to process/event descriptions to identify cause & effects - Speaking – Describing and discussing the reasons of accidents or disasters based on news reports. Reading - Reading longer technical texts– Cause and Effect Essays, and Letters/ emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds; Vocabulary – Word Formation (Noun-Verb-Adj-Adv), Purpose statements.		**CO2**
UNIT III	**PROBLEM SOLVING**	**9**
Listening – Listening to / Watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. Speaking – Group Discussion (based on case studies) - techniques and Strategies, Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences Vocabulary - Compound Words, Sentence Completion.		**CO3**
UNIT IV	**REPORTING OF EVENTS AND RESEARCH**	**9**
Listening – Listening Comprehension based on news reports – and documentaries – Precise writing, Summarising, Speaking –Interviewing, Presenting an oral report, Mini presentations on select topics; Reading – Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Subject-verb agreement, Vocabulary – Conjunctions- use of prepositions		**CO4**

UNIT V	THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY	9
Listening – Listening to technical talks, Presentations, Formal job interviews, (analysis of the interview performance); Speaking – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids; Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses Vocabulary – Easily confused words.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
3. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.

REFERENCE BOOKS

1. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
3. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
4. Developing Communication Skills by Krishna Mohan, Meera Bannerji-Macmillan India Ltd. 1990, Delhi.

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

CO1	To compare and contrast products and ideas in technical texts.
CO2	To identify cause and effects in events, industrial processes through technical texts.
CO3	To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.

CO4	To report events and the processes of technical and industrial nature.
CO5	To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	1	1	-	1	1	-	1	2	2	2	1	1	1	1
CO2	-	-	1	1	-	1	1	-	1	2	2	2	1	1	2	2
CO3	-	-	2	1	-	-	1	-	1	3	2	2	1	1	1	2
CO4	-	-	2	1	-	2	2	1	2	3	2	3	1	1	1	2
CO5	-	-	1	2	-	2	2	1	1	3	2	3	2	2	2	2

MA4202	STATISTICS AND NUMERICAL METHODS	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	4	0	0	4

OBJECTIVES

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	TESTING OF HYPOTHESIS	12
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.		CO1

UNIT II	**DESIGN OF EXPERIMENTS**	**12**
One way and two-way classifications - Completely randomized design – Randomized block design –Latin square design - 2^2 factorial design.		
UNIT III	**SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS**	**12**
Solution of algebraic and transcendental equations by Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalue of a matrix by Power method.		**CO3**
UNIT IV	**INTERPOLATION AND NUMERICAL CALCULUS**	**12**
Interpolations – Newton's forward, Newton's backward and Lagrange's - Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.		**CO4**
UNIT V	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**12**
Single step methods: Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams- Bash forth predictor corrector methods for solving first order differential equations.		**CO5**
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCE BOOKS

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A.,"Schaum's

Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

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

CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the ordinary differential equations with initial conditions by using certain techniques with engineering applications.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	-	-	-	-	-	-	1	2	2	2	2
CO2	2	3	1	1	2	-	-	-	-	-	-	1	2	2	2	2
CO3	2	2	1	1	1	-	-	-	-	-	-	1	2	1	1	1
CO4	2	2	1	0	1	-	-	-	-	-	-	1	2	1	1	1
CO5	3	2	2	1	0	-	-	-	-	-	-	1	2	2	1	1

PH4251	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C
Common for CSE, IT &ADS		3	0	0	3

OBJECTIVES

- To acquire knowledge on the electron transport properties
- To understand the essential principles of semiconductor device
- To have the necessary understanding in optical properties of materials.
- To grasp the principles of magnetic materials and its applications.
- To understand the basics of Nano-electronic devices.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9
Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, expression - Wiedemann-Franz law - Success and failures - electrons in metals - Particle in a three-dimensional box - degenerate states - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential - Energy bands in solids - Electron effective mass - concept of hole - Applications of low resistive and high resistive materials.		**CO1**

UNIT II	SEMICONDUCTOR PHYSICS	9
Intrinsic semiconductors - Energy band diagram - direct and indirect band gap semiconductors - carrier concentration in intrinsic semiconductors - extrinsic semiconductors - carrier concentration in n-type & p-type semiconductors - variation of carrier concentration with temperature - variation of Fermi level with temperature and impurity concentration - carrier transport in semiconductors - Hall effect and devices - Ohmic contacts — Schottky diode - Semiconducting polymers.		**CO2**

UNIT III	MAGNETIC PROPERTIES OF MATERIALS	9
Magnetism in materials - magnetic dipole moment - magnetic permeability and susceptibility - Microscopic classification of magnetic materials : diamagnetism - paramagnetism - ferromagnetism — antiferromagnetism - ferrimagnetism - Curie temperature - Domain Theory - M versus H behavior - Hard and soft magnetic materials - examples and uses - Magnetic principle in computer data storage - Magnetic hard disc - Spintronics - GMR Sensor (Giant Magnetoresistance) - TMR (Tunnel Magnetoresistance)		**CO3**

UNIT IV	OPTICAL PROPERTIES OF MATERIALS	9
Classification of optical materials - carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode - solar cell - LED - Organic LED - p-i-n Photodiodes - Avalanche Photodiodes -Optical data storage techniques- Holography - applications.		**CO4**
UNIT V	**NANO DEVICES**	**9**
Electron density in bulk material - Size dependence of Fermi energy - Quantum confinement - Quantum structures - Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterials - Tunneling: single electron phenomena and single electron transistor - Quantum dot laser - Ballistic transport - Carbon nanotubes: properties and applications - Material Processing by chemical vapor deposition and Laser ablation method - Graphene: properties and applications.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Jasprit Singh, ―Semiconductor Devices: Basic Principles, Wiley 2012.
2. Donald Neaman, Dhrubes Biswas , Semiconductor Physics and Devices (SIE), 4th Edition,2017
3. Salivahanan,S., Rajalakshmi,A., Karthie,S., Rajesh,N.P., ―Physics for Electronics Engineeringand 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, CRCpress, 2014.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain knowledge on classical and quantum electron theories, and energy band structures.

CO2	Acquire knowledge on basics of semiconductor physics and its applications in variousDevices.
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 forOptoelectronics.
CO5	Understand the basics of quantum structures and their applications in carbon electronics.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	1	2	1	1	1	2	1	3	2	2	3
CO2	3	3	1	1	3	1	1	1	2	2	2	1	2	2	3	3
CO3	3	3	1	1	2	2	1	1	1	1	1	2	2	2	2	3
CO4	3	3	3	2	2	1	1	1	2	2	1	3	3	3	3	3
CO5	3	3	3	2	3	1	1	1	2	1	2	3	3	3	3	3

GE4204	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
Common for all Branches of B.E. / B. Tech Programmes		3	0	0	3

OBJECTIVES

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

UNIT I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	9
Definition, scope and importance of environment – Need for public awareness – Role of Individual in Environmental protection – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Food chains, food webs and ecological pyramids – Ecological succession – Types, characteristic features, structure and function of forest, grass land, desert and aquatic (ponds, lakes, rivers, oceans, estuaries) ecosystem.Biodiversity – Definition – Genetic, species and ecosystem diversity – Value of biodiversity – Consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity atglobal, national and local levels – India as a mega diversity nation – Hot spots of biodiversity –Threats to biodiversity– Habitat loss, poaching of wild life, human-wildlife conflicts – Wildlife protection act and forest conservation act – Endangered and endemic species – Conservation of biodiversity – In-situ and ex-situ conservation of biodiversity.		**CO1**
UNIT II	**ENVIRONMENTAL POLLUTION**	**9**
Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: causes, effects and control measures of municipal solidwastes – Problems of e-waste – Role of an individual in prevention of pollution – Pollution case studies – Disaster management – Floods, earthquake, cyclone, tsunami and landslides – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.		**CO2**
UNIT III	**NATURAL RESOURCES**	**9**
Forest resources: Uses and over-exploitation – Deforestation – Case studies – Timber extraction, mining, dams and their effects on forests and tribal people – Water resources – Use and overutilization of surface and ground water, floods, drought, conflicts over water – Dams: benefits and problems – Mineral resources: Uses and exploitation – Environmental effects of extracting and using mineral resources – Case studies – Food resources: World food problems – Changes caused by agriculture and overgrazing – Effects of modern agriculture: fertilizer– pesticide problems, water logging, salinity – Case studies – Energy resources: Growing energy needs – Renewable and non-renewable energy sources – Use of alternate energy sources – Case studies – Land resources: Land as a resource – Land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles – Field study of local area to document environmental assets – River / Forest / Grassland / Hill / Mountain.		**CO3**

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

TEXT BOOKS

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

REFERENCE BOOKS

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, (2007).
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt, Ltd,Hydrabad, (2015).
3. G. Tyler Miller,Scott E. Spoolman, "Environmental Science", Cengage Learning IndiaPvt.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 AgeInternational Pvt. Ltd, New Delhi, (2004).
6. Frank R. Spellman, "Handbook of Environmental Engineering", CRC Press, (2015).

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

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

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	3	3	3	3	2	2	2	3	2	1	2	1
CO2	3	2	3	3	2	3	3	3	3	2	2	3	2	2	2	2
CO3	3	3	2	2	3	3	2	2	1	2	1	3	2	2	2	2
CO4	3	3	3	3	1	2	3	3	2	2	2	2	2	1	2	3
CO5	3	2	3	2	3	3	3	2	2	2	2	3	3	2	3	2

BE4251	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
Common for all branches of B.E. / B. Tech Programmes		3	0	0	3

OBJECTIVES

- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring nstruments

UNIT I	**ELECTRICAL CIRCUITS**	**9**
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) . Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only).		**CO1**
UNIT II	**ELECTRICAL MACHINES**	**9**
Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.		**CO2**
UNIT III	**ANALOG ELECTRONICS**	**9**
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode – Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters		**CO3**
UNIT IV	**DIGITAL ELECTRONICS**	**9**
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)		**CO4**
UNIT V	**MEASUREMENTS& INSTRUMENTATION**	**9**
Functional elements of an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers- CT and PT, DSO- Block diagram- Data acquisition.		**CO5**

TOTAL: 45 PERIODS

TEXT BOOKS

1. D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, McGraw Hill, 2016, Third Edition.
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley,.
5. A.K. Sawhney, PuneetSawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', DhanpatRai and Co, 2015.

REFERENCE BOOKS

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019
2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. MahmoodNahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

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

CO1	Compute the electric circuit parameters for simple problems
CO2	Explain the working principle and applications of electrical machines
CO3	Analyze the characteristics of analog electronic devices
CO4	Explain the basic concepts of digital electronics
CO5	Explain the operating principles of measuring instruments

MAPPING OF COs WITH POs AND PSOs																
COs	**Pos**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	3	3	2	1	3	2	2	3	2	2	2	3
CO2	3	3	3	2	2	1	3	1	1	2	2	2	2	2	2	3
CO3	3	3	3	2	2	1	2	1	1	1	2	3	2	2	2	3
CO4	3	3	3	2	1	2	2	1	1	1	1	2	2	2	2	3
CO5	3	2	1	2	1	1	2	1	1	1	1	2	2	2	2	3

CS4206	**PROGRAMMING IN C**	**L**	**T**	**P**	**C**
	(Common to CSE, IT & ADS)	3	1	0	3

OBJECTIVES

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

UNIT I	**BASICS OF C PROGRAMMING**	**9**
An overview of C: History of C; Compiler Vs. Interpreter, Structure of a C Program, Compiling a C Program; Basic data types: Modifiers, Variables: Type qualifiers, Storage class specifiers; Constants: Enumeration Constants; Keywords; Operators: Precedence and Associativity; Expressions: Order of evaluation, Type conversion in expression, Casts; Input/Output statements; Assignment statements, Selection statements; Iteration statements; Jump statements; Expression statements; Pre-processor directives: Compilation process.		**CO1**
UNIT II	**ARRAYS, STRINGS AND FUNCTIONS**	**9**
Introduction to Arrays: Declaration, Initialization, Single dimensional array, Two dimensional array, Array manipulations; String operations: length, compare, concatenate, copy; Functions: General form of a function, Function Arguments, Built-in functions, return statement, Recursion		**CO2**

UNIT III	POINTERS	9
Pointers: Declaring and defining pointers, Pointer operators, Pointer expression; Pointer assignment, Pointer conversions, Pointer arithmetic, Pointer comparisons; Pointers and Arrays: Array of pointers; Multiple indirection; Pointers to function; Problems with pointers; Parameter passing: Pass by value, Pass by reference.		CO3
UNIT IV	**STRUCTURES AND UNIONS**	**9**
Structure: Accessing structure members, structure assignments; Nested structures; Pointer and Structures; Array of structures; Passing structures to functions: Passing structure member to function, Passing entire structure to functions; Arrays in structures; Self-referential structures; Dynamic memory allocation; typedef statement, Union and Enumeration		CO4
UNIT V	**FILE PROCESSING**	**9**
File system basics: File pointer, opening and closing a File; reading and writing character; working with String: fputs() and fgets(); rewind(); ferror(); fread() and fwrite(); Erasing files; Types of file processing: Sequential access; Random access: fprintf() and fscanf(), fseek() and ftell(); Command line arguments.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

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

EFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, ―C How to Program, Seventh edition, Pearson Publication 2014.
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, DorlingKindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programmingwith 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	**POs**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	2	1	1	1	1	1	1	1	3	2	2	2
CO2	3	3	3	2	2	1	1	1	1	1	1	1	3	2	2	2
CO3	3	3	3	2	2	1	1	1	1	1	1	1	3	2	2	2
CO4	3	3	3	2	2	1	1	1	1	1	1	1	3	2	2	2
CO5	3	3	3	2	2	1	1	1	1	1	1	1	3	2	2	2

GE4251	தமிழரும் தொழில் நுட்பமும்	L	T	P	C
		1	0	0	1

நோக்கங்கள்

- அனைவரும் கற்றுக்கொள்ள சங்க காலத்தில் நெசவுத் தொழில், பாண்டங்களில் கீறல் குறியீடுகள்.
- அனைவரும் உருவாக்க சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள்
- அனைவரும் உருவாக்க இரும்பை உருக்குதல் மற்றும் வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்
- அனைவரும் உருவாக்க அணை ஏரி, குளங்கள் மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள்.
- அறிவியல் தமிழின் வளர்ச்சி மற்றும் இணையத்தில் தமிழ் அகராதிகள் வரிசைப்படுத்தப்பட்டது.

அலகு I	நெசவு மற்றும் பானைத்தொழில்நுட்பம்	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 - தொல்வியல் சான்றுகள்- சிலப்பதிகாரத்தில் மணிகளின் வகைகள்,

அலகு IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:	3

அணை ஏரி, குளங்கள். மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு- மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்:

அலகு V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

TEXT-CUM REFERENCE BOOKS

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

வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL-(in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department 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.

பாடநெறி முடிவுகள்

CO1	சங்க காலத்தில் நெசவுத் தொழில், பாண்டங்களில் கீறல்
CO2	உருவாக்க சங்க காலத்தில் வடிவமைப்பு மற்றும்
CO3	உருவாக்க இரும்பை உருக்குதல் மற்றும் வரலாற்றுச்
CO4	உருவாக்க அணை ஏரி, குளங்கள் மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள்
CO5	அறிவியல் தமிழின் வளர்ச்சி மற்றும் இணையத்தில் தமிழ் அகராதிகள் வரிசைப்படுத்தப்பட்டது

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO2	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO3	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO4	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO5	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3

GE4251	TAMILS AND TECHNOLOGY	L	T	P	C
	Common for all branches of B.E. / B. Tech Programmes	1	0	0	1

OBJECTIVES

- To learn development of weaving industry during sangam age and ceramic technology
- To develop building materials and hero stones of sangam age and temples of nayaka period
- To develop art of ship building, metallurgical studies and beads making-industries stone beads
- To develop significance of kumizhi thoompu of chola period and ancient knowledge of ocean
- Deploy the tamil computing, digitalization of tamil books and sorkuvai project

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo – Saracenic architecture at Madras

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/		
UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	3
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		
TOTAL: 15 PERIODS		

TEXT-CUM REFERENCE BOOKS

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

(Published by: International Institute of Tamil Studies.).

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

Course Outcomes (CO)

CO1	Develop weaving industry during sangam age and ceramic technology
CO2	Develop building materials and hero stones of sangam age and temples of nayaka period
CO3	Implement art of ship building, metallurgical studies and beads making-industries stone beads
CO4	Implement significance of kumizhi thoompu of chola period and ancient knowledge of ocean
CO5	Develop the tamil computing, digitalization of tamil books and sorkuvai project

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO2	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO3	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO4	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3
CO5	-	-	-	-	3	3	2	3	1	3	-	2	1	3	2	3

GE 4207	ENGINEERING PRACTICES LABORATORY	L	P	T	C
(Common to all branches of B.E. / B. Tech Programmes)		0	0	4	2

OBJECTIVES

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

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE **Buildings:** (a) Study of plumbing and carpentry components of residential and industrial buildings.Safety aspects. **Plumbing Works:** (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions,reducers, elbows in household fittings. (b) Study of pipe connections requirements for pumps and turbines. (c) Preparation of plumbing line sketches for water supply and sewage works. (d) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipeconnections with different joining components. (e) Demonstration of plumbing requirements of high-rise buildings. **Carpentry using Power Tools only:** a) Study of the joints in roofs, doors, windows and furniture. b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.	**CO1**
II MECHANICAL ENGINEERING PRACTICE **Welding:** a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding. b) Gas welding practice **Basic Machining:** a) Simple Turning and Taper turning b) Drilling Practice **Sheet Metal Work:** a) Forming & Bending. b) Model making – Trays and funnels. c) Different type of joints. **Machine assembly practice:** a) Study of centrifugal pump b) Study of air conditioner **Demonstration on:**	**CO2**

a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt. b) Foundry operations like mould preparation for gear and step cone pulley. c) Fitting – Exercises – Preparation of square fitting and V – fitting models.	
GROUP B (ELECTRICAL & ELECTRONICS)	
III ELECTRICAL ENGINEERING PRACTICE 1. Residential house wiring using switches, fuse, indicator, lamp and energy meter. 2. Fluorescent lamp wiring. 3. Stair case wiring 4. Measurement of electrical quantities – voltage, current, power & power factor in RLCcircuit.	**CO3**
5. Measurement of energy using single phase energy meter. 6. Measurement of resistance to earth of an electrical equipment.	**CO4**
IV ELECTRONICSENGINEERING PRACTICE 1. Study of electronic components and equipment's — Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR. 2. Study of logic gates AND, OR, EX-OR and NOT. 3. Generation of Clock Signal. 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB. Measurement of ripple factor of HWR and FWR.	**CO5**
TOTAL: 60 PERIODS	

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity Required
	CIVIL	
1.	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 sets
2.	Carpentry vice (fitted to work bench)	15 Nos
3.	Standard woodworking tools 15 Sets.	15 Sets.
4.	Models of industrial trusses, door joints, furniture joints	5 each

5.	**Power Tools:** (a) Rotary Hammer (b) Demolition Hammer (c) Circular Saw (d) Planer (e) Hand Drilling Machine (f) Jigsaw	2 Nos
	MECHANICAL	
1.	Arc welding transformer with cables and holders.	5 Nos
2.	Welding booth with exhaust facility.	5 Nos
3.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets
4.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5.	Centre lathe.	2 Nos
6.	Hearth furnace, anvil and smithy tools.	2 Sets
7.	Moulding table, foundry tools.	2 Sets
8.	Power Tool: Angle Grinder.	2 Nos
9.	**Study-purpose items:** centrifugal pump, air-conditioner.	1 each
	ELECTRICAL	
1.	Assorted electrical components for house wiring.	15 Sets
2.	Electrical measuring instruments.	10 Sets
3.	**Study purpose items:** Iron box, fan and regulator, emergency lamp.	1 each
4.	Megger (250V/500V).	1 No.
5.	**Power Tools:** (a) Range Finder (b) Digital Live-wire detector	2 Nos
	ELECTRONICS	
1.	Soldering guns 10 Nos.	10 Nos.
2.	Assorted electronic components for making circuits 50 Nos.	50 Nos.
3.	Small PCBs.	10 Nos.
4.	Multimeters	10 Nos.
5.	**Study purpose items:** Telephone, FM radio, low-voltage power supply	1 each

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Fabricate carpentry components and pipe connections including plumbing works. Use weldingequipment‘s to join the structures.
CO2	Carry out the basic machining operations Make the models using sheet metal works
CO3	Carry out basic home electrical works and appliances.
CO4	Measure the electrical quantities
CO5	Elaborate on the components, gates, soldering practices

MAPPING OF COs WITH POs AND PSOs

COs	**Pos**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	3	-	-	3	-	-	-	-	-	3	2	2	1	2
CO2	3	2	3	-	-	3	-	-	-	-	-	3	2	2	1	2
CO3	3	1	2	-	-	2	-	-	-	-	-	3	2	2	1	2
CO4	3	2	3	3	1	3	1	1	1	1	2	3	2	2	1	2
CO5	3	2	3	3	1	2	1	1	1	1	2	3	2	2	1	2

CS4208	**PROGRAMMING IN C LABORATORY**	**L**	**T**	**P**	**C**
	Common to CSE, IT & ADS	0	0	4	2

OBJECTIVES

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

LIST OF EXPERIMENTS

1. C programming using simple statements and expressions.	**CO1**
2. Scientific problem-solving using decision making and looping.	
3. Generating different patterns using multiple control statements.	
4. Problems solving using one dimensional array.	
5. Mathematical problem solving using two dimensional arrays.	
6. Solving problems using string functions.	
7. Solving problems with user defined functions.	

8. Solving problems using recursive function.	**CO2**
9. Solving problems with dynamic memory allocation.	
10. Realtime application using structures and unions.	
11. Realtime problem solving using sequential and random-access file.	**CO3**
12. Solving problems with command line argument.	
TOTAL: 60 PERIODS	

REFERENCE BOOKS

1. Problem Solving and Program Design in C, 4th edition, by Jeri R. Hanly and Elli B.Koffman. Reema Thareja, ―Programming in C‖, Oxford University Press, Second Edition, 2016.
2. Programming in C by Pradip Dey, Manas Ghosh 2nd edition Oxford University Press.E.Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill, 2018.
3. Brain W.Kernighan & Dennis Ritchie, C Programming Language, 2nd edition, PHI, 1988.

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	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	1	1	1	1	1	1	1	2	2	1	1
CO2	3	3	3	2	2	1	1	1	1	1	1	1	2	2	1	1
CO3	3	3	3	2	2	1	1	1	1	1	1	1	2	2	1	1

SEMESTER III

MA4351	DISCRETE MATHEMATICS	L	T	P	C
(Common to all Branches of B.E / B. Tech Programmes)		3	1	0	4

OBJECTIVES

- To extend student ‘s logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

UNIT I	LOGIC AND PROOFS	9 + 3
Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.		CO1
UNIT II	**COMBINATORICS**	**9 + 3**
Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications		CO2
UNIT III	**GRAPHS**	**9 + 3**
Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.		CO3
UNIT IV	**ALGEBRAIC STRUCTURES**	**9 + 3**
Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism‘s – Normal subgroup and cosets – Lagrange‘s theorem – Definitions and examples of Rings and Fields.		CO4
UNIT V	**LATTICES AND BOOLEAN ALGEBRA**	**9 + 3**
Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.		CO5
TOTAL: 60 PERIODS		

TEXT BOOKS

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

REFERENCE BOOKS

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

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

CO1	Construct and validate an argument using rules of inference.
CO2	Apply the combinatorial techniques in Algorithms and Data structure for analysis and design.
CO3	Apply the concepts of graph theory in data structures, data mining, image segmentation and in clustering.
CO4	Apply the concepts of algebraic systems for coding algorithms
CO5	Understand the theoretical computer science using lattices and Boolean

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	2	3	-	-	3	2	3	3	3	3	3	2
CO2	3	3	3	2	2	1	-	-	-	-	1	2	2	3	2	3
CO3	3	3	3	2	2	1	-	-	-	-	1	2	2	3	2	3
CO4	3	3	3	2	2	1	-	-	-	-	1	2	2	1	1	2
CO5	3	3	3	2	1	1	-	-	-	-	1	2	2	1	1	2

CS4351	DIGITAL LOGIC AND COMPUTER ORGANIZATION	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

UNIT – I	COMBINATIONAL LOGIC	9
Combinational Circuits - Karnaugh Map - Analysis and Design Procedures - Binary Adder - Subtractor - Decimal Adder - Magnitude Comparator - Decoder - Encoder - Multiplexers – Demultiplexers		CO1
UNIT – II	**SEQUENTIAL LOGIC**	**9**
Introduction to Latches- Difference: combinational Circuits and Sequential Circuits- Sequential Circuits - Flip-Flops - operation and excitation tables, Triggering of FF ,Analysis and design of clocked sequential circuits - Registers - Counters.		CO2
UNIT - III	**COMPUTER FUNDAMENTALS**	**9**
Functional Units of a Digital Computer: Von Neumann Architecture - Operation and Operands of Computer Hardware Instruction - Instruction Set Architecture (ISA): Memory Location, Address and Operation — Instruction and Instruction Sequencing - Addressing Modes, Encoding of Machine Instruction - Interaction between Assembly and High-Level Language.		CO3
UNIT - IV	**PROCESSOR**	**9**
Instruction Execution Building a Data Path - Designing a Control Unit - Hardwired Control, Microprogrammed Control - Pipelining — Data Hazard - Control Hazards.		CO4
UNIT - V	**MEMORY AND I/O**	**9**
Memory Concepts and Hierarchy - Memory Management — Cache Memories: Mapping and Replacement Techniques — Virtual Memory — DMA — I/O — Accessing I/O: Parallel and Serial Interface - Interrupt I/O - Interconnection Standards: USB, SATA.		CO5
		Total: 45 Periods

TEXT BOOKS

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

REFERENCE

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, "Computer Organization and Architecture - Designing for Performance" Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, "Digital Logic and Computer Design" Pearson Education, 2016.

Course Outcomes (CO)

CO1	Design various combinational digital circuits using logic gates
CO2	Design sequential circuits and analyze the design procedures
CO3	State the fundamentals of computer systems and analyze the execution of an instruction
CO4	Analyze different types of control design and identify hazards
CO5	Identify the characteristics of various memory systems and I/O communication

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3	2
CO5	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2

CS4301	DATA STRUCTURES AND ALGORITHMS- I	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the ADTs and its implementation.
- To apply sorting and searching techniques
- To learn and understand the design techniques in algorithm.
- To understand the efficiency of the algorithmic techniques.

UNIT – I	**INTRODUCTION TO DATA STRUCTURES**	**9**
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists- doubly-linked lists – circularly linked lists- applications of lists –Polynomial Manipulation		**CO1**
UNIT – II	**STACKS AND QUEUES**	**9**
Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.		**CO2**
UNIT - III	**SORTING AND SEARCHING TECHNIQUES**	**9**
Sorting: Comparison based sorting – Bubble Sort, Insertion Sort, Selection Sort, quick sort, heap sort, merge sort, Shell sort and Radix sort - Searching – Linear Search - Binary Search.		**CO3**
UNIT - IV	**INTRODUCTION TO ALGORITHMS**	**9**
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency – Asymptotic notations and their significance - complexity analysis of algorithms, worst case and average case - Empirical analysis – Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.		**CO4**
UNIT - V	**ALGORITHM DESIGN TECHNIQUES**	**9**
Multithreaded algorithms: Multithreaded Matrix Multiplication- Multithreaded Merge Sort- Matrix Operation: Solving Systems of Linear equations- Inverting Matrices – Least- Squares Approximation- String Matching: The naïve String- matching algorithm- The Rabin- Karp algorithm- The Knuth- Morris -Pratt algorithm		**CO5**
		Total: 45 Periods

TEXT BOOKS

1. Mark Allen Weiss, "Data structures and Algorithm Analysis in C",Addison Wesley, Second Edition,2007.
2. Anany Levitin,"Introduction to the Design and Analysis of Algorithms",Pearson Education,Third Edition,2012.

REFERENCE

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein "Introduction to Algorithms", MIL Press, Fourth Edition, 2012.
2. Reema Thareja, "Data Structures Using C", Oxford University Press, 2014.

Course Outcomes (CO)

CO1	To explore ADTs and its implementation.
CO2	To learn searching and sorting algorithms.
CO3	To explore about the efficiency of the algorithmic solution.
CO4	To learn about the fundamentals of algorithmic techniques.
CO5	To solve the recurrence relation.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	1	1	3	2	2	2	1	-	1	2	1
CO2	2	1	1	1	1	2	3	2	2	1	2	1	1	-	-	2
CO3	1	2	2	2	2	3	1	-	-	1	1	3	1	2	1	2
CO4	3	1	-	2	-	-	1	3	1	3	1	1	1	2	1	-
CO5	2	1	1	1	2	-	3	-	1	1	3	1	-	1	2	1

CS4352	JAVA PROGRAMMING	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- To Understand basics structure of Java Programming language.
- To know about basic Object-Oriented Programming language concept
- To define exception and use of I/O streams
- To develop a java application with multi-threads and generic classes
- To design and build a java application using JAVAFX

UNIT – I	**INTRODUCTION TO JAVA**	**9**
History of Java-Environmental Setup-features of java-data types-variables- modifiers-keywords-operators-Iterative, Conditional and control statement- command line arguments-string- string buffer- simple java program- enumerators-array-formatting output		**CO1**
UNIT – II	**OBJECT, CLASS INTERFACES AND PACKAGES**	**9**
Object-class-constructor-benefits of OOPS-concepts of OOPS-inheritance-polymorphism-abstract class- generic class- Overriding-Overloading-Interface: Implementation of interface-extending interface-inner class- static and dynamic binding- package: Package as Access Protection-CLASSPATH setting- Import packages.		**CO2**
UNIT - III	**EXCEPTION AND FILE I/O STREAMS**	**9**
Exceptions-benefits of exception-Types of Exceptions-Errors-Control flow- JVM reaction to Exception-usage of try, catch, throw, final and finally keyword-rethrowing exceptions, exception specification, built in exceptions-File I/O: Standard Streams-Reading and writing Streams-Byte Array Stream-Data Stream- File Stream- Input and output Stream.		**CO3**
UNIT - IV	**THREADS AND GENERIC CLASSES**	**9**
Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Critical Factor in Thread –Deadlock-Generic: Introduction to Generics-Built-in Generics collections-writing simple generic class.		**CO4**
UNIT - V	**JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS FOR GUI PROGRAM**	**9**
JAVAFX Events and Controls: Event Basics- Handling Key and Mouse Events, Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox - TextBox - ScrollPane. Layouts- Flowpane-HBox and VBox- BorderPane- StackPane- GridPane. Menus-Basics-Menu- Menu bars- Menu Item.		**CO5**
	Total Periods:	**45**

TEXT BOOKS

1. Herbert Schildt, "Java Complete Reference", McGraw-Hill, 12th Edition, 2021.

REFERENCE

1. Paul Deitel and Harvey Dietel, "Java How to Program", Pearson, 11th Edition, 2017

Course Outcomes (CO)

CO1	Develop a simple java program using all basic data types
CO2	Develop a java program with simple OOPS concepts

CO3	Build a basic java program using Exception and I/O Streams
CO4	Build a java program using multi-threading and with generic class
CO5	Develop a java application using basic event handling and swing component concept

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	1	2	-	-	-	1	2	3	2	1	2	2	2
CO2	2	1	1	3	2	-	-	-	-	1	-	2	3	2	-	-
CO3	3	1	-	3	1	-	-	-	-	-	-	1	2	2	-	-
CO4	3	2	3	3	3	-	-	-	-	-	-	1	3	3	1	1
CO5	3	1	3	3	3	-	-	-	-	-	-	1	2	2	1	1

AD4351	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

UNIT I	INTRODUCTION	9
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data.		CO1
UNIT II	**DESCRIBING DATA**	**9**
Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores.		CO2
UNIT III	**DESCRIBING RELATIONSHIPS**	**9**

Correlation –Scatter plots –correlation coefficient for quantitative data-computational formula for correlation coefficient – Regression – regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations – regression towards the mean.		**CO3**
UNIT IV	**PYTHON LIBRARIES FOR DATA WRANGLING**	**9**
Basics of Numpy arrays –aggregations –computations on arrays – comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.		**CO4**
UNIT V	**DATA VISUALIZATION**	**9**
Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.		**CO5**

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. Rober S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications,2017.(Unit II&III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.(Unit IV&V)

REFERENCE BOOKS

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Define the data science process
CO2	Understand different types of data description for data science process
CO3	Gain knowledge on relationships between data
CO4	Use the Python Libraries for Data Wrangling
CO5	Apply visualization Libraries in Python to interpret and explore data

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	-	-	-	-	-	-	-	3	3	3	3
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	3	3	3
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3	3
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3	3

CS4306	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To design, analyse, and implementation of basic data structures.
- To understand the basic concepts in the specification and analysis of the program.
- To adopt the principles of good program design.

LIST OF EXPERIMENTS

1. Write a program to implement all the functions of a List ADT.	CO1
2. Write a program that implement stack (its operations) using i) Arrays ii) Linked list (Pointers).	
3. Write a program that implement Queue (its operations) using i) Arrays ii) Linked list (Pointers).	
4. Write a program that uses functions to perform the following operations on singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	
5. Write a program that uses functions to perform the following operations on doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	CO2
6. Write a program that uses functions to perform the following operations on circular linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	CO3
7. Implementation of sorting techniques.	
8. Implementation of searching techniques.	
9. Implementation of Rabin- Karp algorithm.	
10. Implementation of Knuth- Morris -Pratt algorithm	

TOTAL: 60 Periods

REFERENCE BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein,"Introduction to Algorithms",MIT Press, Fourth Edition, 2012.
2. Mark Allen Weiss,"Data structures and Algorithm Analysis in C", Addison Wesley, Second Edition,2007.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Able to implement the ADTs and basics of data structures
CO2	Ability to perform searching and sorting techniques
CO3	Ability to solve approximation and randomization problems

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	-	-	2	3	2	3	-	2	3	1	3	3	2	2
CO2	3	2	2	1	2	3	-	2	2	3	-	1	1	-	3	1
CO3	2	3	3	-	-	-	1	2	3	3	-	-	1	2	2	2

CS4357	JAVA PROGRAMMING LABORATORY	L	T	P	C
	(Common to IT & ADS)	0	0	4	2

OBJECTIVES

- To be familiar with basic java program using basic datatypes.
- To learn to write program using inheritance and interface.
- To learn to write a java program using exception and file handling.
- To be familiar with event handling.
- To be exposed to creating application using JAVAFX.

LIST OF EXPERIMENTS

1. Write a java program to find the Fibonacci series using recursive and non-recursive functions.	CO1
2. Write a java program for Method overloading and Constructor overloading.	
3. Write a java program to display the employee details using Scanner class.	
4. Write a java program that checks whether a given string is	

palindrome or not.	
5. Write a java program to represent Abstract class with example.	
6. Write a java program to implement Interface using extends keyword.	
7. Write a java program to create user defined package.	
8. Write a java program to create inner classes.	
9. Write a Java Program to generate employee Pay Slip using Inheritance Concept	CO2
10. Write a java program for creating multiple catch blocks.	
11. Write a java program for producer and consumer problem using Threads.	
12. Write a Java program that implements a multi-thread application that has three threads.	
13. Write a java program for handling Mouse events and Key events	
14. Write a java program that works as a simple calculator. Use a Grid Layout to arrange Buttons for digits and for the + - * % operations. Add a text field to display the result	
15. Program to demonstrate file operations	
16. Program to demonstrate features of generic class	
TOTAL: 60 Periods	

REFERENCE BOOKS

1. Paul Deitel and Harvey Dietel, "Java How to Program", Pearson, 11th Edition, 2017.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Implement java program using basic syntax and using basic Object-oriented Programming language concepts like abstract class, inheritance, interface and packages.
CO2	Develop and implement java program with array list, exception handling, multithreading and design applications using file processing generic program and event handling.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	2	2	2	1	-	1	3	3	3	2	2
CO2	3	3	2	2	3	2	2	2	1	-	1	3	3	3	2	2

AD4358	DATA SCIENCE LABORATORY	L	T	P	C
	(Common to IT)	0	0	4	2

OBJECTIVES

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

LIST OF EXPERIMENTS

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

TOTAL: 60 Periods

REFERENCE BOOKS

1. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Make use of the python libraries for data science and perform descriptive analytics on the benchmark datasets
CO2	Perform correlation and regression analytics on standard data sets and present and interpret data using visualization technologies

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	1	-	-	-	-	1	-	1	1	2	3	3
CO2	3	2	1	-	3	-	-	-	-	3	3	3	2	3	3	3

HS4310	PROFESSIONAL SKILLS LAB	L	T	P	C
(Common to all branches of B.E. / B. Tech Programmes)		0	0	2	1

OBJECTIVES

- Enhance the employability and career skills of students
- Orient the students towards grooming as a professional
- Make them employable graduates
- To acquaint themselves with the major generic divisions in English literature
- Develop their confidence and help them attend interviews successfully

LIST OF EXPERIMENTS

UNIT I	
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 with the presentation; projecting a positive image while speaking; emphasis on effective body language –	**CO1**

general awareness of current affairs	
UNIT II	
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 with the presentation; projecting a positive image while speaking; emphasis on effective body language	**CO2**
UNIT III	
Introduction to group discussion – participating in group discussions – understanding group dynamics – brain storming the topic – questioning and clarifying – GD strategies – structure and dynamics of a GD; techniques of effective presentation in group discussion; preparing for group discussion; accepting others' views /ideas; arguing against others' views or ideas etc	**CO3**
UNIT IV	
Basics of public speaking; preparing for a speech; features of a good speech; speaking with a microphone. (Famous speeches maybe played as model speeches for learning the art of public speaking). Interview etiquette – dress code – body language – attending interviews – telephone/skype interview – one-to-one & a panel interview job interviews purpose and process; how to prepare for an interview; language and style to be used in an interview types of interview questions and how to answer them	**CO4**
UNIT V	
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 change	**CO5**
TOTAL: 30 PERIODS	

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

- ❖ One Server
- ❖ 30 Desktop Computers
- ❖ One Hand Mike
- ❖ One LCD Projector

TEXT 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 Sangeetha Sharma. Professional Communication. Oxford University Press: Oxford 2014
4. S. Hariharan et al. Soft Skills. MJP Publishers: Chennai, 2010
5. Interact English Lab Manual for Undergraduate Students, Orient BlackSwan: Hyderabad, 2016.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop adequate Soft Skills required for the workplace
CO2	Make effective presentations
CO3	Participate confidently in Group discussions
CO4	Attend job interviews and be successful in them
CO5	Hone their communications skills for their career

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	-	2	1	-	-	-	2	3	-	-	1	2	2	1
CO2	-	2	-	2	-	-	-	-	2	3	-	-	1	1	2	1
CO3	-	-	-	-	-	-	-	-	2	2	-	-	1	1	2	1
CO4	-	-	-	-	-	-	-	-	2	2	-	2	2	1	1	1
CO5	-	2	1	1	2	-	2	-	2	3	-	2	2	1	1	1

SEMESTER IV

MA4401	PROBABILITY AND STATISTICS	L	T	P	C
(Common for all branches of B.E. / B. Tech Programmes)		3	1	0	4

OBJECTIVES

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two-dimensional random variables.
- To provide necessary basic concepts of probability and random processes for applications in engineering.
- To introduce the basic concepts and important roles in the statistical quality control.

UNIT I	PROBABILITY AND RANDOM VARIABLES	9 + 3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.		CO1
UNIT II	**TWO - DIMENSIONAL RANDOM VARIABLES**	**9 + 3**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.		CO2
UNIT III	**RANDOM PROCESSES**	**9 + 3**
Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only) – Limiting distributions.		CO3
UNIT IV	**NON-PARAMETRIC TESTS**	**9 + 3**
Introduction – The Sign test – The Signed – Rank test – Rank – sum tests – The U test – The H test – Tests based on Runs – Test of randomness – The Kolmogorov Test.		CO4
UNIT V	**STATISTICAL QUALITY CONTROL**	**9 + 3**
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.		CO5
		TOTAL: 60 PERIODS

TEXT BOOKS

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund ‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3. Ibe, O.C., “Fundamentals of Applied Probability and Random Processes", Elsevier,1st Indian Reprint, 2007.

REFERENCE BOOKS

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014.
2. Hsu, "Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
3. Papoulis,A. and Unnikrishnapillai,S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
4. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
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, 2004.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon
CO2	Understand the basic concepts of one and two-dimensional random variables and apply in engineering applications.
CO3	Apply the concept of random processes in engineering disciplines.
CO4	Apply the basic concepts of statistical quality control.
CO5	Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

MAPPING OF COs WITH POs AND PSOs																
COs	**Pos**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	-	-	-	-	-	2	3	-	1	2	2	3	2
CO2	3	2	2	-	-	-	-	-	1	2	-	1	2	3	2	2
CO3	3	3	3	-	-	-	-	-	2	2	-	1	2	3	2	1
CO4	3	2	2	-	-	-	-	-	2	1	-	2	2	1	1	2
CO5	3	3	2	-	-	-	-	-	2	2	-	2	2	1	1	2

CS4451	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
(Common to IT & ADS)		**3**	**0**	**0**	**3**

OBJECTIVES

- To learn the fundamentals of data models and to represent a database using entity relationship diagrams.
- To study Structured Query Language and write database queries.
- To learn the basic concepts of Transactions, concurrency control techniques, and recovery procedures.
- To understand internal storage structures using different file and indexing techniques which will help in physical DB Design.

UNIT – I	**RELATIONAL DATABASES**	**9**
Introduction to databases - Purpose of Database System - Database system Applications - Views of data - Data Models - File system, Hierarchical and Network - Database system Architecture -Relational Model- keys - Relational Algebra.		**CO1**
UNIT – II	**INTRODUCTION TO SQL**	**9**
Introduction to Structured Query Language-DDL Commands-DML Commands-TCL Commands -views-Index-Synonyms- Sub queries- SQL Functions-Joins-PL/SQL–simple programs-Cursors-Procedures and Functions-Exception Handling.		**CO2**
UNIT – III	**DATABASE DESIGN**	**9**
Entity Relationship Model-ER Diagrams-ER to Relational Model-Functional Dependencies-First, Second and Third Normal Forms-Dependency preservation-Boyce Codd Normal Form-Multivalued		**CO3**

attributes and Fourth Normal Form-Join dependencies and Fifth Normal Form		
UNIT – IV	**TRANSACTIONS AND INTERNAL STORAGE TECHNIQUES**	**9**
Transaction concepts-ACID Properties, Transaction states- Serializability -Concurrency control –Locking protocols -Two-phase Locking - Timestamp –Deadlock-Transaction Recovery- Recovery based on deferred and immediate update File Organization-RAID-Indexing and Hashing-static and Dynamic Hashing		**CO4**
UNIT – V	**ADVANCED DATABASE CONCEPTS**	**9**
Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization- NOSQL Databases: Introduction – CAP Theorem – Document-Based systems – Key value Stores – Column-Based Systems –XML Databases -XML Hierarchical Model - XML Schema, XQuery.		**CO5**
	Total Periods:	**45**

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017.

Reference Books:

1. C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, Pearson Education, Eighth Edition, 2009.
2. Elmsari, Navathe, "Fundamentals of Database Systems" ,5th Edition, Pearson Education (2008).
3. Raghu Ramakrishnan, Johannes Gehrke ,"Database Management Systems", McGraw Hill Publication 3rd Edition 2014.
4. S.K.Singh, "Database Systems, Concepts, Design and Applications", Pearson Education 2nd Edition 2011,10

Course Outcomes (CO)

CO1	Construct SQL Queries using relational algebra
CO2	Design a database using ER model and normalize the database
CO3	Construct queries to handle transaction processing and maintain

	consistency of the database
CO4	Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database
CO5	Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	-	1	-	-	-	-	-	2	3	3	3	3
CO2	2	2	3	1	-	-	-	-	-	-	-	2	3	3	3	3
CO3	2	2	3	2	1	1	-	-	-	-	-	2	3	3	3	3
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	3	3	3
CO5	3	3	3	2	2	1	-	-	-	-	-	2	3	3	3	3

CS4452	OPERATING SYSTEMS	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- The course gives an introduction to operating systems. The central focus is on how an operating system, in an efficient or fair way, provides an abstracted interface to the hardware resources for programs.
- The course consists of theoretical aspects of operating systems and practical experience in using Linux system, C programming and shell scripting

UNIT – I	OPERATING SYSTEMS OVERVIEW	9
Operating system overview: Objectives – functions - Computer System Organization-Operating System Structure - Operating System Operations-System Calls, System Programs.		CO1
UNIT – II	**PROCESS MANAGEMENT**	**9**
Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication. Process Synchronization: The		CO2

Critical-Section Problem - Semaphores - Classic Problems of Synchronization – Monitors. Case Study: Windows 10 operating system		
UNIT - III	**SCHEDULING AND DEADLOCK MANAGEMENT**	**9**
CPU Scheduling: Scheduling Criteria - Scheduling Algorithms. Deadlocks: Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock. Case Study: MAC operating system		**CO3**
UNIT - IV	**MEMORY MANAGEMENT**	**9**
Main Memory: Swapping - Contiguous Memory Allocation, Segmentation, Paging. Virtual Memory: Demand Paging - Page Replacement - Allocation of Frames - Thrashing. Case Study: Android operating system		**CO4**
UNIT - V	**STORAGE STRUCTURE**	**9**
Mass Storage Structure: Disk Structure - Disk Scheduling - Disk Management. File-System Interface: File Concepts, Directory Structure - File Sharing – Protection. File System. Case Study: Linux operating system		**CO5**
	Total Periods:	**45**

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2. Richard Petersen, "Linux: The Complete Reference", 6th Edition, Tata McGraw-Hill, 2008.

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Prentice Hall, Wesley, 2014.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.
3. Harvey M. Deitel, "Operating Systems", 7th Edition, Prentice Hall, 2003.
4. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", 2nd Edition, Tata McGraw-Hill Education, 2007.
5. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.

Course Outcomes (CO)

CO1	Explain the operating system program, structures and operations with

	system calls
CO2	Apply the process management concept for real time problems.
CO3	Illustrate CPU scheduling algorithms and to handle the deadlock for the given situation.
CO4	Explain the concepts of various memory management techniques.
CO5	Summarize the storage concepts of disk and file.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	1	3	2	2	2	-	1	2	1	-	1	2	2	3	3	1
CO3	1	3	2	2	1	-	-	-	1	-	-	-	2	3	3	3
CO4	1	2	2	2	1	-	-	2	-	-	-	1	2	2	2	2
CO5	1	2	2	1	-	1	-	-	-	-	-	1	-	2	2	2

CS4401	DATA STRUCTURES AND ALGORITHMS-II	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand and apply the non-linear data structures.
- To critically analyze the efficiency of trees and hashing.
- To understand different algorithm design techniques.
- To solve problems using dynamic programming and greedy techniques.
- To understand the concepts behind NP completeness, Approximation algorithms.

UNIT – I	INTRODUCTION TO TREES	9
Tree ADT- Tree Traversals - Binary Tree ADT- Expression Trees - Applications of trees - Binary Search Tree ADT- Threaded binary tree - Multiway Search Tree- B Tree - B+ Tree- Heap - Min Heap and Max Heap - Applications of Heap.		CO1
UNIT – II	**SELF BALANCING TREES AND HASHING**	**9**
Self-Balancing Tree: AVL Tree - AVL operations - Red Black Tree: Insertion and Deletion- Splay Tree Operations-Hashing - Hash		CO2

Functions - Separate Chaining - Open Addressing - Rehashing - Extendible hashing.		
UNIT - III	**GRAPH ALGORITHMS**	**9**
Representation of Graphs and applications- Types of Graphs- Graph connectivity and graph Traversal: Breadth First Search- Depth First Search- Directed acyclic graph & Topological Sort- Bi-Connectivity- Euler Circuits- Single Source Shortest Path: The Bellman- Ford Algorithm- Dijkstra's Algorithm.		**CO3**
UNIT - IV	**DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE**	**9**
Dynamic programming — Principle of optimality — Coin changing problem, Computing a Binomial Coefficient — Floyd's algorithm - Greedy Technique — Container loading problem — Prim's algorithm and Kruskal's Algorithm.		**CO4**
UNIT - V	**NP COMPLETENESS AND APPROXIMATION ALGORITHMS**	**9**
Polynomial time- NP-completeness and Reducibility- NP- Complete Problems- Sequencing problems- Partitioning problem- Graph Coloring- Approximation Algorithms: The Vertex- Cover problem- the Travelling-salesman problem-the set-covering problem- the subset- sum problem- the Knapsack problem.		**CO5**
	Total Periods:	**45**

TEXT BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein,"Introduction to Algorithms",MIT Press, Fourth Edition, 2012.
2. Mark Allen Weiss,"Data structures and Algorithm Analysis in C", Addison Wesley, Second Edition,2007.

REFERENCE BOOKS

1. Anany Levitin, "Introduction of the Design and Analysis of Algorithms", Pearson Education,3rd Edition, 2012.
2. Reema Thareja, "Data Structures Using C", Oxford University Press, 2014.

Course Outcomes (CO)

CO1	To understand and learn about algorithm design techniques.
CO2	To explore about the efficiency of the algorithmic solution
CO3	To know about different algorithm design techniques.
CO4	To learn about the state space tree.
CO5	To explore about the concepts behind NP completeness, Approximation algorithms.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	3	1	1	2	1	1	-	2	-	1	1	-	-
CO2	1	3	-	1	2	1	-	2	-	1	2	1	-	-	1	3
CO3	1	-	-	3	-	-	1	1	1	1	1	-	1	1	1	2
CO4	-	3	2	-	1	1	1	1	2	1	2	3	1	1	-	1
CO5	-	1	2	1	1	-	3	-	1	2	1	1	1	2	-	2

CS4402	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

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

UNIT – I	BASIC STRUCTURE OF A COMPUTER SYSTEM	9
Eight ideas-Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making-Data types, Complements, Data Representation-Error Detection codes.		CO1
UNIT – II	**DATA REPRESENTATION AND COMPUTER ARITHMETIC**	**9**
Signed number representation fixed and floating-point operations, Integer addition and subtraction, ripple carry adder, carry look-ahead adder, multiplication, Booth multiplication, Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.		CO2
UNIT – III	**PARALLEL AND MULTI-CORE PROCESSING**	**9**
Parallel Processing challenges – Flynn 's classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale		CO3

Computers and other Message-Passing Multiprocessors.		
UNIT - IV	**MULTIPROCESSORS AND THREAD LEVEL PARALLELISM**	**9**
Symmetric and distributed shared memory architectures – Performance issues –Synchronization – Models of memory consistency – Introduction to Multithreading.		**CO4**
UNIT - V	**MEMORY AND I/O**	**9**
Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time –Main memory and performance – Memory technology. Types of storage devices –Buses – RAID – Reliability, availability and dependability – I/O performance measures –Designing an I/O system.		**CO5**
	Total Periods:	**45**

Text Books:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
2. John Hennessy, David Patterson, Computer ArchitectureA Q uantitative Approach, 6th Edition, November 23, 2017.

Reference Books:

1. William Stallings, ―Computer Organization and Architecture – Designing for Performance‖, Tenth Edition, Pearson Education, 2016.
2. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.
3. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
4. Jim Ledin, ―Modern Computer architecture and Organization‖, Packt Publishing,2020.

Course Outcomes (CO)

CO1	Understand the basics structure of computers, operations and instructions.
CO2	Design arithmetic and logic unit.
CO3	Model a pipeline for consistent execution of instructions with minimum hazards
CO4	Understand parallel processing architectures.
CO5	Analyze the memory access operations and memory architecture

MAPPING OF COs WITH POs AND PSOs																
Cos	**POS**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2	2
CO2	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2	2
CO3	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2	2
CO4	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2	2
CO5	3	3	3	3	2	-	-	-	-	2	-	2	3	3	2	2

CS4453	**ARTIFICIAL INTELLIGENCE AND BASICS OF MACHINE LEARNING**	**L**	**T**	**P**	**C**
	(Common to IT)	**3**	**0**	**0**	**3**

OBJECTIVES

- To provide a strong foundation on fundamental concepts in Artificial Intelligence.
- To enable Problem-solving through various searching techniques.
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- To apply Artificial Intelligence techniques primarily for machine learning.

UNIT – I	**INTRODUCTION TO AI AND SEARCHING**	**9**
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies: A* algorithm – Game Playing: Alpha Beta Pruning – constraint satisfaction problems (CSP)		**CO1**
UNIT – II	**KNOWLEDGE REPRESENTATION**	**9**
Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – forward chaining – backward chaining – resolution		**CO2**
UNIT – III	**SUPERVISED LEARNING**	**9**
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier		**CO3**
UNIT – IV	**ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**	**9**

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization		**CO4**
UNIT - V	**INTELLIGENCE AND APPLICATIONS**	**9**
Natural language processing-Morphological Analysis-Syntax analysis - Semantic Analysis-Ail applications – Language Models - Information Retrieval – Information Extraction – Machine Translation – Machine Learning - Symbol-Based – Machine Learning: Connectionist – Machine Learning.		**CO5**
	Total Periods:	**45**

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCE BOOKS:

1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson Education,2007.
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
4. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition,1997.

COURSE OUTCOMES (CO)

CO1	Ability to use appropriate search algorithms for problem solving
CO2	Provide a basic exposition to the goals and methods of Artificial Intelligence.
CO3	Ability to build supervised learning models
CO4	Ability to build ensemble and unsupervised models
CO5	Improve problem solving skills using the acquired knowledge in the areas of natural language processing with machine learning.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	1	3	-	1	-	-	-	1	3	3	3	3
CO2	2	3	3	2	2	3	-	1	-	-	-	1	3	3	3	3
CO3	2	3	3	2	3	3	-	1	-	-	-	1	3	3	3	3
CO4	2	3	3	2	3	3	-	1	-	-	-	1	3	3	3	3
CO5	2	2	3	2	1	3	-	1	-	-	-	1	3	3	3	3

CS4457	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
	(Common to IT & ADS)	0	0	4	2

OBJECTIVES

- To understand the Data Definition and Data Manipulation commands.
- To Design and execute sub-Queries, Nested Queries and Joins
- Implement simple PL/SQL Programs, cursors and Exceptions.
- Design ER Model for a given Database and implement Normalization for the Application
- To develop mini project using all the above concepts.

LIST OF EXPERIMENTS

1.	DDL, DML and TCL Commands for Insertion, Updation and Deletion operations in Tables	CO1
2.	Database Querying-Simple Queries, Sub queries, Nested Queries and Joins	
3.	Views, Indexes and Synonyms	CO2
4.	Study of PL/SQL-Simple Programs	
5.	Database Programming with Cursors-Implicit and Explicit Cursors	
6.	Procedures and Functions	
7.	Triggers	CO3
8.	Exception Handling	
9.	Database Design using ER Modelling, Normalization and implementation for an application	

10. Mini Project in Database connectivity using VB as Front-End Tool.	

TOTAL: 60 Periods

REFERENCE BOOKS

1. C. J. Date, A. Kannan, S. Swaminathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Use Typical Data Definition and Manipulation Commands and Design Applications to test Nested and Join Queries.
CO2	Implement Applications that require PL/SQL Constructs, cursors and Exceptions.
CO3	Design a Database and develop a client server Application using a Front-End Tool.

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	2	1	-	-	2	1	2	3	2	2	2	2
CO2	1	1	1	1	3	1	-	-	2	1	2	3	2	2	2	2
CO3	1	1	1	1	3	1	-	-	2	1	2	3	2	2	2	2

CS4458	OPERATING SYSTEMS LABORATORY	L	T	P	C
	(Common to IT & ADS)	0	0	4	2

OBJECTIVES

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and Disk Scheduling

LIST OF EXPERIMENTS

1. Basics Of Unix Commands	CO1
2. Shell Programming.	
3. System Calls Implementation: STAT, OPENDIR, READDIR	
4. Simulate Unix Commands Like CP, LS, GREP	

5. Implement Shared Memory and IPC	
6. Implementation of Semaphores	
7. Implementation of CPU Scheduling Algorithm	
8. Implementation of Bankers Algorithm for Deadlock Avoidance	
9. Implementation of Deadlock Detection Algorithm	
10. Implement Memory Allocation Methods for Fixed Partition	CO2
11. Implement Paging Technique of Memory Management	
12. Implementation of Page Replacement Algorithm	
13. Implementation of Various File Organization Technique	
14. Implementation of Disk Scheduling Algorithm	
Total: 30 Periods	

REFERENCE BOOKS

1. Richard Petersen, "Linux: The Complete Reference", 6th Edition, Tata McGraw-Hill, 2008.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Know and simulate UNIX commands for various operations, design and implement shell programs, algorithms for CPU scheduling, file allocation and deadlock detection and avoidance
CO2	Able to design and implement programs for inter process communication, shared memory, memory allocation, paging techniques, threading and process synchronization

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	1	-	-	-	1	2	3	3	3	3	3	3
CO2	3	2	3	2	2	-	-	-	2	3	3	3	3	3	3	3

CS4459	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY	L	T	P	C
	(Common to IT)	0	0	4	2

OBJECTIVES

- To learn to implement uninformed and informed search techniques.
- To build a knowledge base in Prolog and process queries to perform inference.
- To build supervised learning models.
- To explore the regression models.
- To learn to compare and evaluate the performance of different models

LIST OF EXPERIMENTS

1. Implementation of Uninformed search algorithms (BFS, DFS)	CO1
2. Implementation of Informed search algorithms (A* algorithm)	
3. Implement propositional model checking algorithms	CO2
4. Implement forward chaining and backward chaining strategies	
5. Implement naïve Bayes models	CO3
6. Implement Bayesian Networks	
7. Build Regression models	CO4
8. Implement ensembling techniques	
9. Implement clustering algorithms	
10. Implement EM for Bayesian networks	CO5
11. Evaluate the performance of Linear regression and logistic regression.	

TOTAL: 60 Periods

REFERENCE BOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Third Edition, Tata McGraw-Hill, 2010.
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Implement uninformed and informed search techniques
CO2	Build a knowledge base in Prolog and process queries to perform inference
CO3	Develop supervised learning models

CO4	Develop regression models
CO5	Compare and evaluate the performance of different models

MAPPING OF COs WITH POs AND PSOs

COS	POS												PSOS			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	3	3	-	1	-	-	-	1	3	3	3	3
CO2	2	3	3	2	3	3	-	1	-	-	-	1	3	3	3	3
CO3	2	3	3	2	3	3	-	1	-	-	-	1	3	3	3	3
CO4	2	3	3	2	3	3	-	1	-	-	-	1	3	3	3	3
CO5	2	3	3	2	3	3	-	1	-	-	-	1	3	3	3	3

SEMESTER V

CS4551	SOFTWARE ENGINEERING AND DESIGN	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

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

UNIT – I	SOFTWARE PROCESS AND AGILE DEVELOPMENT	9
Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.		CO1
UNIT – II	**REQUIREMENTS ANALYSIS AND SPECIFICATION**	**9**
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets-Data Dictionary.		CO2
UNIT - III	**SOFTWARE DESIGN**	**9**
Design process – Design Concepts- Effective Modular Design – Design Heuristic – Architectural Design – Data Design - Architectural styles,		CO3

Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.		
UNIT - IV	**TESTING AND MAINTENANCE**	**9**
Software testing fundamentals- Internal and external views of Testing-white box testing: basis path testing,control structure testing- black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging – Software Implementation Techniques: Coding practices -Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.		**CO4**
UNIT – V	**PROJECT MANAGEMENT**	**9**
Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning- Risk Management: Identification, Projection, Risk Management, Risk Identification, RMMM Plan.		**CO5**
	Total Periods:	**45**

Text Books:

1. Roger S. Pressman, "Software Engineering – A Practitioner‟s Approach", Eighth Edition, Mc Graw-Hill International Edition, 2019.
2. Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education Asia, 2021.

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. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

Course Outcomes (CO)

CO1	Understand the phases in a software project life cycle
CO2	Understand fundamental concepts of requirements engineering and analyzing the requirement
CO3	Understand the various software design methodologies
CO4	Learn various software testing methodologies
CO5	Learn the project management and estimation phase

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	2	2	1	1	1	1	2	3	3	2	3
CO2	3	3	3	3	2	2	2	1	1	1	1	2	3	3	2	3
CO3	3	3	3	3	2	2	2	1	1	1	1	2	3	3	2	3
CO4	3	3	3	3	2	2	2	1	1	1	1	2	3	3	2	3
CO5	3	3	3	3	2	2	2	1	1	1	1	2	3	3	2	3

CS4552	THEORETICAL COMPUTATION AND COMPILER DESIGN	L	T	P	C
	(Common to IT)	3	0	0	4

OBJECTIVES

- To understand the basics of Finite Automata and Regular Expression.
- To learn the Context Free Grammar and Pushdown Automata.
- To learn the Turing Machine and Introduction to Compilers
- To learn the Parsing Technique.
- To learn the intermediate Code Generation and Code Optimization Techniques

UNIT – I	AUTOMATA AND REGULAR EXPRESSIONS	12
Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions - Equivalence and Minimization of Automata – Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages.		CO1
UNIT – II	**CONTEXT FREE GRAMMAR AND LANGUAGES**	**12**
CFG – Parse Trees – Ambiguity in Grammars and Languages – Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL- Pushdown Automata – Languages of Pushdown Automata – Deterministic Pushdown Automata.		CO2
UNIT - III	**TURING MACHINE AND INTRODUCTION TO COMPILERS**	**12**
Turing Machines – Structure of a Compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – LEX.		CO3

UNIT - IV	**PARSING**	**12**
Role of Parser – Top-Down Parsing - Predictive Parser-LL (1) – Problems with Top-Down Parser, Bottom-Up Parsing - Shift Reduce Parser- SLR – CLR- LALR. Error Handling and Recovery in Syntax Analyzer-YACC.		**CO4**
UNIT - V	**INTERMEDIATE CODE GENERATION AND CODE OPTIMIZATION**	**12**
Syntax Directed Definitions, Intermediate Languages - Types and Declarations, Issues in Code Generation. Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks.		**CO5**
	Total Periods:	**60**

Text Books:

1. J.E.Hopcroft, R.Motwani and J.D Ullman, ―Introduction to Automata Theory, Languages and Computations‖, Third Edition, Pearson Education, 2008.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education, 2013.

Reference Books:

1. J.Martin, ―Introduction to Languages and the Theory of Computation, Third Edition, TMH, 2003.
2. Micheal Sipser, ―Introduction of the Theory and Computation, Thomson Brokecole, 1997.
3. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
4. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.

Course Outcomes (CO)

CO1	To understand the basics of Finite Automata and Regular Expression.
CO2	To learn the Context Free Grammar and Pushdown Automata.
CO3	To learn the Turing Machine and Introduction to Compilers
CO4	To learn the Parsing Technique.
CO5	To learn the + intermediate Code Generation and Code Optimization Techniques

MAPPING OF COs WITH POs AND PSOs																
COs	**Pos**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	1	1	1	1	1	1	1	3	3	1	1	1
CO2	3	3	3	2	1	1	1	1	1	1	1	3	3	1	1	1
CO3	3	3	3	2	1	1	1	1	1	1	1	3	3	1	1	1
CO4	3	3	3	2	1	1	1	1	1	1	1	3	3	1	1	1
CO5	3	3	3	2	1	1	1	1	1	1	1	3	3	1	1	1

CS4553	**COMPUTER NETWORKS AND SECURITY BASICS**	**L**	**T**	**P**	**C**
Common to IT & ADS		**3**	**0**	**0**	**3**

OBJECTIVES

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

UNIT – I	**INTRODUCTION AND PHYSICAL LAYER**	**9**
Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.		**CO1**
UNIT – II	**DATA-LINK LAYER & MEDIA ACCESS**	**9**
Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.		**CO2**
UNIT – III	**ROUTING**	**9**
Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Unicast routing algorithms, Multicast –addresses – multicast routing (DVMRP, PIM)		**CO3**
UNIT – IV	**TRANSPORT LAYER**	**9**
Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements		**CO4**

UNIT – V	INTERNET SECURITY AND SYSTEM SECURITY	9
Electronic Mail security – PGP, S/MIME – IP security – Cloud Security- Wireless Network Security – System Security: Intruders – Malicious software – Firewalls.		CO5
	Total Periods:	45

Text Books:

1. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022
2. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.

Reference Books:

1. Douglas Comer , Computer Networks And Internets, 6Th Edition , PEARSON INDIA, Jan. 2018.
2. Mark Newman , Networks: An Introduction, Second Edition Sept. 2018
3. Larry L. Peterson and Bruce S. Davie, Computer Networks A Systems Approach, Sixth Edition , 2021.

Course Outcomes (CO)

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 Connection less and Connection oriented protocols.
CO5	Design the working of various application layer protocols and network Security practices and System level security issues

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	2
CO2	3	3	3	3	2	1	-	-	-	-	-	2	3	3	2	3
CO3	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	3
CO4	3	3	3	3	2	1	-	-	-	-	-	2	3	3	2	3
CO5	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	3

CS4502	SOFT COMPUTING AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the basic concepts of Soft Computing.
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.
- To study the fuzzy logic components.
- To gain knowledge in machine learning through Support vector machines.

UNIT – I	INTRODUCTION TO SOFT COMPUTING	9
Introduction - Artificial Intelligence-Soft Computing – Characteristics of Soft Computing - Hard Computing -Fuzzy Systems-Genetic Algorithm and Evolutionary Programming- Swarm Intelligent Systems- Classification of ANNs- McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.		**CO1**
UNIT – II	**ARTIFICIAL NEURAL NETWORKS**	**9**
Back propagation Neural Networks - Types of Artificial Neural Network: Supervised Vs Unupervised Network- Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.		**CO2**
UNIT - III	**FUZZY SYSTEMS**	**9**
Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Fuzzification and Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning.		**CO3**
UNIT - IV	**GENETIC ALGORITHMS**	**9**
Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.		**CO4**
UNIT – V	**APPLICATIONS**	**9**
Bio Inspired and evolutionary algorithms – Swarm Intelligence - Particle Swarm Optimization – Ant Colony Optimization – Hidden Markov Modeling (HMM) - Support Vector Machine (SVM).		**CO5**
	Total Periods:	**45**

Text Books:

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press,2015.
2. Timothy J. Ross, Willey,"Fuzzy Logic with Engineering Applications", John Wiley & Sons, 4th Edition, 2016.

Reference Books:

1. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India(3rd Edition),2019.
2. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education,2022.
3. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.

Course Outcomes (CO)

CO1	Learn about soft computing techniques and their applications
CO2	Analyse various neural network architectures
CO3	Understand perceptrons and counter propagation networks
CO4	Define the fuzzy systems
CO5	Analyse the genetic algorithms and their applications

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	2	2	1	-	-	-	1	3	3	3	3
CO2	3	3	3	3	3	2	2	1	-	-	-	1	3	3	3	3
CO3	3	3	3	3	3	2	2	1	-	-	-	1	3	3	3	3
CO4	3	3	3	3	3	2	2	1	-	-	-	1	3	3	3	3
CO5	3	3	3	3	3	2	2	1	-	-	-	1	3	3	3	3

CS4554	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
	Common to IT & ADS	3	0	0	3

OBJECTIVES

- To know the fundamental concepts of image processing.
- To know the image enhancement in spatial and frequency domain
- To learn about image segmentation techniques
- To know about image compression techniques and their standards

UNIT – I	**DIGITAL IMAGE FUNDAMENTALS**	**9**
Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels- Some Basic Morphological Algorithms- Color Models.		**CO1**
UNIT – II	**IMAGE ENHANCEMENT IN SPATIAL DOMAIN**	**9**
Spatial Domain: Basic Intensity Transformation- Histogram processing- Histogram Equalization, Histogram Matching, Local Histogram processing – Fundamentals of Spatial Filtering– Smoothing and Sharpening Spatial Filtering		**CO2**
UNIT - III	**IMAGE ENHANCEMENT IN FREQUENCY DOMAIN**	**9**
Frequency Domain: Introduction to Fourier Transform- Discrete Fourier Transform (DFT), properties of DFT – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth, and Gaussian filters, Selective Filtering		**CO3**
UNIT - IV	**IMAGE SEGMENTATION**	**9**
Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Thresholding Region-based segmentation- Region growing, split and merge technique, Segmentation using Morphological Watersheds- Dam Construction, Watershed Segmentation Algorithm.		**CO4**
UNIT - V	**IMAGE COMPRESSION**	**9**
Introduction, coding Redundancy, Spatial and Temporal redundancy, image compression model, Basic Compression Methods- Huffman Coding, Arithmetic Coding, LZW coding, Run length coding, Bit-Plane Coding, Lossless Predictive Coding, Lossy Predictive Coding, Compression Standards.		**CO5**
	Total Periods:	**45**

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.

Reference Books:

1. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
2. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

Course Outcomes (CO)

CO1	Learn digital image fundamentals and simple image processing techniques

CO2	Understand the transformations and image enhancement in the spatial domain
CO3	Be familiar with image enhancement in the frequency domain
CO4	Learn image segmentation techniques and algorithms.
CO5	Understand the image compression techniques.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	-	1	1	-	-	-	-	2	3	3	3	3
CO2	2	2	3	1	-	-	1	-	-	-	-	2	3	3	3	3
CO3	2	2	3	2	1	1	1	-	-	-	-	2	3	3	3	3
CO4	3	3	3	3	1	1	1	-	-	-	-	2	3	3	3	3
CO5	3	3	3	2	2	1	1	-	-	-	-	2	3	3	3	3

CS4508	SOFTWARE DESIGN METHODOLOGIES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- Ability to translate end-user requirements into system and software requirements
- Ability to develop software requirement specification
- Ability to generate the various design of the system from the software requirements

LIST OF EXPERIMENTS

1. Development of problem statement and Preparation of Software Requirement Specification	CO1
2. Study and usage of Design phase CASE tool	
3. Create various Design by using any Design phase CASE tools.	
4. Create Use case diagram	CO2
5. Create Activity diagram	
6. Create Class diagram	
7. Create Sequence diagram	
8. Create State chart diagram	CO3
9. Create Component diagram	
10. Create Deployment diagram	

TOTAL: 60 Periods

REFERENCE BOOKS

1. Roger S. Pressman, "Software Engineering – A Practitioner"s Approach", Eighth Edition, Mc Graw-Hill International Edition, 2019.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Ability to translate end-user requirements into system and software requirement specification
CO2	Ability to develop basic design of the system from the software requirements
CO3	Ability to generate the component and deployment-based design of the system

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	1	1	2	1	2	3	1	2	3	3	2	3
CO2	3	3	3	1	1	1	2	1	2	3	1	2	3	3	2	3
CO3	3	3	3	1	1	1	2	1	2	3	1	2	3	3	2	3

CS4559	DIGITAL IMAGE PROCESSING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To understand image acquisition and analyse different image transforms on images
- Perform enhancing operations on the image using spatial filters and frequency domain filters.
- Perform segmentation operations in the images.
- Estimate the efficiency of the compression technique on the images.

LIST OF EXPERIMENTS

1. To acquire and Display of an Image, Negative of an Image (Binary & Gray Scale)	CO1
2. Implementation of Relationships between Pixels	
3. Analysis of images with different color models.	
4. Implementation of Transformations of an Image	
5. Histogram Processing and Basic Thresholding functions	CO2
6. Computation of Mean, Standard Deviation, Correlation coefficient of	

the given Image	
7. Implementation of Image Enhancement-Spatial filtering	
8. Implementation of Image Enhancement- Filtering in frequency domain	
9. Image segmentation – Edge detection, line detection and point detection.	CO3
10. Implementation of Region based Segmentation	
11. Basic Morphological operations.	
12. Implementation of Image compression techniques	

TOTAL: 60 Periods

REFERENCE BOOKS

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	To understand image acquisition and analyze different image transforms on images
CO2	To understand image enhancement techniques
CO3	To understand segmentation and compression techniques

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	1	-	-	2	2	2	-	2	3	3	2	2
CO2	3	3	3	1	1	-	-	2	2	2	-	2	3	3	2	2
CO3	2	3	3	1	1	-	-	2	2	2	-	2	3	3	2	2

SEMESTER VI

IT4651	BIG DATA ANALYTICS	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

UNIT – I	**INTRODUCTION TO BIG DATA**	**9**
Defining Big Data – 5V's of Big Data – Traditional Vs Big Data Systems -Big Data Applications - Risks of Big Data – Structure of Big Data - Big Data Use Cases -Understanding Big Data Storage-Evolution of Big Data-Big Data Technologies- Data Analytics Lifecycle-Data analytics lifecycle overview- Discovery- Data Preparation.		**CO1**
UNIT – II	**DATA ANALYSIS**	**9**
Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters. - Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes – Bayes Theorem - Naïve Bayes Classifier.		CO2
UNIT - III	**BIG DATA FILE SYSTEM**	**9**
Google File System (GFS) -Distributed File Systems - Large-Scale File System Organization – Hadoop Ecosystem – Hadoop Distributed File System (HDFS) concepts – HDFS Architecture- HDFS Commands- Hadoop MapReduce -Map reduce Programming Model- Hadoop YARN- Case Studies-Word count program.		**CO3**
UNIT - IV	**MINING DATA STREAMS**	**9**
Streams Concepts – Stream Data Model and Architecture Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform (RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.		**CO4**
UNIT – V	**BIGDATA MODELS**	**9**
Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – Pig Data Model – Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries		**CO5**
	Total Periods:	**45**

Text Books:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 2012.
2. David Loshin and Morgan Kaufmann, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph",El sevier Publishers, 2013.

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition, 2007.

2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses”, Wiley, 2013.
3. P. J. Sadalage and M. Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Addison-Wesley Professional, 2012.
4. Richard Cotton, “Learning R – A Step-by-step Function Guide to Data Analysis”, O_Reilly Media, 2013.

Course Outcomes (CO)

CO1	Work with big data tools and its analysis techniques
CO2	Acquire knowledge on the concepts of wind energy conversion system, siting and grid related issues.
CO3	Ability to understand the solar PV and solar thermal systems
CO4	Ability to analyses other types of renewable energy resources like biomass, geothermal and Hydro energy.
CO5	Ability to Acquire knowledge on tidal energy, hydrogen energy, ocean thermal energy and fuel cell.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	2	3	1	2	2	1	1	2	3	3	2	2
CO2	2	2	2	1	2	2	2	2	2	1	1	2	3	3	2	2
CO3	1	3	3	2	1	3	1	1	2	1	1	2	3	3	2	2
CO4	1	2	2	1	2	2	2	2	2	1	1	3	3	3	2	2
CO5	1	1	3	1	3	2	1	2	2	1	1	2	3	3	2	2

CS4601	INTERNET PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the structure of the Internet and the Web.
- To study and apply the Hyper Text Mark-up Language (HTML) and to explore the Document Object Model (DOM).
- To understand CSS & JAVASCRIPT
- To study Server-Side Scripting – PHP, Servlets and JSP
- To understand Database Handling, Content Management System and ReactJS

UNIT – I	**WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0**	**9**
Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web –Web Clients – Web Servers – Http Request–HTML5: Tables – Lists – Image – HTML5 control elements – Semantic elements – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.		**CO1**
UNIT – II	**CLIENT-SIDE PROGRAMMING**	**9**
Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects, - Regular Expressions- Exception Handling-Validation- Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – SQL.		**CO2**
UNIT - III	**SERVER-SIDE PROGRAMMING**	**9**
Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- Database Connectivity: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.		**CO3**
UNIT - IV	**PHP and XML**	**9**
PHP: Introduction-Variables- Program control- Built-in functions- Form Validation- File handling – Cookies - Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).		**CO4**
UNIT - V	**INTRODUCTION TO AJAX, WEB SERVICES and REACT JS**	**9**
AJAX: Difference between synchronous and asynchronous web programming, AJAX, and JQuery Ajax Client Server Architecture-Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application – React JS: Introduction- Components-react properties- setting properties-component lifecycle.		**CO5**
	Total Periods:	**45**
Text Books:		
1. Deitel and Deitel and Nieto, “Internet and World Wide Web - How to		

Program", Prentice Hall, 5th Edition, 2011.

2. Anthony Accomazzo, Ari Lerner, Clay Allsopp, David Guttman, Tyler McGinnis Nate Murray, "FullStack React", The complete guide to ReactJS and Friends, newline publication (formerly Fullstack.io).

Reference Books:

1. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
3. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
4. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

Course Outcomes (CO)

CO1	Construct a basic website using HTML and Cascading Style Sheets.
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
CO3	Develop server-side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and to represent data in XML format.
CO5	Use AJAX and web services to develop interactive web applications and know basic properties and features of React JS.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	-	-	-	-	1	2	2	3	3	2	2
CO2	3	3	3	2	2	-	-	-	-	1	2	2	3	3	2	2
CO3	3	3	3	2	2	-	-	-	-	1	2	2	3	3	2	2
CO4	3	3	3	2	2	-	-	-	-	1	2	2	3	3	2	2
CO5	3	3	3	2	2	-	-	-	-	1	2	2	3	3	2	2

IT4608	BIG DATA ANALYTICS LABORATORY	L	T	P	C
	(Common to IT & ADS)	0	0	4	2

OBJECTIVES

- The course serves as a comprehensive introduction to various topics in machine learning.
- Students should be able to design and implement machine learning solutions
- to classification, regression, and clustering problems
- Students should able to evaluate and interpret the results of the algorithms

LIST OF EXPERIMENTS

1. Install, configure and run Hadoop and HDFS	CO1
2. Implement word count programs using MapReduce	
3. Implement an MR program that processes a weather dataset	CO2
4. Implement Linear and logistic Regression	
5. Implement Decision tree classification techniques	
6. Implement clustering techniques	
7. Visualize data using any plotting framework	CO3
8. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop	

TOTAL: 60 Periods

REFERENCE BOOKS

1. Data Science and Big Data Analytics: Discovering, Analysing, Visualizing, and Presenting Data, John Wiley & Sons, EMC Education Services, 1st Edition, 2015.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Process big data using Hadoop framework
CO2	Build and apply linear and logistic regression models
CO3	Perform data analysis with machine learning methods and graphical data analysis

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	1	-	-	2	2	2	-	2	3	3	2	2

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

CS4608	**INTERNET PROGRAMMING LABORATORY**	**L**	**T**	**P**	**C**
		0	0	4	2

OBJECTIVES

- To be familiar with Web page design using HTML/XML and style sheets
- To be exposed to creation of user interfaces using Java frames and applets.
- To learn to create dynamic web pages using server-side scripting.
- To learn to write Client Server applications.
- To be familiar with the PHP programming.

LIST OF EXPERIMENTS

1. Develop static pages (using only HTML) of an online Book store. The website should consist the following pages. Home page, Registration and user Login, User profile page, Order confirmation	CO1
2. Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages.	
3. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.	CO2
4. Write programs in Java using Servlets: i. To invoke servlets from HTML forms ii. Session tracking using hidden form fields and Session tracking for a hit count	CO3
5. Write programs in Java to create three-tier applications using servlets for conducting online examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.	
6. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.	
7. Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.	

8. i. Validate the form using PHP regular expression. ii. PHP stores a form data into database.	CO4
9. Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.	CO1
10. Write an XML file to display the Book information with Title, Author Name, ISBN, Publisher, Edition and Price. i. Write a Document Type Definition (DTD) to validate the above XML file. ii. Write XML schema and XSL for the XML file.	
11. Write a web service for finding what people think by asking 500 people's opinion for any consumer product.	CO5
TOTAL: 60 Periods	

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Construct Web pages using HTML/XML and style sheets.
CO2	Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.
CO3	Develop dynamic web pages using server-side scripting.
CO4	Use PHP programming to develop web applications.
CO5	Constructing web applications using web services.

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	-	-	-	-	-	-	-	-	1	2	1	-	-	-
CO2	1	-	-	-	2	-	-	-	-	-	-	2	2	1	1	-
CO3	-	1	-	-	2	-	-	-	-	1	-	2	-	1	-	1
CO4	-	2	-	-	-	-	-	-	2	-	1	-	-	1	-	-
CO5	2	-	2	-	-	-	-	2	2	-	-	2	-	-	2	-

SEMESTER VII

MB4751	PRINCIPLES OF MANAGEMENT	L	P	T	C
		3	0	0	3

OBJECTIVES

- To enable the students to study the evolution of Management.
- To study the functions and principles of management.
- To learn the application of the principles in an organization.
- To acquire the skills of effective leadership and communication.
- To gain the knowledge of tools and techniques for an effective managerial skill.

UNIT I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9
Definition of Management – Science or Art – Manager Vs Entrepreneur – Types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company – Public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management.		CO1
UNIT II	**PLANNING**	**9**
Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.		CO2
UNIT III	**ORGANISING**	**9**
Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – Delegation of authority – Centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.		CO3
UNIT IV	**DIRECTING**	**9**
Foundations of individual and group behaviour – Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – Types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.		CO4
UNIT V	**CONTROLLING**	**9**
System and process of controlling – Budgetary and non–budgetary control techniques – Use of computers and IT in Management control –		CO5

Productivity problems and management – Control and performance – Direct and preventive control – Reporting.	

TOTAL: 45 PERIODS

TEXT BOOKS

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India), Pvt. Ltd., 15th Edition, 2020.

REFERENCE BOOKS

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 10th Edition, 2015.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 11th Edition, Pearson Education, 2017.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 6th Edition 2017.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Ability to understand the various terms and definitions related to management and organization.
CO2	Ability to acquire the skill of planning and various strategies of management in an organization.
CO3	Ability to understand the types of organization and also get an insight into HR planning, recruitment, selection and career planning and management.
CO4	Ability to acquire the skills of leadership and understand the importance of communication to run an organization effectively.
CO5	Ability to understand the concept of budget and budgetary control and acquire the skill of controlling technique.

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	3	1	2	3	1	1	2	3	1	1	1
CO2	1	2	3	2	2	3	2	2	3	2	1	2	3	1	1	1
CO3	1	2	3	1	2	3	2	2	3	3	1	2	3	1	1	1
CO4	1	2	2	1	2	3	1	2	3	3	1	2	3	1	1	1
CO5	1	2	3	2	3	3	1	2	3	1	1	2	3	1	1	1

CS4701	CYBER SECURITY AND ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the basics and the need for cyber security.
- Explore threats on the internet and its applications.
- Gain knowledge on Hacking and its concepts.
- Understand the concept of ethics in hacking and cyber security and the needs of intellectual property rights involved in cyber security.

UNIT – I	CYBER SECURITY: INTRODUCTION	9
Introduction-Cyber Security and its problem, Intervention Strategies: Redundancy, Diversity and Autarchy, Regulation and Jurisdiction for global Cyber security, CopyRight source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Loss.		CO1
UNIT – II	**INTERNET LAWS, CYBER CRIMES AND CYBER LAWS**	**9**
Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.		CO2
UNIT - III	**SYSTEM HACKING**	**9**
System Hacking: System hacking, Types of System hacking, hacking tools, Computer Hole, Hacking Process, Various methods of password cracking, Remote Password Guessing, Role of eavesdropping, Keystroke Loggers, Detection, Prevention and Removal, Sniffers:		CO3

Introduction, Sniffer, Types of Sniffers, Active and Passive Sniffing, ARP Spoofing, ARP Poisoning, DNS Spoofing Techniques, MAC Flooding, Sniffing Countermeasures.		
UNIT - IV	**ETHICAL HACKING**	**9**
Introduction: Hacking, Types of Hacking/Hackers, Cybercrime, Types of cybercrime, Benefits of Ethical Hacking, Limitations of Ethical Hacking, Foot Printing & Reconnaissance: Introduction to foot printing, Use of footprinting, Types of footprinting, Understanding the information gathering process, Information on a company website, Tools used.		**CO4**
UNIT - V	**INTELLECTUAL PROPERTY RIGHTS**	**9**
Copyright-Source of risks, Pirates, Internet Infringement, Fair Use, postings, Criminal Liability, First Amendments, Losing Data, Trademarks, Defamation, Privacy-Common Law Privacy, Constitutional law, Federal Statutes, Anonymity, Technology expanding privacy rights, Ethics, Legal Developments, Late 1990 to 2000, Cyber security in Society, Security in cyber laws, case studies.		**CO5**
	Total Periods:	**45**

TEXT BOOKS:

1. Cyber Security and Cyber Laws by Nilakshi Jain and Ramesh Menon, 2020 Edition, Wiley Publication.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th Edition, Pearson Education, 2015.

REFERENCE BOOKS:

1. Introduction to the Constitution of India, Durga Das Basu Prentice – Hall, 2008.
2. Engineering Ethics M. Govindarajan, S., Natarajan, V. S, Senthil kumar, Prentice –Hall, 2004
   Cyber Security and Cyber Laws, Alfred Basta, Cengage Learning India, 2018.
3. Graham, J. Howard, R., Olson, R., Cyber Security Essentials, CRC Press, 2011.

Course Outcomes (CO)

CO1	Interpret the influence and challenges posed by cyber architectures
CO2	Leading to better and enhanced security practices.
CO3	Compare and understand the various cyber threats and the need for security.

CO4	Illustrate ethical hacking and cyber security technologies for real world applications.
CO5	Understanding the ethical rights and legal development.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3	2
CO5	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2

CS4702	VIRTUALIZATION AND CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

UNIT – I	INTRODUCTION TO VIRTUALIZATION	9
Basics of Virtualization - Create a new virtual machine - Virtualize a physical machine, Starting and Stopping a virtual machine - Virtual Machine Security - Types of Virtualizations - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU - Memory - I/O Devices Virtualization Support and Disaster Recovery.		CO1
UNIT – II	**CLOUD COMPUTING OVERVIEW**	**9**
Introduction to Cloud Computing – Origins of Cloud computing – Evolution of Cloud Computing -Cloud components - Cloud Characteristics – Advantages of Cloud computing- Elasticity in Cloud – On-demand Provisioning - Underlying Principles of Parallel and Distributed Computing.		CO2
UNIT - III	**CLOUD ARCHITECTURE LAYERS, MODELS AND STORAGE**	**9**

Layers in cloud architecture Design, NIST Cloud Computing Reference Architecture, Software as a Service (SaaS), Features of SaaS and benefits, Platform as a Service (PaaS), Features of PaaS and benefits, Infrastructure as a Service (IaaS), Features of IaaS and benefits. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage.		**CO3**
UNIT - IV	**CLOUD TECHNOLOGY**	**9**
Introduction to Hadoop - Hadoop Architecture - HDFS - MapReduce Concepts - Virtual Box - Google App Engine - Programming Environment for Google App Engine - Cloud Storage Providers - S3 - Open Stack - Federation in the Cloud – Four Levels of Federation - Federated Services and Applications - Future of Federation.		**CO4**
UNIT - V	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD**	**9**
Inter Cloud Resource Management - Resource Provisioning and Resource Provisioning Methods -Global Exchange of Cloud Resources - Security Overview - Cloud Security Challenges - Software-as-a-Service Security- Security Governance - IAM -Security Standards.		**CO5**
	Total Periods:	**45**

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing‖, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

Course Outcomes (CO)

CO1	Learn the key and enabling technologies that help in the development of cloud.
CO2	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO3	Develop the ability to understand and use the architecture of compute and storage cloud service and delivery models
CO4	Be able to install the cloud technologies, Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.
CO5	Understand the core issues of cloud computing such as resource management and security.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	1	2	2	2	1	1	2	2	1	2	1	2	2
CO2	1	1	1	1	1	1	1	-	1	1	-	1	1	1	1	1
CO3	2	1	2	1	2	2	2	1	2	2	1	1	1	1	1	1
CO4	2	2	2	1	3	2	2	2	3	1	1	1	2	2	2	2
CO5	2	1	1	1	-	1	2	2	1	2	1	1	1	2	2	2

CS4707	CYBER SECURITY AND ETHICAL HACKING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To learn different cipher techniques, Key exchange mechanisms etc.
- To understand the implementation and working of network monitoring tools.
- To understand the functionalities of hacking and sniffing a network communication.
- To use network security tools and vulnerability assessment tools.

LIST OF EXPERIMENTS

1.	Implementation of Diffie Hellman key Exchange Algorithm.	CO1
2.	Implement the following Attack: a) Dictionary Attack b) Brute Force Attack	
3.	Installation of Wire shark, tcp dump, etc and observe data transferred in client Server communication using UDP/TCP and identify the UDP/TCP datagram.	CO2
4.	Installation of rootkits and study about the variety of options.	
5.	Perform an Experiment to Sniff Traffic using ARP Poisoning.	CO3

6.	Demonstrate intrusion detection system using any tool (snort or any other s/w).	
7.	Demonstrate how to provide secure data storage, secure data transmission using Digital Signatures.	CO4
8.	Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool	
9.	Implement the Signature Scheme - Digital Signature Standard.	CO5
10.	Defeating Malware • Building Trojans • Rootkit Hunter	

TOTAL: 60 Periods

REFERENCE BOOKS

1. Build Your Own Security Lab, Michael Gregg, Wiley India, 2008

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Develop code for Encryption Techniques to solve the problems.
CO2	Work with network monitoring applications to understand data transmission and threats.
CO3	Construct code for decryption/hacking algorithms.
CO4	Develop a signature scheme using Digital signature standard for enforcing security to data.
CO5	Demonstrate the network security system using open-source tools.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	1	-	-	2	2	2	-	2	1	1	2	2
CO2	3	1	1	1	1	-	-	2	2	2	-	2	3	1	2	1
CO3	2	2	1	1	1	-	-	2	2	2	-	2	1	3	2	1
CO4	3	1	2	1	1	-	-	1	1	1	-	1	2	1	2	1
CO5	2	2	1	1	1	-	-	2	2	2	-	2	1	3	2	1

CS4708	VIRTUALIZATION AND CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud-based application
- To learn to implement and use parallel programming using Hadoop.

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.	CO1
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs	
3. Find a procedure to transfer the files from one virtual machine to another virtual machine.	
4. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)	
5. Install Google App Engine. Create hello world app and other simple web applications using python/java.	
6. Use GAE launcher to launch the web applications.	
7. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.	CO3
8. Find the procedure to AWS Account creation.	CO4
9. Find the procedure to crate Amazon S3 bucket creation and its operations.	
10. Install Hadoop single node cluster and run simple applications like wordcount	

TOTAL: 60 Periods

REFERENCE BOOKS

1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Configure various virtualization tools such as Virtual Box, VMware workstation.
CO2	Design and deploy a web application in a PaaS environment and generic cloud environment that can be used as a private cloud.
CO3	Learn how to simulate a cloud environment to implement new schedulers.

CO4	Manipulate large data sets in a parallel environment.

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	1	2	1	1	1	2	2	2	3	3	3	3	3
CO2	3	2	3	3	3	1	1	1	3	3	2	3	3	2	3	2
CO3	2	2	2	1	1	2	2	1	3	1	2	1	2	2	3	2
CO4	1	2	2	2	2	1	3	1	2	2	2	2	3	2	1	2

SEMESTER VII

GE4791	HUMAN VALUES AND ETHICS	L	T	P	C
		3	0	0	2

Objectives

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill moral and social values and loyalty and to appreciate the rights of others.

UNIT I	HUMAN VALUES	10
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.		CO1
UNIT II	**ENGINEERING ETHICS**	**9**
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.		CO2
UNIT III	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9**
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.		CO3
UNIT IV	**SAFETY, RESPONSIBILITIES AND**	**9**

	RIGHTS	
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.		**CO4**
UNIT V	**GLOBAL ISSUES**	**8**
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.		**CO5**
	Total Periods:	**45**

Text Books:

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

References:

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

Course Outcomes (CO)
Upon completion of the course, students should have the

CO1	Students should be able to apply ethics in society, and realize the responsibilities and rights in the society.
CO2	Students should be able to discuss the ethical issues related to engineering
CO3	Understood the core values that shape the ethical behaviour of an

	engineer
CO4	Exposed awareness on professional ethics and human values
CO5	Known their role in technological development

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	2	2	3	2	-	-	2	-	2	-	2
CO2	-	-	-	-	-	2	2	3	2	-	-	2	-	1	-	2
CO3	-	-	-	-	-	2	2	3	2	-	-	2	1	2	-	2
CO4	-	-	-	-	-	2	2	3	2	-	-	2	-	2	-	2
CO5	-	-	-	-	-	2	2	3	2	-	-	2	1	2	-	2

VERTICAL I
FULL STACK DEVELOPMENT

CS4511	SEMANTIC WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of semantic web and to conceptualize and depict ontology for semantic web.
- To make a study of languages for semantic web.
- To learn about the ontology learning algorithms and to utilize in the development of an application.
- To know the fundamental concepts of ontology management.
- To learn the applications related to semantic web.

UNIT – I	THE QUEST FOR SEMANTICS	9
Building Models – Calculating with Knowledge – Exchanging Information – Semantic Web Technologies – Layers – Architecture – Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Sample Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation.		CO1

UNIT – II	LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES	9
Web Documents in XML – RDF – Schema – Web Resource Description using RDF – RDF Properties – Topic Maps and RDF –		CO2

Overview – Syntax Structure – Semantics – Pragmatics –Traditional Ontology Languages – LOOM – OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL – DAML + OIL – OWL.		
UNIT - III	**ONTOLOGY LEARNING FOR SEMANTIC WEB**	**9**
Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Methods for Evaluating Ontologies.		**CO3**
UNIT - IV	**ONTOLOGY MANAGEMENT AND TOOLS**	**9**
Overview – Need for Management – Development Process – Target Ontology – Ontology Mapping – Skills Management System – Ontological Class – Constraints – Issues, Evolution Development Of Tools and Tool Suites – Ontology Merge Tools – Ontology Based Annotation Tools.		**CO4**
UNIT - V	**APPLICATIONS**	**9**
Web Services – Semantic Web Services – Case Study for Specific Domain – Security Issues – Web Data Exchange and Syndication – Semantic Wikis – Semantic Portals – Semantic Metadata in Data Formats – Semantic Web in Life Sciences – Ontologies for Standardizations – Rule Interchange Format.		**CO5**
	Total Periods:	**45**

TEXT BOOKS

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.
2. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering: with Examples from the Areas of Knowledge Management, E- Commerce and the Semantic Web", Springer, 2004.

REFERENCE BOOKS

1. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (CooperativeInformation Systems)", The MIT Press, 2004.
2. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer, 2002.
3. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the

Semantic Web:Ontology –Driven Knowledge Management", John Wiley, 2003.

4. John Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley, 2006.

Course Outcomes (CO)

CO1	Create ontology for a given domain.
CO2	Develop an application using ontology languages and tools.
CO3	Understand the concepts of semantic web
CO4	Use ontology related tools and technologies for application creation.
CO5	Design and develop applications using semantic web.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	2	-	-	-	-	-	-	-	-	-	2	2	2	2
CO2	2	2	3	3	3	-	-	-	-	-	-	-	3	2	2	3
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	-	2	3	3	3	-	-	-	-	-	-	-	2	3	2	2
CO5	-	-	3	3	2	-	-	-	2	-	-	-	2	2	-	2

CS4521	APP DEVELOPMENT	L	T	P	C
	(Common to ADS)	2	0	2	3

OBJECTIVES

- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access
- Deploy the mobile applications in marketplace for distribution

UNIT – I	INTRODUCTION TO MOBILE APPLICATION	6
Basics of Web and Mobile application development - Native App - Hybrid App - Cross-platform App - What is Progressive Web App -		CO1

Responsive Web design		
UNIT – II	**NATIVE APP DEVELOPMENT USING JAVA**	**6**
Native Web App - Benefits of Native App - Scenarios to create Native App - Tools for creating Native App - Cons of Native App - Popular Native App Development Frameworks - Java & Kotlin for Android - Swift & Objective-C for Ios - Basics of React Native - Native Components – JSX – State – Props		**CO2**
UNIT – III	**HYBRID APP DEVELOPMENT**	**6**
Hybrid Web App - Benefits of Hybrid App - Criteria for creating Native App - Tools for creating Hybrid App - Cons of Hybrid App - Popular Hybrid App Development Frameworks – Ionic - Apache Cordova		**CO3**
UNIT – IV	**CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE**	**6**
What is Cross-platform App - Benefits of Cross-platform App - Criteria for creating Cross-platform App - Tools for creating Cross-platform App - Cons of Cross-platform App – Popular Cross - platform App Development Frameworks – Flutter – Xamarin - React-Native - Basics of React Native - Native Components – JSX – State – Props		**CO4**
UNIT – V	**NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS**	**6**
Comparison of different App frameworks - Build Performance - App Performance - Debugging capabilities - Time to Market – Maintainability - Ease of Development - UI/UX - Reusability		**CO5**
	Total Periods:	**30**

PRACTICAL EXERCISES
Total Periods: 30

1. Using react native, build a cross platform application for a BMI calculator.
2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,).
4. Design and develop a cross platform application for day to day task (to-do) management.

5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
6. Design and develop an android application using Apache Cordova to find and display the current location of the user.
7. Write programs using Java to create Android application having Databases.
    - For a simple library application.
    - For displaying books available, books lend, book reservation.

Assume that student information is available in a database which has been stored in a database server.

TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, 3rd edition, 2021
2. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, Full Stack publishing, 5th edition., 2019.

REFERENCE BOOKS

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition 2019
2. Native Mobile Development by Shaun Lewis, Mike Dunn. 2019
3. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition, 2019.

Course Outcomes (CO)

CO1	Develop Native applications with GUI Components.
CO2	Develop hybrid applications with basic event handling.
CO3	Implement cross-platform applications with location and data storage capabilities.
CO4	Implement cross platform applications with basic GUI and event handling.
CO5	Develop web applications with cloud database access.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2	3	-	-	-	1	1	2	1	2	3	3	2
CO2	2	1	3	2	2	-	-	-	3	2	2	3	3	2	1	2
CO3	2	2	2	1	2	-	-	-	1	1	1	1	1	1	2	2
CO4	1	3	1	1	3	-	-	-	1	1	3	2	1	3	1	2
CO5	1	1	3	1	3	-	-	-	1	1	2	1	3	2	1	2

CS4631	FULL STACK SOFTWARE DEVELOPMENT	L	T	P	C
		2	0	2	3

OBJECTIVES

- To understand the various components of full stack development
- To learn Node.js features and applications
- To develop applications with MongoDB
- To understand the role of Angular and Express in web applications
- To develop simple web applications with React

UNIT – I	BASICS OF FULL STACK	6
Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular- Node – Mongo DB – React		CO1
UNIT – II	NODE JS	6
Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js		CO2
UNIT – III	MONGO DB	6
Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications		CO3

UNIT – IV	**EXPRESS AND ANGULAR**	**6**
Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives.		**CO4**
UNIT – V	**REACT**	**6**
MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering.		**CO5**
	Total Periods:	**30**

PRATICAL EXCERISES
Total Periods: 30

1. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter.
2. Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items
3. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
4. Create a food delivery website where users can order food from a particular restaurant listed in the website.
5. Develop a classifieds web application to buy and sell used products.
6. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.
7. Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed.

Text Books:

1. Miguel Grinberg, "Flask Web Development Developing Web Applications with Python", OReilly, 2014.
2. Mark Lutz, "Learning Python", Fifth Edition, O' Reilly 2013.

Reference Books:

1. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the-little- mongodb-book.
2. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016.
3. Scott Chacon and Ben Straub, "Pro Git", Free e-book under Creative commons, Second Edition, Apress , 2016.

COURSE OUTCOMES (CO)

CO1	Understand the object-oriented approach in Python.
CO2	Develop GUI applications with Python.
CO3	Use the collaborative version control system, git.
CO4	Package the developed code in Linux and Windows environment.
CO5	Deploy the developed web application using Flask in real time scenarios such as AWS.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	-	-	-	-	2	2	-	-	2	2	-	2
CO2	2	2	3	2	2	2	2	-	2	2	-	2	3	3	-	2
CO3	2	2	2	-	2	2	2	-	2	2	-	2	3	3	-	2
CO4	-	2	3	-	3	2	2	2	2	2	-	-	3	3	-	2
CO5	2	2	3	-	3	2	-	2	2	2	-	2	3	3	-	2

CS4741	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
	(Common to ADS)	2	0	2	3

OBJECTIVES

- To understand the software testing process
- To understand the various levels of testing
- To learn and understand the various test design strategies
- To understand the Software Quality Concepts.
- To Understand Quality Standards.

UNIT – I	INTRODUCTION	6
Software Testing Basic definition - Importance of testing - Software Testing Terms and Definitions -Testers- Roles and Responsibilities of a Software Tester- Testing Principles - Testing as a Process – Verification and Validation - Testing Maturity Model- Software Testing Axioms- Defects – Defect Classes - Defect Examples.		CO1
UNIT – II	**LEVELS OF TESTING**	**6**
Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit Tests and Recording results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect bash elimination System Testing – System Testing - Acceptance Testing – Performance Testing – Regression Testing – Domain Testing - Ad hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility Testing – Configuration Testing – Compatibility testing – Testing the documentation – Website Testing.		CO2
UNIT - III	**TEST STRATEGIES AND TOOLS**	**6**
Boundary Value Analysis – Equivalence Class Partitioning - Cause-Effect Graphing - Static Testing Vs. Structural Testing – Code Functional Testing – Coverage And Control Flow Graphs – Covering Code Logic – Paths – Code Complexity Testing – Test Adequacy Criteria - Evaluating Test Adequacy Criteria - Software Test Automation – Skill Needed For Automation - Design And Architecture For Automation- Automation Tools.		CO3
UNIT - IV	**INTRODUCTION TO SOFTWARE QUALITY**	**6**
Software quality assurance (SQA) - Definition and objectives - Need for Software quality – Quality challenges - Software quality factors - SQA system and architecture - McCall's quality model - Quality assurance activities in the development process - Quality assurance tools - CASE tools for software quality – Software maintenance quality.		CO4

UNIT - V	SOFTWARE QUALITY MANAGEMENT AND STANDARDS	6
Software quality - Cost of software quality - Classical quality cost model – Extended model – Application of Cost model - Quality management standards – ISO 9001 and ISO 9000-3 - SQA project process standards – IEEE std 1012 & 1028 – Organization of Quality Assurance - Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.		**CO5**
	Total Periods:	**30**

PRACTICAL EXERCISES
Total Periods: 30

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).
2. Design the test cases for testing the e-commerce application
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the test cases for an inventory control system.
5. Execute the test cases against a client server or desktop application and identify the defects.
6. Test the performance of the e-commerce application.
7. Automate the testing of e-commerce applications using Selenium

Text Books:

1. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2006.
2. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.

Reference Books:

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

Course Outcomes (CO)	
CO1	To understand the software testing process
CO2	To understand the various levels of testing
CO3	To learn and understand the various test design strategies
CO4	To understand the Software Quality Concepts.
CO5	To Understand Quality Standards.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	1	1	-	-	1	-	-	1	2	1	-	3
CO2	3	2	2	-	-	1	1	-	1	-	1	2	1	2	-	-
CO3	2	3	2	1	1	1	1	-	1	-	1	2	2	1	1	-
CO4	1	1	2	-	2	1	1	-	1	1	2	1	-	-	1	1
CO5	1	1	1	1	2	1	1	-	-	-	1	2	-	1	1	1

CS4851	UI/UX DESIGN	L	T	P	C
	(Common to ADS)	2	0	2	3

OBJECTIVES

- Understand the definition and principles of UI/UX Design in order to design with intention.
- Achieve a deep understanding of the entire life-cycle of design—the process, purpose, and tools.
- Learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making.
- Discover the industry-standard tools and specific project deliverables in UI/UX.
- Explain why you made design decisions, through presentations of assignments and your personal portfolio.

UNIT I	**FOUNDATIONAL ELEMENTS OF UI/UX**	**6**
User Interface Design (UI) -The Relationship Between UI and UX - Roles in UI/UX- A Brief Historical- Formal Elements of Interface Design- Design Before Design- Look and Feel-Language as a design tool-Active Elements of Interface Design- Static to Active-Functionality-Speed and Style-Composition and Structure-Composing the Elements of Interface Design		**CO1**
UNIT II	**USER EXPERIENCE DESIGN FOUNDATIONS**	**6**
Ideation, Articulation, Development - Planning, Testing, Researching, Mapping - Mapping Content -Mapping Interaction -Non-Visual Paper Prototyping - Non-Visual User Testing -Look and Feel/Visual Research. What Goes Where: Getting real: Wireframes and Interfaces - Nielsen's Usability Heuristics - Consistency and Details - Wireframe Map - Visual Direction - Developing UI - Refining UI		**CO2**
UNIT III	**WEB DESIGN: STRATEGIES AND INFORMATION ARCHITECTURE**	**6**
The User Experience Process - User-centric design - The UX Phases - Waterfall vs. Agile - Web vs. App. Determining Strategy: User Research - Inspiration - Analytics - User Needs and Client Needs - Target Audience - What is in and What is Out: Outlining Scope - Content and Functionality. The Sitemap: Introduction to Sitemaps - Information Architecture - Sitemap Concerns - annotated process - Elements - Treejack Introduction - Treejack Analysis		**CO3**
UNIT IV	**WEB DESIGNS: WIRE FRAMES TO PROTOTYPES**	**6**
Introduction to Wireframes - Responsive Design: Introduction and Primary navigation - Secondary and utility navigation - Related content, inline links, indexes, and search - Wayfinding - Common Form Elements - Homepage Content Strategies - Examples of Homepage Content Strategies - Wireframing Tools. The Mockup Phase: Visual Mockups - Design Principles - Using whitespace to style a form - Web Fonts - Web Typography: Creating Visual Mockups. Putting it all Together: Clickable Prototypes - Invision - Exporting Assets - Importing Assets and Creating Hotspots - Hotspot Templates		**CO4**

UNIT V	UI/UX DESIGN TOOLS	6
User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wireframing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design		CO5
		TOTAL: 30 PERIODS

PRACTICAL EXERCISES
Total Periods: 30

1. Designing a Responsive layout for a societal application.
2. Exploring various UI Interaction Patterns.
3. Developing an interface with proper UI Style Guides.
4. Developing Wireflow diagram for application using open-source software.
5. Exploring various open-source collaborative interface Platform.
6. Hands on Design Thinking Process for a new product.
7. Brainstorming feature for proposed product.
8. Defining the Look and Feel of the new Project.
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles).
10. Identify a customer problem to solve.
11. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping.
12. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.

Total Periods: 30

TEXT BOOKS

1. Buxton, B., Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann, (2007)
2. Jesse James Garrett, The Elements of User Experience: User-centered Design for the Web, New Riders; 2 edition 2010.

REFERENCE BOOKS

1. Russ Unger, Carolyn Chandler, A Project Guide to UX Design: For User Experience Designers in the Field Orndin the Making, New Riders; 2nd Edition, 2012.
2. Don Norman, The Design of Everyday Things, Basic Books; 2 edition, 2013.
3. Everett N. McKay, UI is Communication: How to Design Intuitive, User Centered Interfaces by Focusing on Effective Communication, Morgan Kaufmann; Illustrated edition, 2013.
4. Dr. Erich Gamma, Ralph Johnson, Richard Helm and John Vlissides, Design Patterns: Elements of Reusable Object - Oriented Software, Pearson, 2008

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Summarize all stages of the UI/UX development process
CO2	Experiment with various visual design aspects
CO3	Theme the visual look and feel of the user experiences
CO4	Create effective and compelling screen-based experiences
CO5	Create exposure to wireframing and Prototyping software in the various UI/UX Design tools

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2	2
CO2	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2	2
CO3	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2	2
CO4	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2	2
CO5	3	3	2	3	2	3	3	2	2	2	2	2	2	2	2	2

CS4861	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
(Common to IT & ADS)		3	0	0	3

COURSE OBJECTIVES

The main objectives of this course are to:

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To develop programs in non-procedural programming paradigms

UNIT I	SYNTAX AND SEMANTICS	9
Evolution of programming languages, describing syntax, context, free grammars, attribute grammars, describing semantics, lexical analysis, parsing, recursive - decent bottom - up parsing		CO1
UNIT II	**DATA TYPES AND BASIC STATEMENTS**	**9**
Names, variables, binding, type checking, scope, scope rules, lifetime and garbage collection, primitive data types, strings, array types, associative arrays, record types, union types, pointers and references, Arithmetic expressions, overloaded operators, type conversions, relational and boolean expressions , assignment statements , mixed mode assignments, control structures – selection, iterations, branching, guarded Statements		CO2
UNIT III	**SUBPROGRAMS AND IMPLEMENTATIONS**	**9**
Subprograms, design issues, local referencing, parameter passing, overloaded methods, generic methods, design issues for functions, semantics of call and return, implementing simple subprograms, stack and dynamic local variables, nested subprograms, blocks, dynamic scoping		CO3
UNIT IV	**OBJECT- ORIENTATION, CONCURRENCY, AND EVENT HANDLING**	**9**
Object – orientation, design issues for OOP languages, implementation of object, oriented constructs, concurrency, semaphores, Monitors, message passing, threads, statement level concurrency, exception handling, event handling		

UNIT V	FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES	9
Introduction to lambda calculus, fundamentals of functional programming languages, Programming with Scheme, – Programming with ML- Introduction to logic and logic programming, – Programming with Prolog, multi - paradigm languages		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Concepts of Programming Languages Robert. W. Sebesta 10th Edition, Pearson Education 2012.
2. Programming Language Design Concepts, D. A. Watt, Wiley Dreamtech, 2007.
3. Programming Languages, 2nd Edition, A.B. Tucker, R. E. Noonan, TMH, 2012.

REFERENCE BOOKS

1. Programming Languages, K. C. Louden, 2nd Edition, Thomson, 2003
2. Programming languages –Ghezzi, 3/e, John Wiley
3. Programming Languages Design and Implementation – Pratt and Zelkowitz, Fourth Edition PHI/Pearson Education

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Describe syntax and semantics of programming languages
CO2	Explain data, data types, and basic statements of programming languages
CO3	Design and implement subprogram constructs, Apply object - oriented, concurrency, and event handling programming constructs
CO4	Develop programs in Scheme, ML, and Prolog
CO5	Understand and adopt new programming languages

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2	2
CO2	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2	2
CO3	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2	2
CO4	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2	2
CO5	3	3	3	3	2	-	2	-	-	2	2	2	3	3	2	2

VERTICALS II
CLOUD COMPUTING & DATA CENTRE TECHNOLOGY

CS4512	DISTRIBUTED SYSTEMS	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

UNIT – I	INTRODUCTION	9
Introduction: Definition –Relation to computer system components – Motivation – Message-passing systems versus shared memory systems – Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. **A model of distributed computations:** A distributed program –A model of distributed executions –Models of communication networks. **Logical Time**: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.		**CO1**
UNIT – II	**MESSAGE ORDERING & SNAPSHOTS**	**9**
Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. **Global state and snapshot recording algorithms:** Introduction – System model and definitions –Cuts-Past and future cones of an event-Snapshot algorithms for FIFO channels		**CO2**
UNIT – III	**DISTRIBUTED MUTEX & DEADLOCK**	**9**
Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala algorithm – Maekawa's algorithm. **Deadlock detection in distributed systems:** Introduction – System model – Preliminaries – Models of deadlocks – Mitchell and Merritt's Algorithm for the single resource model, Chandy-Misra-Haas algorithm for the AND model and the OR model.		**CO3**
UNIT – IV	**RECOVERY & CONSENSUS**	**9**
Checkpointing and rollback recovery: Introduction – Background		**CO4**

and definitions – Issues in failure recovery – Checkpoint-based recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. **Consensus and agreement algorithms:** Problem definition – Overview of results – Agreement in a failure –free system – Agreement in synchronous systems with failures.		
UNIT – V	**P2P & DISTRIBUTED SHARED MEMORY**	**9**
Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks. **Distributed shared memory:** Abstraction and advantages – Memory consistency models : Strict consistency, Sequential consistency, Causal consistency –Shared memory Mutual Exclusion.		**CO5**
	Total Periods:	**45**

TEXT BOOKS

1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg ―Distributed Systems Concepts and Design, Fifth Edition, Pearson Education, 2012.

REFERENCE BOOKS

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., ―Distributed Systems: Principles and Paradigms‖, Pearson Education, 2007.

Course Outcomes (CO)

CO1	To elucidate the foundations and issues of distributed systems.
CO2	To understand the various synchronization issues and global state for distributed systems.
CO3	To understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems.
CO4	To describe the agreement protocols and fault tolerance mechanisms in distributed systems.
CO5	To describe the features of peer-to-peer and distributed shared memory systems.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	1	2	1
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	1	2	1
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	1	2	1
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-

CS4522	SOFTWARE DEFINED NETWORKS	L	T	P	C
		2	0	2	3

OBJECTIVES

- To understand the need for SDN and its data plane operations.
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT – I	**SDN: INTRODUCTION**	**6**
Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane		**CO1**
UNIT – II	**SDN DATA PLANE AND CONTROL PLANE**	**6**
Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers		**CO2**
UNIT – III	**SDN APPLICATIONS**	**6**
SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking		**CO3**
UNIT – IV	**NETWORK FUNCTION VIRTUALIZATION**	**6**
Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture.		**CO4**
UNIT – V	**NFV FUNCTIONALITY**	**6**
NFV Infrastructure – Virtualized Network Functions – NFV Management		**CO5**

and Orchestration – NFV Use cases – SDN and NFV	
Total Periods:	**30**

PRACTICAL EXERCISES

1. Setup your own virtual SDN lab i) Virtualbox/Mininet Environment for SDN - http://mininet.org ii) https://www.kathara.org iii) GNS3.
2. Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.
3. Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.
4. Create a simple end-to-end network service with two VNFs using vim-emu https://github.com/containernet/vim-emu
5. Install OSM and onboard and orchestrate network service.

Total Periods: 30

Text Books:

1. Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

Reference Books:

6. Michael Berthold, David J. Hand, ―Intelligent Data Analysis‖, Springer, Second Edition, 2007.
7. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
8. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
9. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, , O_Reilly Media, 2013.

Course Outcomes (CO)

CO1	Analyze the evolution of software defined networks
CO2	Express the various components of SDN and their uses

CO3	Explain the use of SDN in the current networking scenario
CO4	Design various applications of SDN
CO5	Develop various applications of SDN

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	2
CO2	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	2
CO3	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	2
CO4	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	2
CO5	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3	2

CS4632	DATA WAREHOUSING AND DATA MINING	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVE

- Identifying necessity of Data Mining and Data Warehousing for the society.
- Familiar with the process of data analysis, identifying the problems, and choosing the relevant models and algorithms to apply.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.
- Develop ability to design various algorithms based on data mining tools.
- Create further interest in research and design of new Data Mining techniques and concepts.

UNIT I	DATA WAREHOUSING	9
Introduction to Data warehouse, Differences between OLAP and OLTP, A Multi-dimensional data model- Star, Snow flake and Fact constellation schemas, Measures, Concept hierarchy, OLAP Operations in the Multidimensional Data Model, Data warehouse architecture- A three tier Data warehouse architecture, Data warehouse Back-End Tools and Utilities, Metadata Repository, types of OLAP servers, Data warehouse Implementation, Data Warehouse models- Enterprise warehouse.		CO1

UNIT II	**DATA MINING**	**9**
Introduction, what is Data Mining, Definition, Knowledge Discovery in Data (KDD), Kinds of data bases, Data mining functionalities, Classification of data mining systems, Data mining task primitives, Data Preprocessing: Data cleaning, Data integration and transformation, Data reduction, Data discritization and Concept hierarchy.		**CO2**
UNIT III	**ASSOCIATION RULE MINING**	**9**
Association Rules: Problem Definition, Frequent item set generation, The APRIORI Principle, support and confidence measures, association rule generation; APRIORI algorithm-FP-Growth Algorithms, Compact Representation of Frequent item Set-Maximal Frequent item set, closed frequent item set.		**CO3**
UNIT IV	**CLASSIFICATION AND PREDICTION**	**9**
Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.		**CO4**
UNIT V	**CLUSTERING**	**9**
Types of data, categorization of major clustering methods, K-means partitioning methods, hierarchical methods, density-based methods, grid-based methods, model-based clustering methods, outlier analysis-Mining Complex Types of Data: Multi-dimensional Analysis and Descriptive Mining of Complex, Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-Series and Sequence Data, Mining Text Databases, Mining the World Wide Web.		**CO5**
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Jiawei Han, Michelin Kamber, "Data Mining and Data Warehousing Principles and Pratical Techniques", Parteek Bhatia, Publishers, Elsevier, 1st Edition, 2019
2. Alex Berson, Stephen J.Smith, "Data warehousing Data mining and OLAP", Tata McGraw- Hill, 2nd Edition, 2007

REFERENCE BOOKS

1. Arum K Pujari, "Data Mining Techniques", 3rd Edition, Universities Press, 2005
2. Pualraj Ponnaiah, Wiley, "Data Warehousing Fundamentals", Student

Edition, 2004.

3. Ralph Kimball, Wiley, "The Data warehouse Life Cycle Toolkit", Student Edition, 2006

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Learn data warehouse principles and find the differences between relational Databases and data warehouse
CO2	Understand Data Mining concepts and knowledge discovery process
CO3	Illustrate the concept of Apriori algorithm for finding frequent items and generating association rules.
CO4	Understand the decision tree construction classification problem and prediction
CO5	Understand the Cluster and Analysis

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	2	3	2	1	1	2	3	3	2	3	2	1	2
CO2	2	2	2	1	2	2	2	1	2	2	2	3	3	2	2	2
CO3	2	3	2	2	3	2	1	1	2	3	3	2	3	2	3	2
CO4	2	3	2	1	2	1	1	1	2	2	3	3	3	2	3	2
CO5	2	3	2	2	2	2	2	2	2	2	3	3	3	2	3	2

CS4742	INFORMATION MANAGEMENT	L	T	P	C
	(Common to CSE, IT & ADS)	3	0	0	3

OBJECTIVES

- To know the functions of Information systems.
- The understand the Technologies used in Information Management.
- To analyze IT Project Management.
- To understand Leading the information system function.
- To know about ethical issues and challenges.

UNIT – I	INTRODUCTION	9
Data, Information, Information System, evolution, types based on functions and hierarchy, Enterprise and functional information systems.		CO1
UNIT – II	**INFORMATION TECHNOLOGIES**	**9**
Computer hardware: Computer systems, computer peripherals -		CO2

Computer Software: Application Software, System Software - Data Resource Management: Technical foundations of database management, Managing Data Resources – Telecommunications and Networks: The networked enterprise, Telecommunications Networks alternatives.		
UNIT – III	**IT PROJECT MANAGEMENT**	**9**
IT Portfolio Management- Project management Roles- Project Initiation – Project Planning: Scheduling, budgeting, Staffing, Planning documents, Project Execution and control, Managing Project Risks, Managing Business Change, Project Cloning.		**CO3**
UNIT – IV	**LEADING THE INFORMATION SYSTEM FUNCTION**	**9**
IS Organization Responsibilities and Governance, Managing IT Service Delivery, Managing IT Applications, Managing IT Human Resources, Managing the Business/IT Relationship, Measuring Overall IS Performance.		**CO4**
UNIT – V	**MANAGEMENT CHALLENGES**	**9**
Security and Ethical challenges**:** Security and Ethical, and Societal Challenges of IT, Security Management of Information Technology - Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT.		**CO5**
	Total Periods:	**45**

Text Books:

1. Carol V. Brown, Daniel W. DeHayes, Jeffrey Slater, Wainright E. Martin, Managing Information Technology, Pearson Education, 7th Edition,2011.
2. Kenneth C. Laudon and Jane P Laudon, Management Information Systems – Managing the Digital Firm, Pearson Education,15th edition, 2018.

Reference Books:

1. Robert Schultheis and Mary Sumner, Management Information Systems – The Manager' s View, Tata McGraw Hill, 4th edition, 1999.

Course Outcomes (CO)

CO1	Understand the functions of Information System.
CO2	Understand the Technologies used in Information Management
CO3	Apply analysis techniques for Project Management.
CO4	Understand leading Information function
CO5	Gains Knowledge on ethical issues and challenges.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	1	1	3	2	1	2	3	2	3	3	3	2	2
CO2	3	2	3	2	2	3	2	2	2	3	3	3	3	3	3	2
CO3	3	3	3	2	2	3	3	2	3	3	3	3	3	3	3	2
CO4	3	1	1	2	2	2	1	2	3	3	3	3	3	3	3	2
CO5	3	2	3	3	3	3	2	3	3	2	3	3	3	3	3	2

CS4852	SOCIAL MEDIA MINING	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

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

UNIT I	ONLINE SOCIAL NETWORKS (OSNS)	9
Introduction - Types of social networks (e.g., Twitter, Facebook, LinkedIn), Exploring Twitter's API, Exploring Facebook's Social Graph API, Exploring the LinkedIn API		CO1
UNIT II	**STUDY OF MINING WEB PAGES**	**9**
Overview – Scraping, parsing and Crawling the Web – Discovering Semantics by Decoding Syntax – Entity- Centric Analysis – Quality of Analytics for Processing Human Language Data.		CO2
UNIT III	**FUNDAMENTALS OF MINING MAILBOXES**	**9**
Overview – Obtaining and processing a Mail Corpus – Analyzing the Enron Corpus – Discovering and Visualizing Time Series Trends – Analyzing Your Own Mail Data.		CO3
UNIT IV	**BULIGING THE GITHUB'S API**	**9**
Overview – Exploring GitHub's API – Modeling Data with Property		CO4

Graphs - Analyzing GitHub Interest Graphs.		
UNIT V	**MINING THE SEMANTICALLY MARKED-UP WEB**	**9**
Overview – Microformats: Easy-to-Implement Metadata – From Semantic Markup to Semantic Web – The Semantic Web.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Matthew A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, Linkedin, Google+, Github, and More, 3rd Edition, O'Reilly Media, 2019.

REFERENCE BOOKS

1. Jennifer Golbeck, Analyzing the social web, 3rd Edition, Morgan Kaufmann, 2018.
2. CharuAggarwal (ed.), Social Network Data Analytics, Springer, 2017.

COURSE OUTCOMES

Upon completion of the course, students will be able to

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

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	-	-	2	2	2	2	2	3	1
CO2	3	3	1	3	2	-	-	-	-	2	2	2	2	3	2	2
CO3	3	3	1	3	2	-	-	-	-	2	2	2	3	2	3	2
CO4	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2	2
CO5	3	3	1	3	2	-	-	-	-	2	2	2	3	3	2	2

CS4862	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
	(Common to IT)	2	0	2	3

OBJECTIVES

- To know the fundamental concepts of Cloud Computing.
- To Gain Knowledge about cloud Virtualization
- To learn about Cloud Security.
- To know about resource management and security in cloud

UNIT – I	**COMPUTING PARADIGMS**	**6**
Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.		**CO1**
UNIT – II	**CLOUD COMPUTING FUNDAMENTALS**	**6**
Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models		**CO2**
UNIT - III	**VIRTUALIZATION**	**6**
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.		**CO3**
UNIT - IV	**CLOUD SECURITY**	**6**
Cloud Infrastructure security: network, host and application level - aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud - Cloud Security and Trust Management		**CO4**
UNIT - V	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD**	**6**
Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security– IAM –Security Standards.		**CO5**
	Total Periods:	**30**

PRACTICAL EXERCISES

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
2. Simulate resource management using cloud sim
3. Simulate log forensics using cloud sim
4. Simulate a secure file sharing using a cloud sim
5. Implement data anonymization techniques over the simple dataset (masking, kanonymization, etc)
6. Implement any encryption algorithm to protect the images
7. Implement any image obfuscation mechanism
8. Implement a role-based access control mechanism in a specific scenario
9. Implement an attribute-based access control mechanism based on a particular scenario
10. Develop a log monitoring system with incident management in the cloud

Total Periods: 30

Text Books:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014.

Reference Books:

1. Tim Mather, Subra Kumaraswamy, and Shahed Latif ,"Cloud Security and Privacy", O9Reilly Media, Inc.,2009.
2. Ronald L. Krutz Russell Dean Vines “Cloud Security: A Comprehensive Guide to SecureCloud Computing”, Wiley ,2010
3. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach‖, Tata Mcgraw Hill, 2009.

Course Outcomes (CO)

CO1	To know the fundamental concepts of computing paradigms in cloud computing
CO2	To understand basics of cloud computing fundamentals and various deployment models.
CO3	To know the basics of cloud virtualization and its types.
CO4	To learn cloud infrastructure Security.

CO5	To know about the resource management and security.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	2	2	3	1	2	1	1	1	1	1	1	1	1
CO2	2	3	2	1	2	2	2	2	2	2	1	1	2	1	2	2
CO3	2	2	1	1	2	2	2	2	1	2	2	1	1	1	2	1
CO4	2	2	2	3	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	2	1	2	2	2	2	2	1	2	2	1	2	1	-	2

VERTICAL III
CYBER SECURITY & DATA PRIVACY

CS4513	SOCIAL NETWORK SECURITY	L	T	P	C
	(Common to IT & ADS)	2	0	2	3

OBJECTIVES

- To understand the concept of semantic web and related applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining in web social networks
- To discuss the prediction of human behavior in social web and related communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT – I	SOCIAL NETWORKING FUNDAMENTALS	6
Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Measures in network analysis - Web-based networks – Historical overview of privacy and security, Major Paradigms for understanding privacy and security		CO1

UNIT – II	**SECURITY ISSUES IN SOCIAL NETWORK**	**6**
The evolution of privacy and security concerns with networked technologies Contextual influences on privacy attitudes and behaviors - Anonymity in a networked world - Role of ontology in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web		**CO2**
UNIT – III	**EXTRACTION AND MINING IN SOCIAL NETWORK**	**6**
Extraction 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 – Big data and Privacy		**CO3**
UNIT – IV	**HUMAN BEHAVIOUR AND PRIVACY ISSUES**	**6**
Understanding and predicting human behavior for social communities - User data management - Inference and Distribution - Enabling human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Attack spectrum and countermeasures – Neo4j – Nodes – Relationships – Properties		**CO4**
UNIT – V	**ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT**	**6**
Access control requirements for Social Network - Access Control Strategies - Role-based Access Control – Host - Storage and Network Access Control – Firewalls – Authentication and Authorization in Social Network - Identity & Access Management - Single Sign-on - Identity Federation - Identity providers and service consumers - The role of Identity provisioning		**CO5**
	Total Periods:	**30**

PRACTICAL EXERCISES:
Total Periods: 30

1. Design own social media application
2. Create a Network model using Neo4j
3. Read and write Data from Graph Database
4. Find “Friend of Friends” using Neo4j
5. Implement secure search in social media
6. Create a simple Security & Privacy detector

TEXT BOOKS

1. Peter Mika, “Social Networks and the Semantic Web”, Springer, First Edition, 2007.
2. BorkoFurht, “Handbook of Social Network Technologies and

Applications", Springer,1st Edition, 2010.

REFERENCE BOOKS

1. GuandongXu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and Applications", Springer, First Edition, 2011.
2. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.

Course Outcomes (CO)

CO1	Develop semantic web-related applications
CO2	Address privacy and security issues in social networks
CO3	Explain the data extraction and mining of social networks
CO4	Predict human behaviour in social web and related communities
CO5	Describe the applications of social networks

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

CS4523	INFORMATION SECURITY	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To focus on physical security and understand the access models.
- To highlight the salient features of implementation and maintenance of security.

UNIT – I	**INTRODUCTION**	**9**
History - What is Information Security? - Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.		**CO1**
UNIT – II	**SECURITY INVESTIGATION**	**9**
Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.		**CO2**
UNIT – III	**SECURITY ANALYSIS**	**9**
Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem		**CO3**
UNIT – IV	**SECURITY TECHNOLOGY AND PHYSICAL SECURITY**	**9**
Security Technology - Access Controls, Firewalls and VPNs- Intrusion Detection and prevention systems. Physical Security -Introduction- Physical access controls - Fire Security and safety-Failure of supporting utilities and structural collapse - Interception of Data-Remote computing security.		**CO4**
UNIT – V	**INFORMATION SECURITY IMPLEMENTATION AND MAINTENANCE**	**9**
Information security project management-technical aspects of implementation-non technical aspects of implementation- Positioning and staffing the security function. Security Management Maintenance Models-Digital Forensics.		**CO5**
	Total Periods:	**45**

TEXT BOOKS

1. Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, Cengage Learning, 6th Edition, 2017.
2. John R.Vacca, Computer and Information Security Handbook", Morgan Kaufmann Publishers, 3rd Edition, 2017.
3. Jason Andress, The Basics of Information Security, Syngress Press, Elsevier Publications, 2nd edition, 2021.

REFERENCE BOOKS

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2021.
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw- Hill, 7th Edition,2021
3. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2nd Edition 2018.

Course Outcomes (CO)

CO1	Understand the ways to develop a secure model
CO2	Illustrate the legal, ethical and professional issues in information security
CO3	Demonstrate the aspects of risk management.
CO4	Emphasize the relationship between information security and physical security
CO5	Enumerate the organizational considerations to be addressed in a project plan and describe the maintenance issues of security.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	2	-	-	-	-	-	2	2	2	3	3	1	1
CO2	1	1	2	2	-	2	2	2	-	2	2	2	2	1	2	1
CO3	2	2	2	3	-	2	-	-	-	2	2	2	3	2	3	-
CO4	-	-	2	2	3	2	-	-	-	2	2	2	1	2	2	1
CO5	-	-	2	2	2	-	2	-	-	2	3	3	2	1	1	1

CS4633	CYBER FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES

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

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

TEXTBOOKS

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

REFERENCE

1. John R.Vacca, ―Computer Forensics, Cengage Learning, 2005
2. MarjieT.Britz, ―Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
3. Ankit Fadia ― Ethical Hacking Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik ―Insider Computer Fraud Auerbach Publications Taylor & Francis Group–2008.

COURSE OUTCOMES(CO)

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

MAPPING BETWEEN COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	3	-	-	2	2	2	3	3	2	-
CO2	3	3	3	3	3	-	3	-	-	2	2	2	3	3	2	-
CO3	3	3	3	3	3	-	3	-	-	2	2	2	3	3	2	-
CO4	3	3	3	3	3	-	3	-	-	2	2	2	3	3	2	-
CO5	3	3	3	3	3	-	3	-	-	2	2	2	3	3	2	-

CS4743	CYBERCRIME AND COMPUTER ETHICS	L	T	P	C
	(Common to ADS)	2	0	2	3

OBJECTIVES

- To provide with an overview of crimes involving the use of computer technology and the internet.
- Understand various types of cyber crimes

- ❖ Examine current trends and tools in computer crime
- ❖ Discuss how computers pose challenge to traditional philosophical and ethical concepts.
- ❖ Helps students develop the moral reasoning ability to use computers in daily life ethically.

UNIT I	**INTRODUCTION TO CYBERCRIME**	**6**
Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.		**CO1**
UNIT II	**CYBER CRIME ISSUES**	**6**
Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.		**CO2**
UNIT III	**CYBERCRIME: MOBILE AND WIRELESS DEVICES**	**6**
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops		**CO3**
UNIT IV	**CYBERCRIME: TOOLS AND METHODS**	**6**
Proxy Servers and Anonymizers-Phishing-Password Cracking-Keyloggers and Spywares-Virus and Worms-Trojan Horses and Backdoors-Steganography-DoS and DDoS Attacks-SQL Injection-Buffer Overflow-Attacks on Wireless Networks		**CO4**
UNIT V	**COMPUTER ETHICS**	**6**
Computer Ethics-Ethical Analysis- Impact of computer technology on freedom of expression- Privacy in the Internet Age-Intellectual Property- Ethical use of computer systems- Ethical development of computer systems-Case Studies		**CO5**
		TOTAL: 30 PERIODS
PRACTICAL EXERCISES		

1. Install Kali Linux on Virtual box
2. Explore Kali Linux and bash scripting
3. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
4. Understand the nmap command d and scan a target using nmap
5. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities
6. Use Metasploit to exploit an unpatched vulnerability
7. Install Linus server on the virtual box and install ssh
8. Use Fail2banto scan log files and ban Ips that show the malicious signs
9. Launch brute-force attacks on the Linux server using Hydra.
10. Perform real-time network traffic analysis and data pocket logging using Snort.

Total Periods: 30

TEXT BOOKS

1. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.
2. Thomas Halt, Adam M. Bossler and Kathryn C.Seigfried Spellar, "Cybercrime and Digital Forensics: An Introduction", Routledge Taylor and Francis Group 2017.
3. Quinn, M. J. (2016). Ethics for the information age (7th ed.). Boston: Pearson Addison Wesley.
4. 2. Reynolds, G. W. (2018). Ethics in information technology (6th ed.). Boston, Mass: Thomson Course Technology.

REFERENCE BOOKS

1. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004
2. Schneider, G. P., & Evans, J. (2017). New perspectives on the internet: Comprehensive (10th ed.). Boston, Mass.: Course Technology/Cengage Learning.
3. Tavani, H. T. (2015). Ethics and technology: Controversies, Questions, and Strategies for Ethical Computing (5th ed.). Hoboken, NJ: Wiley.
4. Brinkman, B., & Sanders, A. F. (2013). Ethics in a Computing Culture. Boston, Mass.: Course Technology/Cengage Learning.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the various ideas about cybercrime.
CO2	Describe the Cyber Crime Strategy.
CO3	Identify the Cyber Crime Investigation Methodology.
CO4	Identify the relationships between computer ethics and society
CO5	Explain and evaluate various ethical theories

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	1	-	-	-	1	1	2	3	2	2	1
CO2	3	3	2	2	1	1	-	-	-	1	1	2	3	2	2	1
CO3	3	3	2	2	1	1	-	-	-	1	1	2	3	2	1	1
CO4	3	3	2	2	1	1	-	-	-	-	1	2	3	3	1	2
CO5	3	3	2	2	1	1	-	-	-	-	1	2	3	2	2	1

CS4853	**BIG DATA SECURITY**	**L**	**T**	**P**	**C**
	(Common to IT & ADS)	**3**	**0**	**0**	**3**

OBJECTIVES

- To understand the significance of privacy, ethics in big data environment
- Analyzing the steps to secure big data
- To integrate the big data analytics in to the enterprise and its eco system
- To understand the security concerns of big-data

UNIT – I	**INTRODUCTION TO BIG DATA**	**9**
Defining Big Data Arrival of analytics - Big Data Reaches Deep - Obstacles Remain - Data Continue to Evolve - Realizing Value - The Case for Big Data - The Rise of Big Data Options - Beyond Hadoop - Big Data Sources Growing		**CO1**
UNIT – II	**SECURITY, COMPLIANCE, AUDITING & PROTECTION**	**9**
Pragmatic Steps to Securing Big Data - Classifying Data - Protecting Big Data Analytics - Big Data and Compliance - The Intellectual Property Challenge - Big Data: The Modern Era - Today, Tomorrow, and the Next		**CO2**

Day - Changing.		
UNIT – III	**INTEGRATING BIG DATA ANALYTICS INTO THE ENTERPRISE**	**9**
Strategic Plan for Technology Adoption - Standardize Practices for Soliciting Business User Expectations - Acceptability for Adoption: Clarify Go/No-Go Criteria - Prepare the Data Environment for Massive Scalability - Promote Data Reuse - Institute Proper Levels of Oversight and Governance - Provide a Governed Process for Mainstreaming Technology- Considerations for Enterprise Integration		**CO3**
UNIT - IV	**SECURITY ANALYTICS I**	**9**
Introduction to Security Analytics – Techniques in Analytics – Analysis in everyday life – Challenges in Intrusion and Incident Identification – Analysis of Log file – Simulation and Security Process.		**CO4**
UNIT - V	**SECURITY ANALYTICS II**	**9**
Access Analytics – Security Analysis with Text Mining – Security Intelligence – Security Breaches		**CO5**
	Total Periods:	**45**

Text Books:

1. Frank Ohlhorst John Wiley & Sons, “Big Data Analytics: Turning Big Data into Big Money”, John Wiley & Sons, 2013.
2. Mark Talabis, Robert McPherson, I Miyamoto and Jason Martin, “Information Security Analytics: Finding Security Insights, Patterns, and Anomalies in Big Data”Syngress Media, U.S., 2014.

Reference Books:

1. David Loshin, "Big data analytics: From Strategic planning to enterprise integration with tools, techniques, NoSQL, and Graph, Elsevier,2013.
2. Behrouz A. Forouzan, “Cryptography and Network Security”, Tata McGraw Hill Education, 2nd Edition, 2010.
3. Douglas R. Stinson , “Cryptography Theory and Practice” , Chapman & Hall/CRC, 3rd Edition, 2006.

Course Outcomes (CO)

CO1	Understand the significance of privacy, ethics in big data environment
CO2	Analyzing the steps to secure big data
CO3	Integrated the big data analytics in to the enterprise and its eco system
CO4	Understand the security concerns of big-data

CO5	Understand the security concept in text mining

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	3	1	2	3	-	3	3	3	-	3	3	-	3	3
CO2	3	3	3	2	3	3	3	3	3	3	-	-	3	2	3	3
CO3	2	3	3	2	3	3	3	3	3	3	-	-	3	3	3	3
CO4	3	3		3	3	3	3	3	3	-	-	-	3	3	3	3
CO5	-	2	3	3	3	-	3	3	3	-	-	-	3	2	3	3

CS4863	BLOCKCHAIN AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand Blockchain's fundamental components, and examine decentralizationusing blockchain.
- To explain how cryptocurrency works, from when a transaction is created to when itis considered part of the Blockchain.
- To explain the components of Ethereum and Programming Languages for Ethereum.
- To study the basics of Hyperledger.
- To know about alternative Blockchains and Blockchain projects in different domains.

UNIT – I	INTRODUCTION TO BLOCKCHAIN	9
History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization-Benefits and Limitations of blockchain**.**		CO1
UNIT – II	BITCOIN	9

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Bitcoin payments - Alternative Coins –Alternative to Proof of Work, Various stake types - – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts.		**CO2**
UNIT – III	**ETHEREUM**	**9**
The Ethereum Network – Mainnet, Testnet, Private net - Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.		**CO3**
UNIT – IV	**HYPERLEDGER AND HYPERLEDGER FABRIC**	**9**
Hyperledger as a Protocol – The Reference Architecture, Hyperledger Fabric – Membership services, Blockchain services, Consensus services, Distributed Ledger – Corda.		**CO4**
UNIT – V	**APPLICATION OF BLOCKCHAIN – OUTSIDE OF CURRENCIES**	**9**
Internet of Things – Government – Border Control, Voting, Citizen Identification – Health – Finance – Insurance, Post trade settlement, Financial Crime Prevention – Media.		**CO5**
	Total Periods:	**45**

Text Books:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands on Approach", VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014.
3. Alex Leverington, "Ethereum Programming" Packt Publishing, 2017.

Course Outcomes (CO)

CO1	To understand the technology components of Blockchain and identify different approaches to developing decentralized applications.
CO2	To understand Bitcoin and its limitations by comparing with other alternative coins.
CO3	To devise solution using the Ethereum model.

CO4	To understand and use Hyperledger and its development framework.
CO5	To understand application of blockchain.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	-	2	2	-	2	2	-	-	2	2	2	2
CO2	2	2	1	2	1	-	-	-	-	-	-	2	2	3	-	1
CO3	2	2	3	2	2	-	-	-	-	-	-	2	2	2	-	1
CO4	2	2	2	-	1	2	1	2	-	-	-		2	2	-	2
CO5	2	2	1	-	2	2	-	1	2	2	-	2	1	1	-	1

VETRICAL IV
ARTIFICAL INTELLGIENCE AND MACHINE LEARNING

CS4514	ADVANCED MACHINE LEARNING	L	T	P	C
		2	0	2	3

OBJECTIVES

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

UNIT – I	INTRODUCTION	6
Machine Learning – Types of Machine Learning – Supervised Learning – Unsupervised Learning – Basic Concepts in Machine Learning – Machine Learning Process – Weight Space – Testing Machine Learning Algorithms – A Brief Review of Probability Theory –Turning Data into Probabilities – The Bias-Variance Trade-off, FIND–S Algorithm, Candidate Elimination Algorithm		CO1
UNIT – II	**SUPERVISED LEARNING**	**6**
Linear Models for Regression – Linear Basis Function Models – The		CO2

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		
UNIT – III	**UNSUPERVISED LEARNING**	**6**
Mixture Models and EM – K-Means Clustering – Dirichlet Process Mixture Models – Spectral Clustering – Hierarchical Clustering – The Curse of Dimensionality – Dimensionality Reduction – Principal Component Analysis – Latent Variable Models (LVM) – Latent Dirichlet Allocation (LDA)		**CO3**
UNIT – IV	**GRAPHICAL MODELS**	**6**
Bayesian Networks – Conditional Independence – Naive Bayes Classifiers – Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Random Fields – Hidden Markov Model.		**CO4**
UNIT – V	**ADVANCED LEARNING**	**6**
Reinforcement Learning – Representation Learning – Neural Networks – Active Learning – Ensemble Learning – Bootstrap Aggregation – Boosting – Gradient Boosting Machines – Deep Learning		**CO5**
	Total Periods:	**30**

PRACTICAL EXERCISES:
Total Periods: 30

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. 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.
3. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.
5. Implement naïve Bayesian Classifier model to classify a set of

documents and measure the accuracy, precision, and recall.

6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.

TEXT BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

REFERENCE BOOKS

1. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 2017.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Second Edition, Springer, 2008.

Course Outcomes (CO)

CO1	Gain knowledge about basic concepts of machine learning techniques and terminology.
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	POS												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	2	3	-	1	-	-	-	1	3	3	3	3
CO2	2	2	3	2	2	3	-	1	-	-	-	1	3	3	3	3
CO3	2	2	3	2	2	3	-	1	-	-	-	1	3	3	3	3
CO4	2	2	3	2	2	3	-	1	-	-	-	1	3	3	3	3
CO5	2	2	3	2	2	3	-	1	-	-	-	1	3	3	3	3

CS4524	INTELLIGENCE FUZZY	L	T	P	C
		3	0	0	3

OBJECTIVES

- Help students to be familiar with the fundamental concepts of fuzzy set theory and fuzzy logic
- Foster competence in recognizing the feasibility and applicability of the design and implementation of intelligent systems for specific application areas.
- Help students develop a sufficient understanding of fuzzy system design methodology and how it impacts system design and performance

UNIT – I	INTRODUCTION, DEFINITION AND CONCEPTS	9
Intelligent Control – Fuzzy Logic – Fuzzy Control – Applications – Rule Base – Fuzzy Sets – Classic versus Fuzzy Control System Design – An Example of Fuzzy Control.		CO1
UNIT – II	NEURAL NETWORKS: THEORETICAL AND COMPUTATIONAL MODELS	9
Real and Artificial neurons- Supervised Learning in neural networks- Perceptron- Radial Basis functions- Neural Networks models- Fuzzy neurons and Fuzzy neural networks.		CO2
UNIT – III	FUZZY SYSTEMS	9

Fuzzy Rule Base – Fuzzy Inference Engine – Fuzzification – Defuzzification – Mathematical Representations of Fuzzy Systems – The Approximation Properties of Fuzzy Systems.		**CO3**
UNIT – IV	**INTELLIGENT FUZZY CONTROL SYSTEMS**	**9**
Classical Programable Logic Control- Fuzzy Logic Control: A General Model Free Approach- A Closed-Loop Set-Point Tracking System- Design Principle of Fuzzy Logic Controllers- Examples of Model-Free Fuzzy Controller Design.		**CO4**
UNIT – V	**DESIGN OF FUZZY CONTROLLERS**	**9**
Trial and Error Approach – Control surface of a fuzzy controller – Stable Fuzzy Controllers – Fuzzy Supervisory Control – Fuzzy Gain Scheduling – TSK Fuzzy Systems.		**CO5**
	Total Periods:	**45**

TEXT BOOKS

1. Fuzzy Logic with Engineering Applications, 4th Ed. John-Wiley, 2017, T.J. Ross, Lawrence Fussett- fundamental of Neural network Prentice Hall, First Edition.
2. Foundations of Neural Networks, Fuzzy Systems and Knowledge Engineering, A Bradford Book The MIT Press Cambridge, Second printing, 1998, Nikola K. Kasabov

REFERENCE BOOKS

1. X. Wang, "A Course in Fuzzy Systems and Control", Prentice-Hall, 1997.
2. M. Passino, "Fuzzy Control", Addison-Wesley, 1998.
3. Fuzzy Set Teory, 1997, G.Klir et al. Prentice Hall
4. Fuzzy Sets and Fuzzy Logic 1995, G Klir et al. Prentice Hall
5. Kart Kosko, ―Neural network and Fuzzy System‖ - Prentice Hall-1994.

Course Outcomes (CO)

CO1	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
CO2	Comprehend the concepts of feed forward neural networks
CO3	Understand the concept of fuzziness involved in various systems and fuzzy set theory.
CO4	Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
CO5	Analyze the application of fuzzy logic control to real time systems

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	2	2	-	2	2	-	-	2	2	2	2
CO2	2	2	1	2	1	-	-	-	-	-	-	2	2	3	3	1
CO3	2	2	3	2	2	2	-	-	-	-	-	2	2	2	2	1
CO4	2	2	2	2	1	2	1	2	-	-	-		2	2	1	2
CO5	2	2	1	1	2	2	-	1	2	2	-	2	1	1	1	1

IT4524	INFORMATION RETRIEVAL	L	T	P	C
	(Common to CSE & IT)	3	0	0	3

OBJECTIVES

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

UNIT – I	INTRODUCTION TO INFORMATION RETRIEVAL SYSTEMS	9
Definition of Information Retrieval System - Objectives of Information Retrieval Systems - Functional Overview - Early Developments – The IR Problem - The User's Task - Information versus Data Retrieval - The IR System - The Software Architecture of the IR System – The Retrieval and Ranking Processes - The e-Publishing Era - Digital Libraries.		CO1
UNIT – II	**WEB SEARCH BASICS AND CRAWLING**	**9**
The Web - Hypertext - How the web changed Search - Practical Issues on the Web - Search Engine Architectures - Cluster based Architecture - Ranking Process - Learning to Rank - Evaluations - Search Engine Ranking - Link based Ranking - Simple Ranking Functions - Search Engine User Interaction – Browsing – Web Crawler - Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.		CO2
UNIT – III	**INDEXES, TEXT CLASSIFICATION AND**	**9**

	CLUSTERING	
Indexing and Searching - Objectives of Indexing -Indexing Process - Statistical Indexing - Concept Indexing - Inverted Indexes - Multi-dimensional Indexing - Sequential Searching - Organizing the classes - The text classification problem - Naive Bayes text classification - k-nearest neighbours - Support vector Machine- Feature Selection - Vector-space clustering - K-means algorithm -Hierarchical clustering.		**CO3**
UNIT – IV	**RETRIEVAL MODELS AND IMPLEMENTATION**	**9**
Basic IR Models - Boolean Model - TF-IDF Weight - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.		**CO4**
UNIT – V	**RECOMMENDER SYSTEM**	**9**
Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighbourhood models.		**CO5**
	Total Periods:	**45**

Text Books:

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook‖, First Edition, 2011.

Reference Books:

1. C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

Course Outcomes (CO)

CO1	To understand the basics of Information Retrieval.
CO2	To understand various search engine system operations.
CO3	To understand machine learning techniques for text classification and clustering.
CO4	To understand various IR Models and Implementation.
CO5	To learn different techniques of recommender system

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	2	-	-	-	-	-	-	1	-	1	2	1	3	2
CO2	2	1	3	3	3	-	1	-	-	2	-	1	3	3	3	2
CO3	2	2	3	3	3	-	-	-	-	2	-	1	3	3	3	2
CO4	2	2	3	3	3	-	1	1	-	1	-	1	3	3	3	2
CO5	1	1	2	1	1	-	-	1	-	-	1	1	2	2	1	2

CS4744	SOFTWARE AGENTS	L	T	P	C
	(Common to IT)	3	0	0	3

OBJECTIVES

- Identify and explore the advantages of agents and design of the architecture for an agent
- Analyze the typical agent using a tool for implementation
- Analyze agent communication with actions
- Develop agents using agent-oriented framework for the societal benefits
- Analyze the working of intelligent Agents for the betterment of society.

UNIT – I	INTRODUCTION	9
Introduction to Software Agents: What is a software agent? - Why software agents? - Applications of Intelligent software agents-Agents and Multi Agent Systems- Intelligent Agent- – Agent Vs Object – Aglet – Mobile Agents – Agent Frameworks – Agent Reasoning.		CO1
UNIT – II	**ARCHITECTURAL AGENT**	**9**
Processes – Threads – Daemons – Components – Java Beans – ActiveX – Sockets – RPCs – Distributed Computing – Aglets Programming –		CO2

Jini Architecture – Actors and Agents – Typed and proactive messages- Agent Platform – JACK.		
UNIT - III	**MULTIAGENT COMMUNICATION AND COOPERATION**	**9**
Interaction between agents – Reactive Agents – Cognitive Agents – Interaction protocols – Agent coordination – Agent negotiation – Agent Cooperation – Agent Organization – Self-Interested agents in Electronic Commerce Applications-Multi agent planning and synchronization.		**CO3**
UNIT - IV	**DESIGNING AGENTS**	**9**
Interface Agents – Agent Communication Languages – Agent Knowledge Representation – Agent Adaptability – Belief Desire Intension – Mobile Agent Applications. KidSim: Training a personal Digital Assistant.		**CO4**
UNIT - V	**AGENTS FOR INTELLIGENT ASSISTANCE**	**9**
Computer Characters- Software Agents for Cooperative Learning – Integrated Agents- Agent Oriented Programming- KQML as an Agent Communication Language- Agent Based Framework for Interoperability - Agents for Information Gathering - KAoS- Communicative Actions for Artificial Agents – Mobile Agents.		**CO5**
	Total Periods:	**45**

Text Books:

1. Jeffrey M. Bradshaw, "Software Agents", MIT Press, 2010
2. S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education, Fourth Edition,2022.

Reference Books:

1. Lin Padgham and Michael Winikoff, "Developing Intelligent Agent Systems: A Practical Guide", John Wiley & sons Publication, 2004.
2. Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley and Sons Ltd., Second edition, 2009.
3. Gerhard Weiss, ―Multi Agent Systems, MIT Press, Second Edition, 2013.

Course Outcomes (CO)

CO1	Identify and explore the advantages of agents and design the Functionalities of agent
CO2	Analyze the agent in details in a view for the implementation and the architecture for an agent
CO3	Analyze communicative actions with agents.

CO4	Analyze and design typical agents using a tool for different types of sharing Information
CO5	Analyze the working of mobile Agents for the betterment of society.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	2	3	3
CO2	-	3	3	3	-	-	-	-	3	-	-	-	3	2	2	2
CO3	-	3	3	3	3	-	-	-	3	3	3	-	3	2	2	2
CO4	-	3	3	3	3	2	-	2	3	3	3	-	3	2	2	2
CO5	-	3	3	3	3	2	-	2	3	3	3	-	3	2	2	2

CS4854	TEXT AND SPEECH ANALYSIS	L	T	P	C
		2	0	2	3

OBJECTIVES

- To learn the fundamentals of natural language processing
- To understand the fundamentals of the speech processing
- Explore the various speech models
- Gather knowledge about the phonetics and pronunciation processing
- To understand the concepts of speech recognition

UNIT – I	INTRODUCTION	6
Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.		CO1
UNIT – II	**WORD LEVEL ANALYSIS**	**6**
Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.		CO2
UNIT - III	**SPEECH MODELING**	**6**

Fundamentals of Speech recognition - Speech-Production process - computing likelihood: the forward algorithm– Autoregressive HMM-transformation based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling.		**CO3**
UNIT - IV	**SPEECH PRONUNCIATION AND SIGNAL PROCESSING**	**6**
Phonetics - speech sounds and phonetic transcription - articulatory phonetics – phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology		**CO4**
UNIT - V	**SPEECH IDENTIFICATION AND RECOGNITION**	**6**
Speech synthesis - text normalization - phonetic analysis - prosodic analysis – diphone waveform synthesis - unit selection waveform synthesis – evaluation Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training -multipass decoding: n-best lists and lattices- a* ('stack') decoding - context-dependent acoustic models: triphones - iscriminative training - speech recognition by humans		**CO5**
	Total Periods:	**30**

PRACTICAL EXERCISES:

Total Periods: 30

1. Create Regular expressions in Python for detecting word patterns and tokenizing text.
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, and Bigrams.
3. Accessing Text Corpora using NLTK in Python
4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
5. Implement the Word2Vec model.
6. Use a transformer for implementing classification.
7. Design a chatbot with a simple dialog system

Text Books:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Person education,2013.
2. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech

Recognition", Pearson Education, 2003.

Reference Books:

1. Kai-Fu Lee, "Automatic Speech Recognition", The Springer International Series in Engineering and Computer Science, 1999.
2. Himanshu Chaurasiya, "Soft Computing Implementation of Automatic Speech Recognition", LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio Prina Ricotti, "Speech Recognition: Theory and C++ implementation",Wiley publications 2008.
4. Ikrami Eldirawy , Wesam Ashour, "Visual Speech Recognition", Wiley publications , 2011.

Course Outcomes (CO)

CO1	To tag a given text with basic Language features
CO2	To design an innovative application using NLP components
CO3	Derive new speech models
CO4	Perform various language phonetic analysis
CO5	Generate a new speech identification and recognition system

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3	2	2	1	-	2	2	3	3	3	1	2	2
CO2	3	3	3	3	3	2	1	-	3	2	3	3	3	1	2	2
CO3	3	2	2	3	3	2	2	-	3	2	2	3	2	3	3	3
CO4	1	2	2	3	3	2	2	-	3	3	2	3	2	3	3	3
CO5	1	1	2	2	3	1	1	-	2	3	3	3	3	1	2	3

CS4864	ARTIFICIAL INTELLIGENCE AND ROBOTICS	L	T	P	C
	(Common to IT)	3	0	0	3

OBJECTIVES

- To develop semantic-based and context-aware systems to acquire, organize process, share and use the knowledge embedded in multimedia content.
- To maximize automation of the complete knowledge lifecycle and achieve semantic interoperability between Web resources and services. Research will aim the field of Robotics is a multi-disciplinary as robots are amazingly complex system comprising mechanical, electrical, electronic H/W and S/W and issues germane to all these.

UNIT I	SCOPE OF AI & PROBLEM SOLVING	9
Introduction to Artificial Intelligence- Applications- Games, Theorem proving, Natural language processing, Vision and speech processing,Robotics, Expert systems. - AI techniques- search knowledge, Abstraction -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.		**CO1**
UNIT II	**KNOWLEDGE REPRESENTATION**	**9**
Knowledge Representation issues - first order predicate calculus - Horn Clauses -Resolution, -Semantic Nets, Frames - Partitioned Nets -Procedural Vs Declarative knowledge - Forward Vs Backward Reasoning.		**CO2**
UNIT III	**UNDERSTANDING NATURAL LANGUAGES**	**9**
Introduction to NLP -Basics of Syntactic Processing-Basics of Semantic Analysis -Basics of Parsing techniques - context free and transformational grammars - transition nets -augmented transition nets - Conceptual Dependency - Scripts - Basics of grammar free analyzers -Basics of sentence generation and translation.		**CO3**
UNIT IV	**EXPERT SYSTEM AND LEARNING**	**9**
Expert System: Need - Justification for expert systems - knowledge acquisition -Case studies: MYCIN, RI. -Learning: Concept of learning -learning automation - Learning by inductions, Handling Uncertainties: Non-monotonic reasoning - Probabilistic reasoning - Use of certaintyfactors - Fuzzy logic.		**CO4**
UNIT V	**INTRODUCTION TO ROBOTICS**	**9**
Robotics – Introduction, Architecture - Robot Kinematics: Position Analysis -Trajectory Planning - Sensors and vision system - Application of Robotics - Features of Robotics.		**CO5**
		TOTAL:45 PERIODS

TEXT BOOKS

1. E.Rich and K.Knight,"Artificial Intelligence", 2nd Edition 2018.
2. N.J.Nilsson, "Principles of AI", NarosaPubl.House.
3. John J.Craig," Introduction of Robotics", Addison Wesley publication.
4. D.W.Patteron,"Introduction to AI and Expert System".

REFERENCE BOOKS

1. Robin R.Murphy," Introduction to AI Robotics", 2nd Edition 2019, MIT Press, Cambridge, London.
2. Francis X.Govers," Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI Techniques", 1stEdition,Kindle Edition 2018.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
CO2	Analyze the local and global impact of computing on individuals, organizations, and society.
CO3	Use current techniques, programming skills, and AI tools necessary for computing practice in the field of AI and robotics.
CO4	Gain the knowledge about knowledge representation, expert system and the understanding of natural language.
CO5	Apply design and development principles in the construction of software systems of varying complexity.

MAPPING OF COs WITH POs AND PSOs

Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2	2	1	1	1	2	2	3	3	3	1	2	1
CO2	3	1	1	2	3	2	1	2	3	2	3	3	3	1	2	1
CO3	1	2	2	3	3	2	2	1	2	2	2	3	2	3	3	2
CO4	1	2	2	3	3	2	2	2	3	2	2	3	2	3	3	2
CO5	3	2	1	2	2	1	1	1	2	2	3	3	3	1	2	1

VERTICAL V
DATA SCIENCE & EMERGING TECHNOLOGIES

CS4515	INTERNET OF THINGS ESSENTIALS	L	T	P	C
	(Common to IT)	3	0	0	3

OBJECTIVES

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

UNIT – I	INTRODUCTION TO IOT	9
What is IoT, Genesis, Digitization, Impact of IoT, Convergence of technology and IoT, Challenges, IoT Network Architecture and Design, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.		CO1
UNIT – II	**SENSORS & MODELS**	**9**
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, Domain model, information model, functional model, communication model, IoT reference architecture		CO2
UNIT - III	**NETWORK & TRANSPORT LAYER**	**9**
IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Network layer, 6LowPAN, CoAP, Security, The Transport Layer: IoT Application Transport Methods, Protocol Standardization for IoT, Efforts, M2M and WSN Protocols, SCADA and RFID, Protocols, Unified Data Standards, IEEE 802.15.4, BACNet Protocol, Modbus, Zigbee Architecture.		CO3
UNIT - IV	**IOT & DATA ANALYTICS**	**9**
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT.		CO4
UNIT - V	**PROGRAMMING WITH ARDUINO &**	**9**

	RASPBERRY	
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints, RaspberryPi: Introduction to RaspberryPi, Linux on Raspberry Pi,Raspberry Pi Interfaces, Programming Raspberry Pi with Python, An IoT Strategy for Smarter Cities, Smart City Use-Case Examples.		**CO5**
	Total Periods:	**45**

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017

REFERENCE BOOKS:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)
3. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012

Course Outcomes (CO)

CO1	Interpret the influence and challenges posed by IoT networks leading to novel architectural models.
CO2	Compare and contrast the application & implementation of smart objects and the technologies to connect them to real world network.
CO3	Evaluate the role of transport and network layer in an IoT architecture.
CO4	Elaborate the need for Data Analytics and Security in IoT.
CO5	Illustrate sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	2	-	-	-	-	-	1	1	2	1	2	2	2
CO2	2	2	2	1	-	-	-	-	-	1	1	2	2	2	1	2
CO3	1	1	3	2	-	-	-	-	-	1	1	2	2	1	1	1
CO4	1	2	2	1	-	-	-	-	-	1	1	3	1	1	2	1
CO5	1	1	3	1	-	-	-	-	-	1	1	2	1	1	1	1

CS4525	INTRODUCTION TO VIRTUAL REALITY AND AUGMENTED REALITY	L	T	P	C
	(Common to IT & ADS)	3	0	0	3

OBJECTIVES

- To gain the knowledge of historical and modern overviews and perspectives on virtual reality.
- To learn the fundamentals of sensation, perception, and perceptual training.
- To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.
- To learn the Evaluation of virtual reality from the lens of design.
- To learn the technology of augmented reality and implement it to have practical knowledge.

UNIT – I	INTRODUCTION	9
Introduction to Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR, VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.		CO1
UNIT – II	**VR SYSTEMS**	**9**
VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware: VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays, Methodology and terminology, user performance studies, VR health		CO2

and safety issues, Usability of virtual reality system, cyber sickness - side effects of exposures to virtual reality environment.		
UNIT - III	**STEREOSCOPIC VISION & HAPTIC RENDERING**	**9**
Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images.		**CO3**
UNIT - IV	**VR DEVELOPMENT**	**9**
Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, 3D interaction techniques: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation.		**CO4**
UNIT - V	**APPLICATIONS**	**9**
AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit, Medical applications, military applications, robotics applications, Advanced Real time Tracking, other applications, games, movies, simulations, therapy, Understanding Meta, AR VR in Cyber Currency.		**CO5**
	Total Periods:	**45**

TEXT BOOKS

1. George Mather, Foundations of Sensation and Perception: Psychology Press; 2ndedition, 2009.
2. The VR Book: Human-Centered Design for Virtual Reality, by Jason Jerald
3. Learning Virtual Reality by Tony Parisi, O' Reilly
4. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition.Wiley, IEEE Press, 2003/2006.
5. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

REFERENCE BOOKS

1. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016
2. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
3. Schmalstieg / Hollerer, "Augmented Reality: Principles & Practice", Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494

Course Outcomes (CO)	
CO1	Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR and AR experiences.
CO2	Describe how VR and AR systems work.
CO3	Choose, develop, explain, and defend the use of particular designs for AR and VR experiences.
CO4	Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body.
CO5	Identify and examine state-of-the-art AR and VR design problems and solutions from the industry and academia.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	-	-	-	-	-	-	-	-	2	2	2	2
CO2	1	2	2	-	2	-	-	-	-	-	-	1	2	2	2	2
CO3	1	2	2	-	-	-	-	-	-	-	-	2	2	2	2	2
CO4	1	2	2	-	2	-	-	-	-	-	-	1	2	2	2	2
CO5	1	2	2	2	3	-	-	-	-	-	-	2	2	2	2	2

CS4635	R PROGRAMMING IN DATA SCIENCE	L	T	P	C
	(Common to ADS)	2	0	2	3

OBJECTIVES

- To learn basics and importance of R programming
- To define and manipulate R data structures, including vectors, factors, lists, and data frames.
- To read, write, and save data files and to tabulate the data using Factors
- To create artful graphs to visualize complex data sets and functions and to query the database
- To perform statistical analysis on variety of data

UNIT I	**INTRODUCTION TO R PROGRAMMING**	**6**
History and overview of R - Install and configuration of R programming environment - Starting and ending R, R as a scientific calculator, handling package, workspace, inspecting variables, operators and expressions in R- Conditions and Loops –Functions: built-in and user-defined functions.		**CO1**
UNIT II	**DATA STRUCTURES AND DATA MANIPULATION**	**6**
Vectors - Combining multiple vectors - Arrays and Matrices, Lists – Creating lists - List operations – Applying functions to lists – Recursive lists, Data frames–Creating and Accessing Data frames - Merging Data Frames – Applying functions to Data frames, Data Transformation, Outlier Detection, String Operations - Regular Expressions - Date and Time Format		**CO2**
UNIT III	**WORKING WITH DATA**	**6**
Reading CSV, Excel, and Built-in Datasets - Reading Text Files - Writing and Saving to Files - HTTP Request and REST API - Web Scraping: Working with Messy Data - Renaming Columns(Variable Names) - Attaching / Detaching - Tabulating Data: Constructing Simple Frequency Tables - Ordering Factor Variables		**CO3**
UNIT IV	**GRAPHICS AND VISUALIZATION**	**6**
Visualize data using ggplot2package - Apply themes from ggthemes to refine and customize charts and graphs - Scatter Plots - Box Plots - Scatter Plots and Box and-Whisker Plots – Histograms - Building data graphics for dynamic reporting. Data Querying - Writing SQL statements - Using the Select, From, Where, Is, Like, Order By, Limit, Max, Min SQL functions.-Data wrangling with dplyr.		**CO4**
UNIT V	**STATISTICAL ANALYSIS**	**6**
Importing data files, exporting data, outputting results, exporting - Performing data analysis tasks: R commands for descriptive statistics, data aggregation, representation of multivariate data, code factorization and optimization, statistical libraries in R.		**CO5**
		TOTAL: 30 PERIODS

PRATICAL EXCERISES
Total Periods: 30

1. Download and install R-Programming environment and install basic packages using install.packages() command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)
3. Write a program to find list of even numbers from 1 to n using R-Loops.
4. Create a function to print squares of numbers in sequence.
5. Implement different data structures in R (Vectors, Lists, Data Frames)
6. Implement different String Manipulation functions in R.
7. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
8. R program for reading and writing different types of data sets
9. Reading different types of data sets(.txt,.csv) from web and disk and writing in specific disk location.
10. Write a program to read a csv file and analyze the data in the file in R.
11. Explore data using Single Variables: Unimodal, Bimodal, Histograms, Density Plots, Bar charts
12. Explore data using two Variables: Line plots, Scatter Plots, smoothing cures, Bar charts
13. Demonstrate the visualization and graphics using visualization packages.
14. Downloading and Importing Data
15. Creating Reports
16. Measures of Central Tendency, Variability and Correlations Downloading and Importing Data
17. Creating Reports
18. Measures of Central Tendency, Variability and Correlations

TEXT BOOKS

1. Garrett Grolemund and Hadley Wickham, R for Data Science Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media, 2016
2. Normal Maltoff, The Art of R programming O'Reilly Media, 2011

REFERENCE BOOKS

1. Purohit S. G., Gore S. D., Deshmukh S. K., ―Statistics using R‖, Narosa
2. Rizzo, M. L., ―Statistical Computing with R‖, Boca Raton, FL: Chapman & Hall/CRC Press
3. Learning resources:
   - R Project: http://www.r-project.org/
   - RStudio: http://www.rstudio.com
   - Quick-R: http://www.statmethods.net/

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand basics and importance of R programming
CO2	Understand data structures including vectors, factors, lists, and data frames.
CO3	Analyse the data files and to tabulate the data using Factors
CO4	Visualize complex data sets and functions and to query the database
CO5	Analyse and predict statistical data on variety of datasets

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2	2
CO2	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2	2
CO3	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2	2
CO4	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2	2
CO5	3	3	3	3	2	-	-	-	1	2	2	2	3	3	2	2

CS4745	NLP TOOLS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand natural language processing.
- To learn how to apply basic algorithms in this field.
- To get acquainted with the algorithmic description of the main language levels:
  morphology, syntax, semantics, and pragmatics, as well as the resources of natural language data - corpora.

UNIT – I	**SOUND**	**9**
Biology of Speech Processing-Place and Manner of Articulation-Word Boundary Detection- Argmax based computations- HMM and Speech Recognition.		**CO 1**
UNIT – II	**WORDS AND WORD FORMS**	**9**
Morphology fundamentals- Morphological Diversity of Indian Languages- Morphology Paradigms-Finite State Machine Based Morphology- Automatic Morphology Learning-Shallow Parsing- Named Entities-Maximum Entropy Models-Random Fields.		**CO2**
UNIT - III	**STRUCTURES**	**9**
Theories of Parsing, Parsing Algorithms- Robust and Scalable Parsing on Noisy Text as in Web documents-Hybrid of Rule Based and Probabilistic Parsing- Scope Ambiguity and Attachment Ambiguity resolution.		**CO3**
UNIT - IV	**MEANING**	**9**
Lexical Knowledge Networks, Wordnet Theory- Indian Language Wordnets and Multilingual Dictionaries- Semantic Roles- Word Sense Disambiguation-WSD and Multilinguality- Metaphors- Coreferences		**CO4**
UNIT - V	**WEB 2.0 APPLICATIONS**	**9**
Sentiment Analysis-Text Entailment- Robust and Scalable Machine Translation- Question Answering in Multilingual Setting-Cross Lingual Information Retrieval (CLIR).		**CO5**
	Total Periods:	**45**

TEXT BOOKS:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

REFERENCE BOOKS:

1. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
2. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
3. Any other Study Material: https://nptel.ac.in/syllabus/106101007/

COURSE OUTCOMES (CO)

CO1	To understand natural language processing.
CO2	To learn how to apply basic algorithms in this field.
CO3	To get acquainted with the algorithmic description of the main language levels
CO4	To know about lexical knowledge networks, word sense disambiguation and wordnet theory.
CO5	To Learn the basics of sentiment analysis, machine translation and cross lingual information retrieval.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2	2	1	1	-	2	2	3	3	3	1	2	1
CO2	3	2	1	2	3	2	1	-	3	2	3	3	3	1	2	1
CO3	1	2	2	3	3	2	2	-	3	2	2	3	2	3	3	2
CO4	1	2	2	3	3	2	2	-	3	2	2	3	2	3	3	2
CO5	3	2	1	2	2	1	1	-	2	2	3	3	3	1	2	1

CS4855	PREDICTIVE ANALYTICS	L	T	P	C
	(Common to ADS)	3	0	0	3

COURSE OBJECTIVES

The main objectives of this course are to:

- To learn, how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, logistic regression, support vector machines and , K-nearest –Neighbour classifiers.
- To know the use of the binary classifier and numeric predictor nodes to automate model selection.
- To advice on when and how to use each model.
- Also learn how to combine two or more models to improve prediction
- To learn about supervised and unsupervised learning

UNIT I	LINEAR METHODS FOR REGRESSION AND CLASSIFICATION	9
Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.		CO1
UNIT II	MODEL ASSESMENT AND SELECTION	9
Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Esimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error.		CO2
UNIT III	ADDITIVE MODELS, TREES AND BOOSTING	9
Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, NewZealand fish, Demographic data)		CO3
UNIT IV	NEURAL NETWORKS(NN) , SUPPORT VECTOR MACHINES(SVM), AND K-NEAREST NEIGHBOR	9
Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest –Neighbour classifiers(Image Scene Classification)		CO4
UNIT V	UNSUPERVISED LEARNING AND RANDOM FORESTS	9
Association rules, Cluster analysis, Principal Components, Random forests and analysis.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, "Predictive Analytics For Dummies", Wiley Publisher, 2nd Edition, 2016.
2. Dean Abbott, Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Wiley Publishers, 1st Edition 2014
3. C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop simple applications regression and classifications.
CO2	Design and implement model assessment and selection.
CO3	Develop and implement applications using additive models.
CO4	Develop applications using neural network and support vector machine.
CO5	Design applications using cluster and random forest analysis.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2
CO2	3	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2
CO3	3	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2
CO4	3	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2
CO5	3	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2

CS4865	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES

- The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focusses on how digital marketing can be utilized by organizations and how its effectiveness can measure.

UNIT I	INTRODUCTION TO DIGITAL MARKETING	9
Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand- Website - Planning and Creation- Content Marketing.8		CO1
UNIT II	**SEARCH ENGINE OPTIMISATION**	**9**
Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.		CO2
UNIT III	**E-MAIL MARKETING**	**9**
E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximising email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns- Profiling and targeting.		CO3
UNIT IV	**SOCIAL MEDIA MARKETING STRATEGIES**	**9**
Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz .Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.		CO4
UNIT V	**DIGITAL TRANSFORMATION**	**9**
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia; Publisher: Pearson Education; First edition (July 2017).
2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press (April 2015)

REFERENCE BOOKS

1. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler; Publisher: Wiley; 1st edition (April 2017);
2. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.
3. Pulizzi, J Beginner's Guide to Digital Marketing, Mcgraw Hill Education.
4. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western, Cengage Learning.

COURSE OUTCOMES

CO1	To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
CO2	To focusses on how digital marketing can be utilised by organisations and how its effectiveness can measured.
CO3	To know the key elements of a digital marketing strategy
CO4	To study how the effectiveness of a digital marketing campaign can be measured
CO5	To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

MAPPING OF COs WITH POs AND PSOs

COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	3	3	1	1	2	1	3	1	2	2	2	1
CO2	3	3	2	1	3	1	1	2	1	1	1	1	2	2	2	1
CO3	3	3	3	2	1	1	2	1	3	1	1	2	2	2	2	1
CO4	3	3	2	2	3	3	2	1	1	1	3	2	2	2	2	1
CO5	3	2	2	1	2	2	2	3	1	1	2	2	2	2	2	1

MANDATORY COURSES I

MX4001	INTRODUCTION TO WOMEN AND GENDER STUDIES	L	T	P	C
(Common to all branches of B.E. / B. Tech Programmes)		3	0	0	0

OBJECTIVES

- To enhance social sensitivity, sensibility and responsibility thereby instilling the life skills among students, through applied learning.
- To upgrade knowledge and comprehension of gender issues for attitudinal and behavioural changes among marginalized groups to claim the right to life with dignity and equality through extension and collaborative activities.
- To evolve inclusive approach for holistic development in order to promote women empowerment

UNIT I	INTRODUCTION TO WOMEN'S STUDIES	
Key concepts in Gender studies - Need, Scope and challenges of Women's Studies – Women's Studies as an academicdiscipline - Women's Studies to Gender Studies - Need for Gender Sensitization - Women's Movements – global and local: Pre-independence - Post-independence andContemporary Debates - National Committees and Commissions for Women.		**CO1**
UNIT II	**FEMINIST THINKERS AND THEORIES**	
Liberal Feminism - Marxist Feminism - Radical Feminism - Socialist Feminism - Indian Feminism - Black Feminism - Eco-Feminism - New Feminist Debates- Post Colonial /Post Modern - Masculinity Studies - Contemporary Contestations – Intersex and Transgender Movements. Feminist thinkers in 18^{th}, 19^{th}, 20h and 21^{st} Century.		**CO2**
UNIT III	**GENDER AND EDUCATION**	
Women's Education – Gender diversities and disparities in enrolment, Curriculum content, Dropouts, profession and Gender - Gendered Education- Family, Culture, Gender roles, Gender Identities -Education for the Marginalized Women - Recent Trends in Women's Education – Committees and Commissions on Education - Vocational education and skill Development for women.		**CO3**

UNIT IV	WOMEN, WORK AND EMPLOYMENT	
Theoretical Perspective: Fredrick Engels, Rosa Luxemburg, Sandra Whiteworth, Boserup Esther -Concept of Work – Productive and non – productive work – Use value and market value - Gender Division of Labour – Mode of Production – Women in organized and unorganized sector - New Economic Policy and its impact on Women's Employment – Globalization –Structural Adjustment Programs.		**CO4**
UNIT V	**GENDER AND ENTREPRENEURSHIP**	
Concept and meaning, Importance of Entrepreneurship, Entrepreneurial traits, Factors contributing to Entrepreneurship, enabling environment, small Enterprises, women in agri-business - Gender and emerging Technology – Impact - Self-help Groups and Micro Credit - Gender mainstreaming, Gender budgeting, planning and Analysis.		**CO5**

TEXT BOOKS

1. Jaya Kothari Pillai- 1995, Women and Empowerment, New Delhi: Gyan Publishing House
2. JoRoland–: 1997, Questioning Empowerment, Oxfam Oxford.
3. Janet Townsend etal-: 1999, Women and Power, Fighting Patriarchy and Poverty. Zed Books, London.
4. Naila Kabeer: 1996, Reversed Realities, Kali for women, New Delhi.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To enhance the social sensitivity, sensibility and responsibility thereby instilling the life skills among students.
CO2	To upgrade knowledge and comprehension of gender issues for attitudinal and behavioral change among men, women and transgender etc. to claim the right to life with dignity and equality.
CO3	To bring social, economic, political and cultural empowerment and gender equality in personal as well Professional life.
CO4	To crystallize the teaching of Women's Studies in term of teaching, research and extension. in order
CO5	To create more gender equality and equity world by education, sensitization and empowerment.

MAPPING OF COs WITH POs AND PSOs

COs	Pos											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	-	-	-	1	-	1	-	-	-	1
CO2	-	-	-	-	-	1	-	1	-	-	-	1
CO3	-	-	-	-	-	1	-	1	-	-	-	1
CO4	-	-	-	-	-	1	-	1	-	-	-	1
CO5	-	-	-	-	-	1	-	1	-	-	-	1

MX4002	**ELEMENTS OF LITERATURE**	**L**	**T**	**P**	**C**
(Common to all branches of B.E. / B. Tech Programmes)		3	0	0	0

OBJECTIVES

1. To understand the recent contexts, concepts and ideologies.
2. To acquaint themselves with the major generic divisions in English literature.
3. To acknowledge the conventions of literary research and documentation.

UNIT I	**KEY ELEMENTS OF LITERATURE**	
Language - Plot - Setting/Milieu - Character - Theme - Point of View - Tone/Mood.		**CO1**
UNIT II	**PROSE**	
The form of prose - written and spoken prose - individual and common style - simplicity and ornamentation - abstract and concrete - realism, romance and unreality - the science of rhetoric.		**CO2**
UNIT III	**POETRY**	
The importance of form - the physical form of poetry - metre - variation - rhyme - internal pattern - logical sequence - the use of associations - patterns of imagery the main types of poetry.		**CO3**
UNIT IV	**NOVEL**	
The concept of fiction - verisimilitude - the point of view - plot - character - character revealed - conversation - scene and background - dominant themes - the experimental novel.		**CO4**

UNIT V	DRAMA	
Live literature - action - plots - conventional divisions - direct experience of characters - dialogue and conversation - verse and prose - types of drama - drama and history - use of notes – interpretation.		**CO5**

TEXT BOOKS

1. Barnet Sylvan, Types of Drama; Plays and Essays, Boston, Little Brown, 1981.
2. Brooks, Peter, Reading for the Plot; Design and Intention in Narrative, Oxford, Clarendon Press, 1984.
3. Hardings D.W., Words Into Rhythm; English Speech, OUP, New Delhi, 1976.
4. Murfin, Ross, and Supriya M. Ray. The Bedford Glossary of Critical and Literary Terms. New York: Macmillan Press Ltd., 1997.
5. Paul, Poplawski, ed. English Literature in Context. London: CUP,2008.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Comprehend various forms of literature like prose, poetry, drama and fiction.
CO2	Interpret and appreciate the didactic purpose in literature.
CO3	Identify the poetic devices to the connection of poems.
CO4	Describe the process and origin of the development of drama in its structure with the text.
CO5	Define the various types of novels with their structure

MAPPING OF COs WITH POs AND PSOs

COs	Pos											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	-	-	-	1	-	1	-	-	-	1
CO2	-	-	-	-	-	1	-	1	-	-	-	1
CO3	-	-	-	-	-	1	-	1	-	-	-	1
CO4	-	-	-	-	-	1	-	1	-	-	-	1
CO5	-	-	-	-	-	1	-	1	-	-	-	1

MX4003	Personality Development Through Life Enlightenment Skills	L	T	P	C
(Common to all branches of B.E. / B. Tech Programmes)		3	0	0	0

OBJECTIVES

- ❖ To develop inter personal skills and be an effective goal-oriented team player.
- ❖ To develop professionals with idealistic, practical and moral values.
- ❖ To develop communication and problem-solving skills.
- ❖ To re-engineer attitude and understand its influence on behavior

UNIT I	
Neetisatakam-Holistic development of personality I Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue)	**CO2** **CO3**
UNIT II	
Neetisatakam-Holistic development of personality II Verses- 52,53,59 (don'ts), Verses- 71,73,75,78 (do's)	**CO2** **CO3**
UNIT III	
Approach to day-to-day work and duties. Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	**CO2** **CO1**
UNIT IV	
Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 - Verses 13, 14, 15, 16,17, 18	**CO2** **CO1**
UNIT V	
Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63.	**CO2** **CO1**

TEXT BOOKS

1. "Srimad Bhagavad Gita" by Swami Swarupananda, Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

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

CO1	Study of Shrimad Bhagwad Geeta will help the student in developing his personality and achieve the highest goal in life.
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity.
CO3	Study of Neetishatakam will help in developing versatile personality.

MAPPING OF COs WITH POs AND PSOs

COs	**Pos**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	-	-	-	1	-	1	-	-	-	1
CO2	-	-	-	-	-	1	-	1	-	-	-	1
CO3	-	-	-	-	-	1	-	1	-	-	-	1

MX4004	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

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

UNIT I	INTRODUCTION TO DISASTERS	9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.		**CO1**
UNIT II	**APPROACHES TO DISASTER RISK REDUCTION (DRR)**	**9**
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake- holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.		**CO2**
UNIT III	**INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**	**9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.		**CO3**
UNIT IV	**DISASTER RISK MANAGEMENT IN INDIA**	**9**
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment		**CO4**
UNIT V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**	**9**
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, NewDelhi, 2010.

REFERENCE BOOKS

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Differentiate the types of disasters, causes and their impact on environment and society
CO2	Assess vulnerability and various methods of risk reduction measures as well as mitigation
CO3	Draw the hazard and vulnerability profile of India, Scenarios in the Indian context,
CO4	Know about the relief measures, Disaster damage assessment and management.
CO5	Learn through case studies about the damages caused due to various disasters.

MAPPING OF COs WITH POs AND PSOs

COs	**Pos**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	3	-	-	3	3	-	-	-	-	2
CO2	-	-	3	-	-	3	3	-	-	-	-	2
CO3	-	-	3	-	-	3	3	-	-	-	-	2
CO4	-	-	3	-	-	3	3	-	-	-	-	2
CO5	-	-	3	-	-	3	3	-	-	-	-	2

MA7003	**PRACTICES**	**L**	**T**	**P**	**C**
		3	**0**	0	0

OBJECTIVES

- Explaining the purpose of well-being and impact it has on their work and life
- To teach basic methods used in the systems of Ayurveda, Siddha and Yoga
- Identify key factors that contribute to work place burnout and sustainability.

Unit1	**HEALTH AND HAPPINESS**	**9**
Mental and physical health, physical and emotional safety, and a feeling of belonging, sense of purpose, achievement and success.Need for Managing Self, Positive Psychology and Yoga.		**CO1**
Unit 2	WELL BEING	**9**
Health and Wellbeing: Perspectives from Positive Psychology, Yoga and Ayurveda, Attaining Wellbeing – Methods, Obstacles, Realms and Types of Interventions for Managing Self and Career		**CO2**
Unit 3	**YOGA PRACTICES**	**9**
Definitions of Eight parts of yoga.(Ashtanga). Asan and Pranayam - Various yoga poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam		**CO3**
Unit 4	**AYURVEDA PRACTICS**	**9**
Health Benefits of Ayurveda, Ayurvedic techniques: Diet, Herbal, Acupuncture, Massage and Meditation. Ayurveda and allied disciplines –Approach to health disease in Ayurveda		**CO4**
Unit 5	**BASIC CONCEPTS AND PRINCIPLES OF SIDDHA MEDICINE**	**9**
Principles of Siddha- the five natural elements and three humours, Physical constituents.		**CO5**
		TOTAL: 45 PERIODS

TEXT BOOKS

TEXT BOOK

1. Mental health and well-being in workplace by Gillhassan and Donna Butler.
2. Yogic Asanas for Group Training - Part- I": Janardan Swami Yogabhyasi Mandal, Nagpur.
3. Textbook of Ayurveda: Volume 1 - Fundamental Principles of Ayurveda by Dr Vasant Lad.
4. Siddha medicine handbook of traditional remedies by Paul Joseph

REFERENCE BOOKS

1. The Social Psychology of Mental Health: Basic Mechanisms and Applications by Diane N Ruble
2. "Raja yoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama Publication Department, Kolkata**.**

COURSE OUTCOME

CO1	To create awareness about health and happiness
CO2	To develop healthy mind in a healthy body thus improving social health also
CO3	To educate the importance of various yoga asanas
CO4	To know the values of ayurveda system
CO5	To understand the importance of siddha medicine.

MAPPING OF COs WITH POs AND PSOs

COs	**Pos**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	3	2	2	2	3	2	2	2
CO2	3	2	3	3	2	2	2	2	2	2	2	3
CO3	3	3	2	3	2	2	2	3	3	2	2	2
CO4	3	3	3	2	2	2	3	3	3	2	2	2
CO5	2	3	2	2	3	2	2	2	3	2	2	2

MX4006	HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA	L	T	P	C
		3	0	0	0

OBJECTIVES

- To provide an exposure to the development of science and technology in India
- To impart authentic knowledge of India's scientific and technological traditions.
- To provide an understanding of the socio-cultural and philosophical context in which science and technology developed.
- To help in repositioning India's contributions in science and technology

Unit1	**Introduction**	**9**
Logic and methodology of Indian sciences - An overview of Indian contributions to sciences - An overview of Indian contributions to technology		**CO1**
Unit 2	**Astronomy**	**9**
Development of astronomy in India- Pancanga: Indian calendrical computations- The distinct features of Indian planetary models- Computation of eclipses: Its simplicity- elegance and efficiency- Observational astronomy in India		**CO2**
Unit 3	**Mathematics**	**9**
An overview of the development of mathematics in India – Mathematics contained in Sulbasutras – combinatorial aspects of the Chandassastra – Solutions to the first and second order indeterminate equations- Weaving mathematics into beautiful poetry: Bhaskaracarya – The evolution of sine function in India – The discovery of calculus by Kerala astronomers.		**CO3**
Unit 4	**Ayurveda**	**9**
History of Ayurveda – Rational foundations of Ayurveda – Textual sources in Ayurveda – Ayurveda and allied disciplines –Approach to health disease in Ayurveda – Approach to diet and nutrition in Ayurveda – Ayurveda and modern medicine – Ayurveda and Yoga		**CO4**

Unit 5	Technological development in India	9
Agriculture: Origin and development- ancient crops- Traditional practices Water management: Overview- Harappan water management- Other case studies- Medieval Water structures Pottery: Overview- Technical aspects Silpasastra: Architecture and Construction: An introduction to Silpasastra- Construction Technology Metallurgy: Copper/Bronze/Zinc- Iron and Steel Technology in India		CO5
		TOTAL: 45PERIODS

TEXT BOOKS

1. Suvobrata Sarkar, History of Science, Technology, Environment, and Medicine in India, Taylor & Francis, London
2. NeeraMisra, Sabareesh P.a. 2022, A Brief History of Science in India, Garuda Prakashan Private Limited.
3. Prittam Dutta 2021, WHAT IS ASTRONOMY ?, Notion Press

REFERENCE BOOKS

1. D. P. Chatpathayaya, History of science, philosophy, and culture in India civilization, Uma das Gupta, Pearson Education.
2. Bryan Bunch, Bryan H. Bunch, Alexander Hellemans, The History of Science and Technology, Houghton Mifflin.
3. Projit Bihari Mukharji · 2016, Doctoring Traditions-Ayurveda, Small Technologies, and Braided Sciences, University of Chicago Press

COURSE OUTCOME

CO1	Gain knowledge on Indian sciences
CO2	Able to understand the evolution of stars as well as of the large-scale structure of the Universe
CO3	Can use to solve problems involved in arithmetic, algebra, geometry, and other fields of mathematics
CO4	Helps in understanding each individual at a very subtle, personal level and gives a detailed protocol for diet, daily routines and activities to be followed.
CO5	Gain knowledge on origin of agriculture, technical aspects of pottery and silpasastra

MAPPING OF COs WITH POs AND PSOs

COs	Pos											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	-	1	-	-	2	2	-	-	-	2
CO2	2	2	1	1	1	2	2	1	-	-	1	3
CO3	3	3	2	1	1	-	-	-	1	-	1	2
CO4	1	-	-	-	-	3	3	1	-	-	-	3
CO5	2	2	1	1	2	3	3	1	-	-	-	2

MX4007	**POLICAL AND ECONOMIC THOUGHT FOR HUMAN SOCIETY**	**L**	**P**	**T**	**C**
		3	0	0	3

OBJECTIVES

- To understand the concept of political science and theories of political science.
- To know the types of political socialization and their role.
- To explore various theories of economic thought.
- To learn the importance of human values of life.

UNIT I	**POLITICAL THOUGHTS**	9
Political science: Definition, Nature & Scope; Relation of Political Science with other Social Sciences; Traditional approaches to the study of Political Science: Normative, Empirical and Feminist-State: Definition; Elements; Relation with other organizations; Theories of origin of state (Theory of Divine, Force, and Evolutionary); Sovereignty- definition and characteristics.		CO1
UNIT II	**POLITICAL CULTURE AND POLITICAL SOCIALIZATION**	9
Meaning and dimensions of political culture, meaning and types of political socialization agencies of political socialization and their role- Meaning and types of political participation, political apathy – reasons for political apathy, Determinants of political participation –		CO2

psychological, social and political.		
UNIT III	**HISTORY OF ECONOMIC THOUGHT**	9
Nature and Importance of Economic thought – Approaches of Economic Thought – Scholastics – Mercantilism, French and English – Thomas Munn – Scientific Method and the French Physiocrats – Quesnay – The Classical School – Adam Smith – Division of Labour – Ricardo and Theory of Rent – Comparative Cost Theory – Stationary State – Malthus and Theory of Population and Theory of Gluts.		CO3
UNIT IV	**ECONOMIC BEHAVIOUR AND MORAL SENTIMENTS**	9
Importance of ethics in economics; Outcomes of ethical analysis; Duties, rules and virtues; Economic behaviour: Self-interest and rational behaviour- Adam Smith and self-interest - Social Philosophy (Naturalism, Optimism, Self Interest, Invisible hand, Laisseze faire); Economic ideas: Wealth, Labour & Division of labour, Value, Distribution.		CO4
UNIT V	**HUMAN VALUES**	9
Value Education, Self-Exploration - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Method to fulfill the human Values, understanding and living in harmony at various levels.		CO5
		TOTAL: 45 PERIODS

TEXT BOOKS

1. Bhargava, R. (2008) 'What is Political Theory', in Bhargava, R and Acharya, A. (eds.) Political Theory: An Introduction. New Delhi: Pearson Longman.
2. Olivier Blanchard and David R. Johnson, Macroeconomics, Sixth Edition, Pearson, 2017.
3. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

REFERENCE BOOKS

1. O.P.Gauba, (2015) An Introduction to Political Theory, New Delhi: Mayur Publishers.
2. Ashaf, Ali and Sharma B.N. 2001.Political Sociology, University Press, Hyderabad .
3. Jonathan Conlin, Great Economic Thinkers: From Adam Smith to Amartya Sen, Speaking Tiger Publishing, 2018.
4. Linda Yueh, The Great Economists: How Their Ideas Can Help Us Today, Viking, 2018.
5. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Book.
6. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
7. Irene van Staveren, The Values of Economics: An Aristotelian Perspective, London: Routledge, 2001

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To explain the traditional approached of political science and theories of state.
CO2	To identify the political culture, socialization, participation and apathy.
CO3	To understand the importance of economic thought and their approaches.
CO4	To explore the economic behaviour and moral sentiments of the individuals.
CO5	To learn the human values for harmony and to build better relationships.

MAPPING OF COs WITH POs AND PSOs

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

MX4008	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

OBJECTIVE

- To impart knowledge on safety engineering fundamentals and safety management practices.

UNIT I	INTRODUCTION	9
Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.		CO1
UNIT II	**CHEMICAL HAZARDS**	**9**
Chemical exposure – Toxic materials – Ionizing Radiation and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.		CO2
UNIT III	**ENVIRONMENTAL CONTROL**	**9**
Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.		CO3
UNIT IV	**HAZARD ANALYSIS**	**9**
System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment		CO4
UNIT V	**INDUSTRIAL SAFETY**	**9**
Explosions – Disaster management – catastrophe control, hazard control, Safety education and training - Factories Act, Safety regulations Product safety – case studies.		CO5

TOTAL: 45 PERIODS

TEXTBOOKS

1. John V.Grimaldi, “Safety Management”, AITB S Publishers, 2003.

REFERENCE BOOKS

1. Safety Manual, “EDEL Engineering Consultancy”, 2000.
2. David L.Goetsch, “Occupational Safety and Health for Technologists”, 5th Edition, Engineers and Managers, Pearson Education Ltd., 2005

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the modern safety concepts and Mechanical hazards
CO2	Identify the effects of Chemical exposure and Toxic materials
CO3	Understand the Industrial Health Hazards due to environment
CO4	Understand the System Safety Analysis Techniques
CO5	Understand the Factories Act, Safety regulations

MAPPING OF COs WITH POs AND PSOs

COs	Pos											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	3	-	-	3	2	2	-	-	-	3
CO2	-	-	3	-	-	3	2	2	-	-	-	3
CO3	-	-	3	-	-	3	2	2	-	-	-	3
CO4	-	-	3	-	-	3	2	2	-	-	-	3
CO5	-	-	3	-	-	3	2	2	-	-	-	3

OPEN ELECTIVE I

OEE411	**INTRODUCTION TO RENEWABLE ENERGY SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

- To create awareness about renewable and non-renewable Energy Sources, technologies and its impact on the environment
- To learn wind energy conversion system and its issues with grid integration.
- To learn the concepts of solar PV and solar thermal systems.
- To learn other alternate energy sources such as Biomass, geothermal energy and hydro energy variety of issues in harnessing.
- To understand the concept of tidal energy, hydrogen energy, ocean thermal energy and its significance.

UNIT I	**RENEWABLE ENERGY SOURCES**	**9**
Conventional energy sources- Fossil Fuels, Types of fossil fuel, Environmental consequences of fossil fuel use, non-Conventional energy sources- Renewable energy (RE) and its types, Significances of renewable energy sources, Sustainable Design and development, Effects and Limitations of RE sources.		**CO1**
UNIT II	**WIND ENERGY**	**9**
Wind formation, Power in the Wind – WPP (wind power plant)- Components of WPPs -Types of Wind Power Plants (WPPs)– Working of WPPs- Siting of WPPs-Grid integration issues of WPPs.		**CO2**
UNIT III	**SOLAR - THERMAL SYSTEMS AND PV SYSTEMS**	**9**
Solar Radiation, Radiation Measurement, Solar Thermal system and its types, Solar Photovoltaic systems (SPV) : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array, I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections - Applications.		**CO3**
UNIT IV	**BIOMASS, GEOTHERMAL AND HYDRO ENERGY SOURCES**	**9**
Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Essential components of hydroelectric system.		**CO4**
UNIT V	**OTHER ENERGY SOURCES**	**9**
Tidal Energy: Energy from the tides, Barrage and Non-Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Hydrogen Production and Storage- Fuel cell: Principle of working- various types - construction and applications.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2015.
2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources

and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.

3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCE BOOKS

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011
2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.
3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011
4. Bradley A. Striebig, AdebayoA.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.
5. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.
7. NPTEL Video Lecture Notes on "Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems" by Prof. Vaibhav Vasant Goud, Prof. R. Anandalakshmi, IIT Guwahati.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Ability to create awareness about non- renewable and renewable Energy Sources and technologies
CO2	Acquire knowledge on the concepts of wind energy conversion system, siting and grid related issues.
CO3	Ability to understand the solar PV and solar thermal systems
CO4	Ability to analyse other types of renewable energy resources like biomass, geothermal and Hydro energy.
CO5	Ability to Acquire knowledge on tidal energy, hydrogen energy, ocean thermal energy and fuel cell.

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

OMA411	**GRAPH THEORY AND ITS APPLICATIONS**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES

- ❖ To introduce the basic notions of graphs and trees which will then be used to solve related problems.
- ❖ To introduce and apply the concepts of trees, connectivity and planarity.
- ❖ To understand the basic concepts of colouring in graph theory.
- ❖ To understand the basic concepts of permutations and combinations.
- ❖ To acquaint the knowledge of recurrence relations and generating function.

UNIT I	**INTRODUCTION OF GRAPHS**	**9**
Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.		**CO1**
UNIT II	**TREES, CONNECTIVITY AND PLANARITY**	**9**
Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planer graphs – Different representation of a planer graph.		**CO2**

UNIT III	MATRICES, COLOURING AND DIRECTED GRAPH	9
Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.		**CO3**
UNIT IV	**PERMUTATIONS AND COMBINATIONS**	**9**
Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.		**CO4**
UNIT V	**GENERATING FUNCTIONS**	**9**
Generating functions - Partitions of integers - Exponential generating function – Summation operator - Recurrence relations - First order and second order – non-homogeneous recurrence relations - Method of generating functions.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", Prentice Hall of India, 2003.
2. Grimaldi R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley, 1994.

REFERENCE BOOKS

1. Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.
2. Mott J.L., Kandel A. and Baker T.P. "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice Hall of India, 1996.
3. Liu C.L., "Elements of Discrete Mathematics", Mc Graw Hill, 1985.
4. Rosen K.H., "Discrete Mathematics and Its Applications", Mc Graw Hill, 2007.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Write precise and accurate mathematical definitions of objects in graph

	theory.
CO2	Use mathematical definitions to identify and construct examples and to distinguish examples from non-examples.
CO3	Validate and critically assess a mathematical proof.
CO4	Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.
CO5	Reason from definitions to construct mathematical proofs.

MAPPING OF COs WITH POs AND PSOs

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

OEC412	**FOUNDATIONS OF ROBOTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

- ❖ To comprehend how a robot's fundamental parts work.
- ❖ To examine how different Ends of Effector and sensors are used.
- ❖ To disseminate information on programming and robot kinematics.
- ❖ To learn about the economics, safety, and future of robots.

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

UNIT II	**SYSTEMS FOR ROBOT DRIVE AND ENDEFFECTORS**	**9**
Pneumatic Drives - Hydraulic Drives - Mechanical Drives - Electrical Drives - D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison - End effectors - Classification, Types of Mechanical actuation, Gripper design, Robot drive system Types, Position, and velocity feedback devices - Robot joints and links - Types, Motion interpolation.		**CO2**
UNIT III	**SENSORS AND MACHINE VISION**	**9**
Sensors in robots: Touch Sensors, Tactile Sensors, Proximity, and range sensors, Force sensor, Light sensors, Pressure sensors - Triangulation Principles Structured - Lighting Approach, Time of Flight, Camera, Frame Grabber, Sensing and Digitizing Image Data - Signal Conversion, Image Storage, Lighting Techniques, Image Processing, and Analysis - Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications Inspection, Identification, Visual Serving and Navigation.		**CO3**
UNIT IV	**KINEMATICS AND PROGRAMMING FOR ROBOTS**	**9**
Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation -Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point-to-point, Continuous Path Control, Robot programming - Introduction to Artificial Intelligence.		**CO4**
UNIT V	**ROBOT APPLICATIONS AND ECONOMIC IMPLEMENTATION**	**9**
RGV, AGV, Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, and Disaster management. Applications, Micro and Nanorobots, Future Applications. - Robotics adoption in Industries - Safety Considerations for Robot Operations - Economic Analysis of Robots.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Klafter R.D., Chmielewski T.A, and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.
2. Bruno Siciliano, Oussama Khatib, "Springer Handbook of Robotics", Springer, 2008.

REFERENCE BOOKS

1. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.
2. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, "Industrial Robotics Technology, Programming and Applications", Tata – McGraw Hill Pub. Co., 2008.
3. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
4. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill, 1995.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	List and describe the fundamental components of industrial robots.
CO2	Examine the kinematics and control strategies of the robot.
CO3	To improve performance, classify the numerous robot sensors.
CO4	Able to apply basic engineering knowledge for the design of robotics
CO5	To list the different commercial and noncommercial uses of robots.

MAPPING OF COs WITH POs AND PSOs

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

OEC413	EMBEDDED SYSTEMS	L	T	C
		3	0	3

OBJECTIVES

- ❖ To study about the building blocks of the Embedded System
- ❖ To teach a student how to analyze requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- ❖ To introduce the technologies for implementation Internet of Things (IoT).

UNIT I	INTRODUCTION TO EMBEDDED SYSTEMS	9
Embedded Systems definition – Embedded Systems Vs General Computing Systems, History of Embedded Systems, Functional blocks of Embedded processor, selection of processor & memory devices- Direct Memory Access – Memory management techniques- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator.		CO1
UNIT II	**NETWORKING FOR EMBEDDED DEVICES**	**9**
Introduction to Embedded Networking, Concepts of Ports, Buses– Serial Bus communication protocols RS232 standard – Parallel Communication - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – Device Drivers – USB Bus.		CO2
UNIT III	**EMBEDDED FIRMWARE DEVELOPMENT AND PROGRAMMING**	**9**
Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.		CO3
UNIT IV	**RTOS BASED EMBEDDED SYSTEM DESIGN**	**9**
RTOS Definition – RTOS Basics – Concepts of Interrupts, routines in RTOS - Task, process & threads, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.		CO4

UNIT V	CASE STUDIES	9
Various applications of Embedded system based in Home automations – Design of embedded devices in Smart cities – Implementing in Environment – Case study of Embedded based system in Logistics – Agriculture – Industry - Health and life style .		CO5

TOTAL: 45 PERIODS

TEXT BOOKS

1. Peckol, "Embedded system Design", John Wiley & Sons,2010.
2. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013

REFERENCE BOOKS

1. Raj Kamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013,
2. C.R.Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
3. Marilyn Wolf, ―Computers as Components - Principles of Embedded Computing System Design‖, Third Edition ―Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
4. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To understand the Embedded systems
CO2	Analyze the networking in an embedded system for a given application.
CO3	To understand the firmware and programming concepts of embedded systems.
CO4	Ability to understand basics of Real time operating system.
CO5	To Analyze applications of IoT in real time scenario.

MAPPING OF COs WITH POs AND PSOs

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

OEC414	BASICS OF BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ To study about the biopotentials and its propagation
- ❖ To understand the different types of electrodes and its placement for various recording
- ❖ To study the design of bio amplifier for various physiological recording
- ❖ To learn different measurement techniques for non-physiological parameters
- ❖ To discuss the recent trends in the field of diagnostic and therapeutic equipment

UNIT I	BIOPOTENTIAL RECORDING AND ELECTRODE TYPES	9
Biopotential origin and its propagation. Types of electrodes and its equivalent circuits - surface, needle and micro electrodes. Recording problems - measurement with two electrodes		CO1
UNIT II	**FEATURES OF BIOSIGNAL AND ELECTRODE CONFIGURATIONS**	**9**
Features of Bio-signal – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system. EEG – unipolar, bipolar, average mode and 10-20 electrode system. EMG– unipolar and bipolar mode.		CO2
UNIT III	**BIOAMPLIFIER CIRCUITS AND ASSIST DEVICES**	**9**
Basic requirements for bio-amplifier - differential bio-amplifier, PLI, Right leg driven ECG amplifier, Band pass filtering. Assist Devices- Dialyzer, Cardiac Pacemakers, and Heart Lung Machine.		CO3
UNIT IV	**MEASUREMENT OF NON-ELECTRICAL AND BIO-CHEMICAL PARAMETERS**	**9**
Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, direct methods: electronic manometer, Systolic, diastolic pressure, Blood flow and cardiac output measurement: Indicator dilution, and dye dilution method. Calorimeter, Sodium Potassium Analyzer, auto analyzer		CO4

(simplified schematic description).		
UNIT V	**CURRENT TRENDS IN MEDICAL DEVICES**	**9**
Laser in medicine and its applications, Thermograph – System, working, endoscopy unit, Cryogenic application, Introduction to tele-medicine.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi,2007.
2. John G. Webster, "Medical Instrumentation: Application and Design", John Wiley and sons, NewYork,2004.(Unit I,II&III).

REFERENCE BOOKS

1. MyerKutz, "Standard Handbook of Biomedical Engineering and Design", McGraw Hill Publisher, 2003.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.(Unit II&IV)
3. Joseph J. Carr and John M Brown, "Introduction to Biomedical Equipment Technology", Pearson Education,2004.
4. Chan and Anthony Y.K, ''Biomedical Device Technology: Principles and Design'', Springfield, Illinois : Charles C. Thomas publisher Limited,2016.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To acquire knowledge about biopotentials and its propagation
CO2	To get familiarized with different electrode placements for various physiological recording
CO3	To design bio amplifiers for various physiological recording
CO4	To understand various techniques for non-electrical and physiological measurements
CO5	To understand the recent trends in the field of diagnostic and therapeutic equipment

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

OMB415	**DESIGN THINKING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

- ❖ To understand the principles of Design Thinking, a creative solution-based approach to problem solving.
- ❖ To understand about Agile methodology as a practice to promote continuous iteration of development and testing throughout SDLC.
- ❖ To understand the basics about development cycles, IT Operations & faster innovation.
- ❖ To understand the practice of design thinking for Strategic Innovation
- ❖ To understand DevOPs the advanced process of software engineering for faster problem resolution & team collaboration.

UNIT I	**INTRODUCTION TO DESIGN THINKING**	**9**
Introduction to Design Thinking – Importance of Design Thinking – History of Design Thinking- Design Thinking Framework - Design Thinking Methods - Empathise –Define – Ideate – Prototype – Test- Software Development Methodology – Waterfall model – V –model - Customer Example.		**CO1**
UNIT II	**INTRODUCTION TO AGILE**	**9**
History of Agile – Agile principles – Agile Vs Waterfall – Agile Methodology Overview- Agile frameworks – Extreme programming - Rational Unified Process (RUP) - Test Driven Development (TDD) – Feature Drive Development (FDD)- Scrum - Kanban Methodology – Agile and Devops.		**CO2**

UNIT III	AGILE SOFTWARE DEVELOPMENT	9
Software Development- using Extreme Programming – Roles & Rules - Software Development using Scrum Framework – Scrum team – Sprints – Sprints planning – Metrics – Scrum tools - Case Studies.		CO3
UNIT IV	**DESIGN THINKING FOR STRATEGIC INNOVATION**	**9**
Innovation Management-Changing Management Paradigms-Design Thinking related to Science and art-Design Thinking in Business-Linking Design Thinking Solution to Business Challenges		CO4
UNIT V	**DEVOPS**	**9**
Introduction to DevOps – DevOpsvs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD &DevOps Tools– Version Control – Build Automation – Configuration Management – Containerization – Continuous Deployment – Continuous Integration – Continuous Testing – Continuous Monitoring.		CO5
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Stephen Fleming, Pravin, ―DevOps Handbook: Introduction of DevOps Resource Management―,1st Edition, Createspace Independent Pub. , 2010.
2. Len Bass, Ingo Weber, Liming Zhu, G., ―DevOps: A Software Architect‘s Perspective, 1st Edition, AddisonWesley Professional, 2015.
3. Alistair Cockburn, “Agile Software Development”, 2nd ed, Pearson Education, 2007.

REFERENCE BOOKS

1. Maurício Vianna, Ysmar Vianna, Brenda Lucena and Beatriz Russo,” Design thinking: Business innovation”, MJV Technologies and innovation press, 2011.
2. Design Thinking: Integrating Innovation, Customer Experience, and Brand Valueby Thomas Lockwood (Editor) Published February 16th 2010 by Allworth Press.

3. Kallori Vikram, ―Introduction to DevOps, 1 st Edition, Kallori Vikram Publication, 2016.
4. Jaokim Verona, ―Practical DevOps, 2 nd Edition, Packt. Publication, 2018.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Apply design thinking concepts to give solution for the problems identified
CO2	Implement Agile software methodology for faster development of quality software
CO3	Describe how to improve collaboration between development and operations.
CO4	Design innovative products
CO5	Implement Automated Installations and Deployments

MAPPING OF COs WITH POs AND PSOs

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

OMB416	**ENTREPRENEURSHIP SKILL DEVELOPMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

- To equip and develop the learners' entrepreneurial skills and qualities essential to undertake business.
- To impart the learners' entrepreneurial competencies needed for managing business efficiently and effectively.

UNIT I	**ENTREPRENEURAL COMPETENCE**	**9**
Entrepreneurship concept–Entrepreneurship as a Career–Entrepreneurial Personality-Characteristics of Successful Entrepreneurs–Knowledge and Skills of an Entrepreneur.		**CO1**

UNIT II	**ENTREPRENEURAL ENVIRONMENT**	**9**
Business Environment-Role of Family and Society-Entrepreneurship Development Training and Other Support Organizational Services-Central and State Government Industrial Policies and Regulations.		**CO2**
UNIT III	**BUSINESS PLAN PREPARATION**	**9**
Sources of Product for Business-Prefeasibility Study-Criteria for Selection of Product-Ownership-Capital Budgeting- Project Profile Preparation-Matching Entrepreneur with the Project-Feasibility Report Preparation and Evaluation Criteria.		**CO3**
UNIT IV	**LAUNCHING OF SMALL BUSINESS**	**9**
Finance and Human Resource Mobilisation - Operations Planning - Market and Channel Selection-Growth Strategies -Product Launching–Incubation, Venture capital, Start-ups.Monitoring and Evaluation of Business - Business Sickness - Prevention and Rehabilitation of Business Units - Effective Management of small Business-Case Studies.		**CO4**
UNIT V	**BUSINESS PROJECT APPRAISAL**	**9**
Project Management – Sources of a Business Idea, Concept of Project and Classification –Project Identification – Project Formulation - Elements – Project Report – Project Appraisal, Project feasibility study.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. S. S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, New Delhi, 2016.
2. R.D. Hisrich, Entrepreneurship, Tata Mc Graw Hill, New Delhi, 2018.
3. Rajeev Roy, Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
4. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.

REFERENCE BOOKS

1. Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH, 2006.
2. Arya Kumar, Entrepreneurship, Pearson, 2012.
3. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 8th edition, 2017.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	The learners will gain entrepreneurial competence to run the business efficiently.
CO2	The learners are able to undertake businesses in the entrepreneurial environment
CO3	The learners are capable of preparing business plans and undertake feasible projects
CO4	The learners are efficient in launching and develop their business ventures successfully
CO5	The understand the project appraisal techniques and feasibility study of projects.

MAPPING OF COs WITH POs AND PSOs

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

OME417	**INTRODUCTION TO INDUSTRIAL ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES

- ❖ To provide the knowledge on Forecasting methods and planning procedure.
- ❖ To expose the students to the basics in Inventory and Quality Control.
- ❖ To provide the knowledge on various Economic Evaluation techniques.

UNIT I	**FORECASTING AND AGGREGATE PLANNING**	**9**
Defining Operations Management, functions and its historical evolution. Forecasting: Approaches to Forecasting: Qualitative approach - Judgmental methods, quantitative methods- time series, regression. Aggregate Planning: purpose, procedure and techniques		**CO1**
UNIT II	**PRODUCTION MANAGEMENT& SCHEDULING**	**9**
Production Management: Types of production systems, Product analysis, brief treatment of functions of production Planning and Control, Value analysis Scheduling: Introduction, concept of batch production systems, Loading, Sequencing, and Scheduling the n jobs on a single machine, two machines, three machines, m-machines. Problem solving.		**CO2**

UNIT III	INVENTORY AND QUALITY CONTROL	9
Inventory Control : Introduction, models, Inventory costs, Basic models EOQ and EBQ with-out shortages, Quantity discounts, Selective control -- ABC analysis, Problem solving Quality Control : Inspection and types, SQC - Control charts for attributes and variables, construction and application – Acceptance sampling, sampling plans, Construction of O.C. curve. Problem solving.		**CO3**
UNIT IV	**GENERAL AND PERSONNEL MANAGEMENT**	**9**
General Management: General Management, Principles of Scientific Management; Brief Treatment of Managerial Functions. Modern Management concept. Personnel Management: The Personnel Function, Staff Role in Person Department, Personnel Functions, Job Design, Job Information,		**CO4**
UNIT V	**ECONOMIC EVALUATION**	**9**
Financial Management: Concept of Interest, Compound Interest, Economic Evaluation of Alternatives: The Annual Equivalent Method, Present Worth Method, Future Worth Method Depreciation – Purpose, Types of Depreciation; Common Methods of Depreciation; The Straight-Line Method, Declining Balance Method, The Sum of the years Digits Method, A BriefTreatment of Balance Sheet, Ratio Analysis. Introduction to JIT / Lean Manufacturing, Six Sigma Quality Concept, Supply Chain Management, Business Process Reengineering, Concurrent Engineering, Enterprise Resource Planning		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. O.P.Khanna, Industrial Engineering and Management, 7th Edition, Dhanpat Rai& Sons, 2002.
2. Mortand Telsang, Production and Operating Management, 2nd Edition, S.Chand,2006.

REFERENCE BOOKS

1. E.S.Buffa, Modern Production/Operation Management, 8th Edition, Wiley India, 2007.
2. Joseph G Monks, Operation Management, 3rd Edition, Tata McGraw Hill, 1987.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the Forecasting methods and planning procedure.
CO2	Explain the concepts of general management, financial management, human resources, production management, and marketing management.

CO3	Illustrate the application with to identify solutions to industry problems
CO4	Implement the Principles of Scientific and personnel Management
CO5	Identify the optimum solutions with system approach to both industry and service sector.

MAPPING OF COs WITH POs AND PSOs

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

OCY418	CLIMATE CHANGE AND ITS IMPACT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the Earth's Climate System and the concept of Global Warming
- To comprehend the impact of climate change on society and its mitigation measures

UNIT I	EARTH'S CLIMATE SYSTEM	9
Introduction - Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies – Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation –The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.		CO1
UNIT II	**OBSERVED CHANGES AND ITS CAUSES**	**9**
Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC–Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modeling.		CO2

UNIT III	IMPACTS OF CLIMATE CHANGE	9
Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.		CO3
UNIT IV	**CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES**	**9**
Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW& Bio waste, Biomedical, Industrial waste – International and Regional cooperation.		CO4
UNIT V	**CLEAN TECHNOLOGY AND ENERGY**	**9**
Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Biofuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.		CO5
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.
2. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007

REFERENCE BOOKS

1. IPCC Fifth Assessment Report, Cambridge University Press, Cambridge, UK, 2013
2. IPCC Fourth Assessment Report – The AR4 Synthesis Report,
3. Neelin David J, "Climate Change and Climate Modelling", Cambridge University Press 2011

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basics and causes of climate change
CO2	Comprehend the latest IPCC climate scenarios

CO3	Gain in-depth knowledge on vulnerability of climate change
CO4	understand the adaptation measures to overcome the climate change impacts
CO5	Gain knowledge to mitigate climate change impacts in an ecofriendly manner

MAPPING OF COs WITH POs AND PSOs

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

OPEN ELECTIVE II

OEC421	**FUNDAMENTALS OF REMOTE SENSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To model and simulate different types of remote sensing concepts.
- To study the types of platforms and sensors.
- To expose the processing details of image interpretation.
- To master various radar systems and imaging techniques.
- To become familiar with remote sensing applications.

UNIT I	**BASICS OF REMOTE SENSING**	**9**
Definition of Remote sensing - Principles of Remote Sensing, Electromagnetic Radiation - Radiometric terms - and definitions - Radiation Laws, EM spectrum - Sources of EM - Interaction of EM Radiation with atmosphere and target - Atmospheric Widows - imaging spectrometry, Spectral signature of various land cove features		**CO1**

UNIT II	**PLATFORMS AND SENSORS**	**9**
Platforms and its types - ground, airborne, and space born platforms – satellite orbit, Kepler's Law, characteristics of satellite - satellites for Earth observations studies, and planetary missions (Chandrayana) - Classification of sensors: and Types of sensors - imaging modes - Optical sensors and its characteristics - Resolution of sensor - spectral, radiometric and temporal - Characteristics of detectors		**CO2**
UNIT III	**VISUAL IMAGE INTERPRETATION**	**9**
Basic principles of image interpretation and its types, steps and elements - Techniques of visual interpretation and interpretation keys - Multidate, multispectral and multidisciplinary concepts - Visual interpretation Instruments - Interpretation Keys, Methods of searching and sequence of Interpretation - Methods of analysis and Reference levels - Computer compatible tapes – Band sequential format, Band interleaved by Line format, Run-length encoding format - Hardcopy outputs – Generation of B/W and False Color Composites - Generally supported scales of the data products, Information about annotation of the products.		**CO3**
UNIT IV	**THERMAL IMAGING SYSTEM**	**9**
Introduction of Thermal Imaging System - IR region of the Electromagnetic spectrum, Atmospheric transmission, Kinetic and radiant temperature, Thermal properties of materials, Emissivity, Radiant temperature – Thermal conductivity - Thermal capacity, thermal inertia, apparent thermal inertia - Thermal diffusivity - Radiation principles - Plank's Law, Stephen Boltzman law Wien's displacement law, Kirchoffs Law - IR - radiometers, Airborne and Satellite TTR scanner system - Characteristics of IR images - Scanner distortion, image irregularities, Film density and recorded-Effects of weather on images - Clouds, Surface winds, Penetration of smoke plumes -Interpretation of thermal imagery - Advantages of Thermal imagery		**CO4**
UNIT V	**MICROWAVE REMOTE SENSING**	**9**
Introduction to Electromagnetic spectrum, Airborne and Space borne radar systems-based instrumentation - System parameters - Wave length, Polarization, Resolutions, Radar geometry - Target parameters - Back scattering, Point target, Volume scattering - Penetration, Reflection, Bragg resonance, Cross swath variation. Speckle radiometric calibration - Microwave sensors and Image characteristics, Microwave image		**CO5**

interpretation - Application: Geology, Forestryetc. Future trends and Research - laser interaction with objects. Types of LiDAR (Topographic, Bathymetric) platforms of LiDAR, components of LiDAR.	

TOTAL: 45 PERIODS

TEXTBOOKS

1. Floyd, F. Sabins, Jr: Remote Sensing Principles and Interpretation, Freeman and Co., San Franscisco, 1978.
2. Illesand and Kiefere: Remote Sensing and Image interpretation, John qwiley, 1987.

REFERENCE BOOKS

1. Manual of Remote Sensing Vol. I&II, 2nd Edition, American Society of Photogrammetry.
2. Remote Sensing: The quantitative approach, P.H. Swain and S.M. Davis, McGraw Hill.
3. Introductory Digital Image Processing: A remote sensing perspective, John R. Jensen, Prentice Hall.
4. Imaging Radar for Resource Survey: Remote Sensing Applications, 3, W Travelt, Chapman & Hall.
5. Remote sensing Notes –Edited by Japan Associates of Remote sensing- JARS 1999.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Describe different basic concepts and terms used in Remote Sensing.
CO2	Understand the classification and types of platforms and sensors in Remote Sensing.
CO3	Analyze and apply Thermal Imaging System.
CO4	Recognize the BIST techniques for improving testability.
CO5	Understand the applicability Remote sensing in various applications such as LiDAR.

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

OEE421	**ELECTRIC AND HYBRID VEHICLE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

- ❖ To provide knowledge of the operation and dynamics of electrical vehicles
- ❖ To impart knowledge on vehicle control for standard drive cycles of electrical vehicles (EVs)
- ❖ To estimate the energy requirement of EVs and Hybrid Electric Vehicles (HEVs)
- ❖ To provide knowledge about different energy sources and energy management in HEVs.
- ❖ To provide knowledge of supervisory control of EVs

UNIT - I	**INTRODUCTION TO CONVENTIONAL AND ELECTRIC VEHICLES**	**9**
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics. Electric Vehicle: EV system- Series parallel architecture of Hybrid Electric Vehicles (HEV) - Plug-in Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes.		**CO1**
UNIT - II	**MECHANICS OF ELECTRIC VEHICLES**	**9**
Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of EV's - motor torque and power rating and battery capacity.		**CO2**

UNIT - III	**CONTROL OF DC AND AC MOTOR DRIVES**	**9**
Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter-based V/f Operation (motoring and braking) of induction motor drives, Construction and operation of PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives.		**CO3**
UNIT - IV	**ENERGY STORAGE AND MANAGEMENT SYSTEMS**	**9**
Battery: Principle of operation, types, models, Estimation of SOC & SOH, Traction Batteries and their capacity for standard drive cycles. Alternate sources: Fuel cells, Ultra capacitors, Fly wheels.		**CO4**
UNIT - V	**HYBRID VEHICLE CONTROL STRATEGY**	**9**
HEV supervisory control - Selection of modes - power spilt mode - parallel mode - engine brake mode - regeneration mode - series parallel mode.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. Iqbal Husain, "Electric and Hybrid vehicles: Design fundamentals", CRC PRESS, Boca Raton London, New York Washington, D.C,2005.

REFERENCE BOOKS

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
3. Larminie, James and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012.
4. Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017.
5. Sheldon S. Williamson, "Energy Management Strategies for Electric and

Plug-in Hybrid Electric Vehicles", Springer, 2013.

6. Gregory L. Plett, "Battery Management systems", ARTECH House,London,2016.
7. NPTEL Video Lecture Notes on "Fundamentals of Electric Vehicles: Technology and Economics" by Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan, IIT Madras.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Learned the significance of Electric Vehicle compared to conventional vehicles.
CO2	Understood the concept of mechanics of Electric Vehicles.
CO3	Acquired the knowledge in control of DC And AC motor drives.
CO4	Concepts related to battery technology and energy storage systems are analysed.
CO5	Acquired knowledge in control strategy for Hybrid Vehicle & Battery management systems for EV

MAPPING OF COs WITH POs AND PSOs

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

OEE422	**BASIC CIRCUIT THEORY**	**L**	**T**	**C**
		3	**0**	**3**

OBJECTIVES

- To determine the response of electric circuits using basic analysis methods.
- To impart knowledge on solving circuit equations using network

theorems.

- ❖ To analyze the transient behavior of electric circuits with different types of sources.
- ❖ To understand the concepts of resonance and coupled circuits.
- ❖ To compute and analyses the two-port network and its parameters.

UNIT – I	**ANALYSIS OF ELECTRIC CIRCUITS**	**9**
Mesh Analysis - Analysis with independent and dependent voltage sources, Super mesh Analysis. Node Analysis - Analysis with independent and dependent current sources, Super nodal Analysis.		**CO1**
UNIT - II	**NETWORK THEOREMS FOR DC AND AC CIRCUITS**	**9**
Network reduction: voltage and current division, source transformation, star delta conversion. Applications of: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem.		**CO2**
UNIT - III	**TRANSIENT RESPONSE ANALYSIS**	**9**
Transient response: Natural response & Forced response of RL, RC and RLC circuits using Laplace transform for DC input and AC sinusoidal input.		**CO3**
UNIT - IV	**RESONANCE AND COUPLED CIRCUITS**	**9**
Series and parallel resonance: Variation of impedance with frequency - Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor - Selectivity. Mutual coupled circuits: Self and mutual inductance – Coefficient of coupling – Dot Convention in coupled circuits.		**CO4**
UNIT - V	**TWO PORT NETWORK AND NETWORK FUNCTIONS**	**9**
Two Port Networks, terminal pairs, relationship of two port variables, impedance(Z) parameters, admittance(Y) parameters, transmission parameters (ABCD) and hybrid parameters(H), interconnections of two port networks.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. William H. Hayt Jr, Jack E. Kemmerly, Jamie D. Phillips and Steven M. Durbin, "Engineering Circuits Analysis", 9th Edition, McGraw Hill Education (India) Private Limited, 2020.

2. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Fifth Edition, McGraw Hill, 2020.

REFERENCE BOOKS

1. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 2017.
2. Sudhakar. A, Shyammohan. S.P “Circuits and Networks-Analysis and Synthesis”. Tata McGraw Hill publishers, 2018.
3. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2020.
4. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 2018.
5. M Nahvi I J A Edminster “Electric Circuits”; Schaum's Outline series , Tata Mcgraw Hill companies, 4th Edition, 2019.
6. David A Bell ,” Electric circuits “, Oxford University Press, 2019.
7. NPTEL Video Lecture Notes on “Basic Electrical Circuits” by Prof. Nagendra Krishnapura, IIT Madras.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Able to Determine the response of Electric circuits using basic analysis methods and network topology
CO2	Able to Compute the response of electric circuits using network theorem in real time applications.
CO3	Able to Apply Laplace transform techniques for solving problems and discuss the complete response of circuits.
CO4	Able to Design and analyze resonance and coupled circuits.
CO5	Able to Evaluate and analyze two port networks and its parameters.

MAPPING OF COs WITH POs AND PSOs

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

OMB423	HOSPITAL MANAGEMENT	L	P	T	C
		3	0	0	3

OBJECTIVES:

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

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

TEXTBOOKS

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

REFERENCE BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To 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 its uses.
CO5	Understand safety procedures followed in hospitals.

MAPPING OF COs WITH POs AND PSOs

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

OME424	SUSTAINABLE MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide students with knowledge of key environmental and sustainability issues relevant to modern manufacturing.
- To provide a set of tools and skills that may be used to design, analyze, and improve manufacturing Processes, products, and business operations.

UNIT I	NEED FOR SUSTAINABLE MANUFACTURING	9
Introduction to the environmental issues pertaining to the manufacturing sector – pressure to reduce costs – processes that minimize negative environmental impacts – environmental legislation and energy costs – acceptable practice in society – adoption of low carbon technologies – need to reduce the carbon footprint of manufacturing operations.		**CO1**
UNIT II	**TECHNIQUES FOR NON-MARKET VALUATION**	**9**
Cost and income-based approaches, demand estimation methods – expressed and revealed preference, choice modeling – Multi-criteria analysis- Stakeholder analysis – Environmental accounting at sector and national levels		**CO2**
UNIT III	**SUSTAINABILITY PERFORMANCE EVALUATORS AND PRINCIPLES OF SUSTAINABLE OPERATIONS**	**9**
Frameworks and techniques – environmental management systems – life cycle assessment –strategic and environmental impact assessments – carbon and water foot-printing. Life cycle assessment Manufacturing and service activities –Influence of product design on operations – Process analysis – Capacity management – Quality management –Inventory management – Just-In-Time systems – Resource efficient design – Consumerism and sustainable well-being.		**CO3**
UNIT IV	**STRATEGIES AND DESIGN APPROACHES**	**9**
Concepts of Competitive Strategy and Manufacturing Strategies and development of a strategic improvement programme – Manufacturing strategy in business - success Strategy formation and formulation – Structured strategy formulation – Sustainable manufacturing system design options –Approaches to strategy formulation – Realization of new strategies/system designs		**CO4**

UNIT V	CHALLENGES AND OPPORTUNITIES	9
Challenges in logistics and supply chain – developing the right supply chain strategy for the products – need to align the supply network around the strategy – Tools that can be used systematically to identify areas for improvement in supply chains – Specific challenges and new thinking in the plan, source and delivering of sub-processes.		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Seliger, G,(2012), Sustainable Manufacturing: Shaping Global Value Creation, Springer.
2. Davim, J.P.(2010), Sustainable Manufacturing, John Wiley & Sons.

REFERENCE BOOKS

1. Gupta, S.M. and Lambert, A.J.D.(2008), Environment Conscious Manufacturing, CRC Press.
2. Douglas C.Montgomery, "Design and Analysis of Experiments", 5th Edition, John Wiley & Sons.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Identify key requirements and concepts in lean manufacturing.
CO2	Understand the need for sustainability assessment and their types.
CO3	Develop sustainability assessment framework model depending on the process under investigation.
CO4	To Frame Strategic polices and implement sustainability approaches
CO5	Apply knowledge of lean and other sustainability concepts in a typical sustainable manufacturing setup.

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

OEN425	**ENGLISH FOR RESEARCH PAPER WRITING**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES:

- ❖ Be Teach how to improve writing skills and level of readability
- ❖ Tell about what to write in each section
- ❖ Summarize the skills needed when writing a Title
- ❖ Infer the skills needed when writing the Conclusion
- ❖ Ensure the quality of paper at very first-time submission

UNIT I	**INTRODUCTION TO RESEARCH PAPER WRITING**	**9**
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness		**CO1**
UNIT II	**PRESENTATION SKILLS**	**9**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction		**CO2**
UNIT III	**TITLE WRITING SKILLS**	**9**
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check		**CO3**

UNIT IV	RESULT WRITING SKILLS	9
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions		**CO4**
UNIT V	**VERIFICATION SKILLS**	**9**
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission		**CO5**
		TOTAL: 45 PERIODS

REFERENCE BOOKS

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand that how to improve your writing skills and level of readability
CO2	Learn about what to write in each section
CO3	Understand the skills needed when writing a Title
CO4	Understand the skills needed when writing the Conclusion
CO5	Ensure the good quality of paper at very first-time submission

MAPPING OF COs WITH Pos

Cos	PROGRAM OUTCOMES (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	1	-	1	-	-	-	1	1	2	1	1
CO2	-	1	-	1	-	-	-	1	1	2	1	1
CO3	-	1	-	1	-	-	-	1	1	2	1	1
CO4	-	1	-	1	-	-	-	1	1	2	1	1
CO5	-	1	-	1	-	-	-	1	1	2	1	1

OMA426	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
	(Common to CSE, IT & ADS)	3	0	0	3

OBJECTIVES:

- ❖ Be familiar with resource management techniques.
- ❖ Learn to solve problems in linear programming and Integer programming.
- ❖ To understand the concept of non-linear programming.
- ❖ Be exposed to CPM and PERT.

UNIT I	LINEAR PROGRAMMING	9
Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis.		CO1
UNIT II	**DUALITY AND NETWORKS**	**9**
Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and Assignment model - Shortest route problem.		CO2
UNIT III	**INTEGER PROGRAMMING**	**9**
Cutting plan algorithm – Branch and Bound methods, Multistage (Dynamic) Programming.		CO3
UNIT IV	**CLASSICAL OPTIMISATION THEORY**	**9**
Unconstrained external problems, Newton – Raphson method – Equality constraints – Jacobian methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.		CO4
UNIT V	**OBJECT SCHEDULING**	**9**
Network diagram representation – Critical path method – Time charts and resource leveling – PERT		CO5
		TOTAL: 45 PERIODS

TEXTBOOKS

1. H.A. Taha “Operation Research”, Prentice Hall of India, 2002.
2. Paneer Selvam “Operations Research”, Prentice Hall of India, 2002

REFERENCE BOOKS

1. Anderson "Quantitative Methods for Business", 8th Edition, Thomson Learning, 2002.
2. Winston "Operation Research", Thomson Learning, 2003.
3. Vohra "Quantitative Techniques in Management", Tata Mc Graw Hill, 2002.
4. Anand Sarma "Operation Research", Himalaya Publishing House, 2003

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Solve optimization problems using simplex method.
CO2	Solve optimization problems using Duality concept,solve Transportation and assignment models.
CO3	Apply integer programming and linear programming to solve real-life applications.
CO4	Solving Unconstrained external problems.
CO5	Use PERT and CPM for problems in project management.

MAPPING OF COs WITH POs AND PSOs

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

OME427	**REVERSE ENGINEERING**	**L**	**T**	**C**
	(Common to ECE, CSE, IT & ADS)	3	0	3

OBJECTIVES:

- To learn the need for and the various tools required for reverse engineering
- To know the important research challenges associated with Reverse engineering
- To study the various concepts in quality and reliability principles in the

design of an engineering product		
UNIT I	**INTRODUCTION**	**9**
Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wireframe, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation- Software for AM- Case studies.		**CO1**
UNIT II	**TOOLS FOR REVERSE ENGINEERING**	**9**
Functionality- dimensional- developing technical data - digitizing techniques - construction of surface model - solid-part material-characteristics evaluation -software and application prototyping – verification.		**CO2**
UNIT III	**CONCEPTS OF REVERSE ENGINEERING**	**9**
History of Reverse Engineering – Preserving and preparation for the four-stage process – Evaluation and Verification- Technical Data Generation, Data Verification, Project Implementation.		**CO3**
UNIT IV	**DATA MANAGEMENT**	**9**
Data reverse engineering – Three data Reverse engineering strategies – Definition – organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software – Design experiments to evaluate a Reverse Engineering tool – Rule based detection for reverse Engineering user interfaces – Reverse Engineering of assembly programs: A model-based approach and its logical basics		**CO4**
UNIT V	**INTEGRATION OF REVERESE ENGINEERING**	**9**
Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering -–coordinate measurement – feature capturing – surface and solid members		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. Kevin Otto & Kristin Wood, Product Design Techniques in Reverse Engineering and New Product Development, Pearson Education (LPE), 2011.
2. Reverse Engineering: Mechanisms, Structures, Systems & Materials 1st

Edition by Robert W. Messler Jr. Dec 10, 2013.

REFERENCE BOOKS

1. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011.
2. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
3. Kathryn, A. Ingle, Reverse Engineering, McGraw-Hill

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand need for and the various tools required for reverse engineering with exposure to the software needed for implementing reverse engineering.
CO2	Understand select the suitable tools and methodology for reverse engineering for any product.
CO3	Understand important research challenges associated with Reverse engineering and its data processing tools.
CO4	Understand important integrating reverse engineering, reuse and specification tool environments to reverse engineering
CO5	Understand with various concepts in quality and reliability principles in the design of an engineering product or a service.

MAPPING OF COs WITH POs AND PSOs

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

OME428	INDUSTRIAL SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get knowledge of various safety management principles, various safety systems, various machine guarding devices, hazard identification techniques,
- To compare different hazard identification tools and choose the most appropriate based on the nature of industry.

UNIT I	SAFETY INTRODUCTION	9
Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.		CO1
UNIT II	**PERSONAL PROTECTION IN WORK ENVIRONMENT**	**9**
Personal protection in the work environment, Types of PPEs, Personal protective equipment respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 S of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.		CO2
UNIT III	**SAFETY ISSUES IN CONSTRUCTION**	**9**
Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning &Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space –Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.		CO3

UNIT IV	SAFETY HAZARDS IN MACHINES	9
Machinery safeguard-Point-of-Operation, Principle of machine guarding - types of guards and devices. Safety in turning, and grinding. Welding and Cutting-Safety Precautions of Gas welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries.		**CO4**
UNIT V	**HAZARD IDENTIFICATION AND ANALYSIS**	**9**
Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants- The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operability study (HAZOP)) – methodology, criticality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets(MSDS)		**CO5**
		TOTAL: 45 PERIODS

TEXTBOOKS

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, KhannaPublications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997). Safety management in Industry. Jaico Publishing House, New Delhi.

REFERENCE BOOKS

1. John V. Grimaldi and Rollin H.Simonds. (1989) Safety management. All India Traveller Book Seller, Delhi.
2. Ronald P. Blake. (1973). Industrial safety. Prentice Hall, NewDelhi.
3. Alan Waring. (1996). Safety management system. Chapman & Hall, England.

COURSE OUTCOMES Upon completion of the course, students will be able to	
CO1	Describe the theories of accident causation and preventive measures of industrial accidents.
CO2	Explain about personal protective equipment, its selection, safety performance &indicators and importance of housekeeping.
CO3	Explain different issues in construction industries.
CO4	Describe various hazards associated with different machines and mechanical material handling.
CO5	Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards.

MAPPING OF COs WITH POs AND PSOs

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