



SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

**B. Tech. ARTIFICIAL INTELLIGENCE AND
DATA SCIENCE**

CURRICULA AND SYLLABI

REGULATIONS 2019

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VISION OF THE INSTITUTE

“Educate to excel in Social Transformation”

To accomplish and maintain international eminence and become a model institution for higher learning through dedicated development of minds, advancement of knowledge and professional application of skills to meet the global demands.

MISSION OF THE INSTITUTE

- To contribute to the development of human resources in the form of professional engineers and managers of international excellence and competence with high motivation and dynamism, who besides serving as ideal citizen of our country will contribute substantially to the economic development and advancement in their chosen areas of specialization.
- To build the institution with international repute in education in several areas at several levels with specific emphasis to promote higher education and research through strong institute-industry interaction and consultancy.

VISION OF THE DEPARTMENT

To become a model for Artificial Intelligence with innovation and analysis for higher learning through various analytical knowledge, creative competent and dynamic technocrats; while remaining responsive to ethical, societal and environmental issues.

MISSION OF THE DEPARTMENT

M1: To develop the students as an Artificial Intelligence designer and data analyst professionals in order to meet the global design challenges and entrepreneurs of International excellence as global leaders capable of contributing towards technological innovations, learning process, participation citizenship in their neighborhood and economic growth.

M2: To transform value-based data science education to the students and groom them as leaders in the field of Artificial Intelligence and Data Science for the empowerment of society

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B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATIONS – 2019

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

1. To afford the necessary background in the field of Artificial Intelligence and data Science to deal with engineering problems to excel as engineering professionals in industries.
2. To improve the qualities like creativity, leadership, teamwork and skill thus contributing towards the growth and development of society.
3. To develop ability among students towards innovation and entrepreneurship that caters to the needs of Industry and society.
4. To inculcate and attitude for life-long learning process through the use of Artificial Intelligence and Data Science sources.
5. To prepare then to be innovative and ethical leaders, both in their chosen profession and in other activities.

2. PROGRAMME OUTCOMES (POs):

After going through the four years of study, Bachelor of Technology in Artificial Intelligence and Data Science Graduates will exhibit ability to:

PO#	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, 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 public health and safety, and 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 the 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

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

After the completion of Bachelor of Technology in Artificial Intelligence and Data Science programme the student will have following Program specific outcomes

1. Design and develop secured database applications with data analytical approaches of data preprocessing, optimization, visualization techniques and maintenance using state of the art methodologies based on ethical values.
2. Design and develop intelligent systems using computational principles, methods and systems for extracting knowledge from data to solve real time problems using advanced technologies and tools.

3. Design, plan and setting up the network that is helpful for contemporary business environments using latest software and hardware.
4. Planning and defining test activities by preparing test cases that can predict and correct errors ensuring a socially transformed product catering all technological needs.

4. PEO / PO Mapping:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES												PROGRAM SPECIFIC OUTCOMES			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
I	✓	✓											✓	✓	✓	
II			✓		✓	✓	✓		✓					✓		
III			✓	✓	✓	✓					✓	✓			✓	✓
IV												✓	✓			
V								✓		✓			✓	✓	✓	✓

MAPPING – UG –ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

S. No	Semester	Course Code	Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	
I YEAR																				
1	Sem I	1919101	Communicative English	3	3	3	2	3	3	2	-	-	3	-	1	1	1	1	1	
2		1918102	Engineering Mathematics - I	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-	-	
3		1920103	Engineering Physics	3	1	1	1	1	1	1	1	-	-	-	-	1	-	1	-	
4		1921104	Engineering Chemistry	3	2	3	1	2	2	2	2	-	1	1	-	2	1	1	1	2
5		1901006	Programming in C	3	2	2	2	2	2	1	1	-	2	-	1	1	3	1	2	3
6		1901007	Engineering Graphics	2	-	3	-	-	-	-	-	-	1	3	-	1	2	1	1	1
7		1901108	Physics and Chemistry Laboratory	3	1	1	1	-	1	2	1	1	-	-	1	2	3	2	1	
8		1901010	C Programming Laboratory	3	2	3	2	2	2	2	-	3	1	1	2	1	2	2	2	2
9	Sem II	1919201	Technical English	3	2	2	2	-	-	-	-	-	3	2	1	1	1	1	2	
10		1918202	Engineering Mathematics - II	3	2	1	1	-	-	-	-	-	-	-	1	-	-	-	-	
11		1920202	Physics for Information Science	3	2	2	-	1	1	1	-	-	-	-	-	-	-	-	2	-
12		1921203	Environmental Science and Engineering	1	1	3	-	-	2	3	-	3	-	-	1	1	1	1	1	1
13		1901005	Problem Solving and Python Programming	3	2	3	2	2	2	2	1	-	-	2	2	2	2	2	2	3
14		1901008	Basic Civil and Mechanical Engineering	3	2	2	1	-	1	1	1	1	-	-	-	1	2	1	1	2

15		1901009	Problem Solving and Python Programming Laboratory	3	2	2	1	2	2	-	1	-	-	2	3	2	3	2	3	
16		1901208	Engineering Practices Laboratory	3	2	2	2	2	1	-	-	1	-	1	1	3	2	2	2	
17		1901209	Applied Physics and Environmental Chemistry Laboratory	3	2	2	2	-	2	3	1	1	-	-	2	1	1	1	1	
18			NSS/NCC/YRC /NSO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
II YEAR																				
19	Sem III	1918302	Discrete Mathematics	3	3	2	-	-	-	-	-	1	-	-	1	-	-	-	-	
20		1922301	Computational Intelligence Essentials	2	2	2	3	3	-	3	3	3	-	-	-	-	3	2	-	
21		1922302	Programming and Data Structures	3	-	3	2	-	-	-	-	-	-	-	3	-	-	3	3	3
22		1908302	Digital Principles and System Design	3	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
23		1908007	Operating Systems Concepts	3	1	3	-	-	-	-	-	-	-	-	-	-	3	2	2	2
24		1922303	Computational Intelligence Essentials Laboratory	2	3	3	2	3	2	2	3	2	3	3	3	3	2	3	3	3
25		1922304	Programming and Data Structures Laboratory	3	-	-	-	3	-	-	-	-	-	-	3	-	-	3	3	-
26	Sem IV	1918406	Numerical Linear Algebra	3	3	3	-	-	-	-	-	-	-	-	1	-	-	-	-	
27		1922401	Database Management Systems and Mining	1	1	3	1	2	-	-	-	-	-	1	1	-	3	1	-	
28		1922402	Data Communication and Networks	3	3	3	-	-	-	-	-	3	-	-	-	3	-	3	2	
29		1922403	Data Science Concepts	2	3	3	3	2	-	-	-	-	-	2	2	3	2	2	2	-

30		1915001	Professional Ethics	-	-	-	-		3	3	2	-	-	-	-	1	-	1	-	
31		1922404	Database Management Systems and Mining Laboratory	1	-	2	1	3	-	-	-	-	-	1	1	-	3	1	-	
32		1922405	Data Science Laboratory	2	2	3	-	3	-	-	-	-	-	2	2	3	-	2	2	
33		1919001	Communication Skills Laboratory-Project based	3	3	2	2	3	-	3	-	-	3	-	1	2	-	1	1	
III YEAR																				
34	Sem V	1918502	Probability Random Processes and Statistics	3	3	3	-	-	-	-	-	-	-	-	-	-	-	1	-	
35		1922501	Software Engineering and Management	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
36		1922502	R Programming in Data Science	3	1	2	-	2	-	-	-	-	-	-	-	-	-	2	-	-
37		1922507	Software Engineering and Management Laboratory	2	2	2	2	2	-	-	-	-	-	2	-	-	-	-	-	3
38		1922508	R Programming in Data Science Laboratory	3	-	2	-	2	-	-	-	2	-	-	2	-	2	-	2	-
39	Sem VI	1908604	Digital Image Processing	3	2	3	-	2	-	-	-	-	-	2	-	-	2	-	-	
40		1904006	Artificial Intelligence	2	1	2	2	3	3	-	-	-	-	-	-	2	2	-	2	
41		1904011	Big Data Analytics	3	3	2	-	3	3	-	-	2	2	-	-	-	3	3	2	
42		1922609	Big Data Analytics Laboratory	3	2	1	-	2	-	-	-	1	-	-	2	-	2	-	2	
43		1904009	Artificial Intelligence Laboratory	1	2	2	2	3	3	3	3	-	-	-	-	2	2	2	-	
44		1919002	Professional Communication	2	-	-	-	-	2	-	-	1	3	-	3	1	2	-	-	

45		1922610	Mini Project	3	3	3	1	3	3	3	-	-	-	-	-	2	3	3	3
IV YEAR																			
46	Sem VII	1922701	Statistical Approaches for Data Science	3	3	3	3	3	1	-	-	-	-	-	-	3	3	-	-
47		1908005	Virtual Reality	2	2	3	-	2	-	-	-	-	-	-	-	-	3	-	-
48		1908013	Deep Learning and its Applications	2	2	3	2	-	-	-	-	-	-	-	-	-	3	-	-
49		1922706	Statistical Approaches for Data Science Laboratory	3	3	3	3	3	-	-	-	-	-	-	-	2	3	-	-
50		1922707	Virtual reality Laboratory	3	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
51		1922708	Project Work - Phase I	3	3	3	3	3	2	2	1	3	3	3	2	3	3	3	3
52	Sem VIII	1922808	Project Work - Phase II	3	3	3	3	3	2	2	1	3	3	3	2	3	3	3	3
PROFESSIONAL ELECTIVES																			
53	Sem V PE-I	1922503	Computer Vision	1	1	2	1	3	-	-	-	-	-	1	1	1	-	3	-
54		1922504	Artificial Intelligence based Embedded System	1	3	3	-	3	-	-	-	-	-	-	-	1	2	-	-
55		1922505	Advanced Concepts of Databases	3	2	2	-	3	2	-	-	-	-	2	2	-	3	2	2
56		1922506	Data Visualization	1	2	2	-	3	-	-	-	-	-	-	-	3	2	2	2
57		1908506	System Software	3	3	3	2	3	-	-	-	-	-	-	-	-	2	-	-
58		1904004	Natural Language Processing	2	3	2	3	2	2	2	-	-	2	-	-	-	3	2	-
59	Sem VI PE-II	1922601	Optimization Techniques	2	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-

60		1922602	Machine Learning Tools and Techniques	3	3	3	-	2	-	-	-	2	2	-	-	3	2	3	2
61		1922603	Pattern recognition	2	3	2	3	3	-	-	-	2	-	-	-	3	2	-	-
62		1908012	Social Network Analysis	2	2	2	2	-	-	2	-	-	-	-	-	-	2	3	-
63		1904606	Intellectual Property Rights	1	2	2	3	2	2	2	-	2	-	2	2	3	2	2	2
64		1904005	Cryptography and Network Security	2	2	2	2	2	-	1	-	-	1	2	2	2	2	1	1
65	Sem VI PE-III	1922604	Real Time Systems	3	3	3	2	-	-	-	-	-	2	-	-	2	3	2	-
66		1922605	Introduction to Business Intelligence	3	2	2	2	-	2	2	-	-	-	-	-	3	-	-	-
67		1922606	Fundamentals of Web Scraping	3	2	3	3	3	-	-	-	-	2	-	-	3	3	-	-
68		1922607	Introduction to Cloud Computing	2	2	3	3	2	2	3	-	-	-	-	-	2	3	-	-
69		1922608	Artificial Neural Network	3	2	3	3	3	-	-	-	-	-	-	-	-	2	-	-
70		1908609	Internet of Things and its Applications	2	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
71	Sem VII PE-IV	1922702	Big Data Framework	2	2	2	2	-	2	2	-	-	-	2	-	2	-	-	-
72		1922703	Image and Video Analytics	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-	-
73		1922704	Web Development Frameworks	2	2	3	-	3	-	-	-	-	-	-	-	2	-	2	-
74		1922705	Introduction to Big Data for IoT	3	3	2	3	2	3	-	-	-	-	-	-	2	-	2	-
75		1908704	Cyber Forensics	3	-	-	2	3	-	-	-	-	-	-	-	-	-	2	-

76		1915003	Total Quality Management	-	1	1	-	2	-	2	-	-	-	1	-	1	-	-	1
77	Sem VIII PE-V	1922801	Genetic Algorithm	2	2	3	1	-	-	-	-	-	-	-	-	-	2	-	-
78		1922802	Web Mining	3	2	2	2	-	-	-	-	-	-	-	-	2	2	-	-
79		1922803	Open source for data science	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-	-
80		1922804	Business Analytics	3	3	3	3	3	-	-	-	-	3	-	-	3	-	-	-
81		1908807	Blockchain	2	2	3	-	2	-	-	-	-	-	-	2	-	3	-	-
82		1904803	Green Computing	2	2	3	2	3	2	2	2	-	-	-	3	-	3	2	-
83	Sem VIII PE-VI	1922805	Data Quality and Transformations	3	2	3	3	1	2	2	2	-	-	-	2	3	-	-	-
84		1922806	Augmented Reality	3	2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
85		1922807	Principles of Fog Computing	1	2	2	1	-	1	-	-	-	-	-	-	2	-	2	-
86		1908801	Information Security	3	2	2	2	-	-	-	-	-	-	-	-	-	-	3	-
87		1908804	Fundamentals of Ethical Hacking	2	2	3	-	-	-	-	3	-	-	-	-	2	-	-	-
88		1908011	Information Retrieval Techniques	2	2	3	-	2	-	-	-	-	-	-	-	-	2	3	-

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CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULA & SYLLABI

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1919101	Communicative English	HS	3	3	0	0	3
2.	1918102	Engineering Mathematics-I	BS	4	3	1	0	4
3.	1920103	Engineering Physics	BS	3	3	0	0	3
4.	1921104	Engineering Chemistry	BS	3	3	0	0	3
5.	1901006	Programming in C	ES	3	3	0	0	3
6.	1901007	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
7.	1901108	Physics and Chemistry Laboratory	BS	4	0	0	4	2
8.	1901010	C Programming Laboratory	ES	4	0	0	4	2
TOTAL				30	17	1	12	24

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	
THEORY									
1.	1919201	Technical English	HS	3	3	0	0	3	
2.	1918202	Engineering Mathematics-II	BS	4	3	1	0	4	
3.	1920202	Physics for Information Science	BS	3	3	0	0	3	
4.	1921203	Environmental Science and Engineering	BS	3	3	0	0	3	
5.	1901005	Problem Solving and Python Programming	ES	3	3	0	0	3	
6.	1901008	Basic Civil and Mechanical Engineering	ES	3	3	0	0	3	
PRACTICALS									
7.	1901009	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2	
8.	1901208	Engineering Practices Laboratory	ES	4	0	0	4	2	
9.	1901209	Applied Physics and Environmental Chemistry Laboratory	BS	4	0	0	4	2	
10.		NSS / NCC / YRC / NSO	PCD	1*	0	0	0	1	
<ul style="list-style-type: none"> • <i>Conducted after college hours</i> 				TOTAL	31	18	1	12	26

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1918302	Discrete Mathematics	BS	4	3	1	0	4
2.	1922301	Computational Intelligence Essentials	PC	3	3	0	0	3
3.	1922302	Programming and Data Structures	PC	3	3	0	0	3
4.	1908302	Digital Principles and System Design	PC	3	3	0	0	3
5.	1908007	Operating Systems Concepts	PC	3	3	0	0	3
PRACTICALS								
6.	1922303	Computational Intelligence Essentials Laboratory	PC	4	0	0	4	2
7.	1922304	Programming and Data Structures Laboratory	PC	4	0	0	4	2
TOTAL				24	15	1	8	20

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1918406	Numerical Linear Algebra	BS	4	3	1	0	4
2.	1922401	Database Management Systems and Mining	PC	3	3	0	0	3
3.	1922402	Data Communication and Networks	PC	3	3	0	0	3
4.	1922403	Data Science Concepts	PC	3	3	0	0	3
5.	1915001	Professional Ethics	HS	3	3	0	0	3
PRACTICALS								
6.	1922404	Database Management Systems and Mining Laboratory	PC	4	0	0	4	2
7.	1922405	Data Science Laboratory	PC	4	0	0	4	2
8.	1919001	Communication Skills Laboratory – Project Based	EEC	2	0	0	2	0
TOTAL				26	15	1	10	20

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1918502	Probability Random Processes and Statistics	BS	4	3	1	0	4
2.	1922501	Software Engineering and Management	PC	3	3	0	0	3
3.	1922502	R Programming in Data Science	PC	3	3	0	0	3
4.	19XXXXX	Professional Elective – I	PE	3	3	0	0	3
5.	19XXXXX	Open Elective – I	OE	3	3	0	0	3
PRACTICALS								
6.	1922507	Software Engineering and Management Laboratory	PC	4	0	0	4	2
7.	1922508	R Programming in Data Science Laboratory	PC	4	0	0	4	2
TOTAL				24	15	1	8	20

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1908604	Digital Image Processing	PC	3	3	0	0	3
2.	1904006	Artificial Intelligence	PC	3	3	0	0	3
3.	1904011	Big Data Analytics	PC	3	3	0	0	3
4.	19XXXXX	Professional Elective – II	PE	3	3	0	0	3
5.	19XXXXX	Professional Elective – III	PE	3	3	0	0	3
PRACTICALS								
6.	1922609	Big Data Analytics Laboratory	PC	4	0	0	4	2
7.	1904009	Artificial Intelligence Laboratory	PC	4	0	0	4	2
8.	1919002	Professional Communication	EEC	2	0	0	2	1
9.	1922610	Mini Project	EEC	4	0	0	4	2
TOTAL				29	15	0	14	22

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1922701	Statistical Approaches for Data Science	PC	3	3	0	0	3
2.	1908005	Virtual Reality	PC	3	3	0	0	3
3.	1908013	Deep Learning and its Applications	PC	3	3	0	0	3
4.	19XXXXX	Professional Elective – IV	PE	3	3	0	0	3
5.	19XXXXX	Open Elective – II	OE	3	3	0	0	3
PRACTICAL S								
6.	1922706	Statistical Approaches for Data Science Laboratory	PC	4	0	0	4	2
7.	1922707	Virtual reality Laboratory	PC	4	0	0	4	2
8.	1922708	Project Work - Phase I	EEC	4	0	0	4	2
9.	1922709	Internship *	EEC	0	0	0	0	1
TOTAL				27	15	0	12	22

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	19XXXXX	Professional Elective – V	PE	3	3	0	0	3
2.	19XXXXX	Professional Elective – VI	PE	3	3	0	0	3
PRACTICALS								
3.	1922808	Project Work - Phase II	EEC	12	0	0	12	6
TOTAL				18	6	0	12	12

* Internship (2 Weeks)

**PROFESSIONAL ELECTIVES (PE)
SEMESTER V - PROFESSIONAL ELECTIVE I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1922503	Computer Vision	PE	3	3	0	0	3
2.	1922504	Artificial Intelligence based Embedded System	PE	3	3	0	0	3
3.	1922505	Advanced Concepts of Databases	PE	3	3	0	0	3
4.	1922506	Data Visualization	PE	3	3	0	0	3
5.	1908506	System Software	PE	3	3	0	0	3
6.	1904004	Natural Language Processing	PE	3	3	0	0	3

SEMESTER VI - PROFESSIONAL ELECTIVE II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1922601	Optimization Techniques	PE	3	3	0	0	3
2.	1922602	Machine Learning Tools and Techniques	PE	3	3	0	0	3
3.	1922603	Pattern recognition	PE	3	3	0	0	3
4.	1908012	Social Network Analysis	PE	3	3	0	0	3
5.	1904606	Intellectual Property Rights	PE	3	3	0	0	3
6.	1904005	Cryptography and Network Security	PE	3	3	0	0	3

SEMESTER VI - PROFESSIONAL ELECTIVE III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1922604	Real Time Systems	PE	3	3	0	0	3
2.	1922605	Introduction to Business Intelligence	PE	3	3	0	0	3
3.	1922606	Fundamentals of Web Scraping	PE	3	3	0	0	3
4.	1922607	Introduction to Cloud Computing	PE	3	3	0	0	3
5.	1922608	Artificial Neural Network	PE	3	3	0	0	3
6.	1908609	Internet of Things and its Applications	PE	3	3	0	0	3

SEMESTER VII - PROFESSIONAL ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1922702	Big Data Framework	PE	3	3	0	0	3
2.	1922703	Image and Video Analytics	PE	3	3	0	0	3
3.	1922704	Web Development Frameworks	PE	3	3	0	0	3
4.	1922705	Introduction to Big Data for IoT	PE	3	3	0	0	3
5.	1908704	Cyber Forensics	PE	3	3	0	0	3
6.	1915003	Total Quality Management	PE	3	3	0	0	3

SEMESTER VIII - PROFESSIONAL ELECTIVE V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1922801	Genetic Algorithm	PE	3	3	0	0	3
2.	1922802	Web Mining	PE	3	3	0	0	3
3.	1922803	Open source for data science	PE	3	3	0	0	3
4.	1922804	Business Analytics	PE	3	3	0	0	3
5.	1908807	Blockchain	PE	3	3	0	0	3
6.	1904803	Green Computing	PE	3	3	0	0	3

SEMESTER VIII - PROFESSIONAL ELECTIVE VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1922805	Data Quality and Transformations	PE	3	3	0	0	3
2.	1922806	Augmented Reality	PE	3	3	0	0	3
3.	1922807	Principles of Fog Computing	PE	3	3	0	0	3
4.	1908801	Information Security	PE	3	3	0	0	3
5.	1908804	Fundamentals of Ethical Hacking	PE	3	3	0	0	3
6.	1908011	Information Retrieval Techniques	PE	3	3	0	0	3

OPEN ELECTIVES (OE) - I

**SEMESTER V
OPEN ELECTIVE - I**

Sl. No	COURSE CODE	COURSE TITLE	COURSE OFFERING DEPARTMENT	CONTACT PERIODS	L	T	P	C
1.	1902512	Environment and Agriculture	AGRI	3	3	0	0	3
2.	1902513	Production Technology of Agricultural Machinery	AGRI	3	3	0	0	3
3.	1903514	Air Pollution and Control Engineering	CIVIL	3	3	0	0	3
4.	1903515	Participatory Water Resources Management	CIVIL	3	3	0	0	3
5.	1904504	Geographic Information System	CSE	3	3	0	0	3
6.	1905001	Energy Conservation and Management	EEE	3	3	0	0	3
7.	1905508	Renewable Energy Sources	EEE	3	3	0	0	3
8.	1905509	SCADA System Management	EEE	3	3	0	0	3
9.	1906507	Entertaintronics	ECE	3	3	0	0	3
10.	1906505	Photonic Networks	ECE	3	3	0	0	3
11.	1906506	Telecommunication Network Management	ECE	3	3	0	0	3
12.	1907503	Sensors and Transducers	EIE	3	3	0	0	3
13.	1907504	Instrumentation in Biomedical Engineering	EIE	3	3	0	0	3
14.	1909510	Product Design and Development	MECH	3	3	0	0	3
15.	1909511	Vibration and Noise Control	MECH	3	3	0	0	3
16.	1909512	Industrial Safety Engineering	MECH	3	3	0	0	3
17.	1910504	Principles of Food Preservation	MEDICAL ELECTRONICS	3	3	0	0	3
18.	1920501	Nanotechnology	PHYSICS	3	3	0	0	3
19.	1920502	Microscopy	PHYSICS	3	3	0	0	3
20.	1921501	Advanced Engineering Chemistry	CHEMISTRY	3	3	0	0	3
21.	1921502	Industrial Nanotechnology	CHEMISTRY	3	3	0	0	3

OPEN ELECTIVES (OE)-II								
SEMESTER VII - OPEN ELECTIVE – II								
SI. No	COURSE CODE	COURSE TITLE	COURSE OFFERING DEPARTMENT	CONTACT PERIODS	L	T	P	C
1.	1903706	Green Building Design	CIVIL	3	3	0	0	3
2.	1903716	Environmental and social impact assessment	CIVIL	3	3	0	0	3
3.	1904703	Tamil Computing	CSE	3	3	0	0	3
4.	1905711	Electrical Circuits	EEE	3	3	0	0	3
5.	1905712	Renewable Energy systems	EEE	3	3	0	0	3
6.	1905713	Electric Vehicles and Power Management	EEE	3	3	0	0	3
7.	1906705	Acoustics	ECE	3	3	0	0	3
8.	1906706	Visual Communication	ECE	3	3	0	0	3
9.	1906707	MEMS and NEMS	ECE	3	3	0	0	3
10.	1907001	Transducers Engineering	EIE	3	3	0	0	3
11.	1907003	Process Modeling and Simulation	EIE	3	3	0	0	3
12.	1907708	State Variable Analysis and Design	EIE	3	3	0	0	3
13.	1909718	Robotics	MECH	3	3	0	0	3
14.	1909719	Testing of Materials	MECH	3	3	0	0	3
15.	1909720	Design of Electrical Vehicles	MECH	3	3	0	0	3
16.	1910703	Clinical Trials	MEDICAL ELECTRONICS	3	3	0	0	3
17.	1910704	Regulatory requirements in Pharmaceutical Industries	MEDICAL ELECTRONICS	3	3	0	0	3
18.	1910705	Microbiology	MEDICAL ELECTRONICS	3	3	0	0	3
19.	1920701	Analytical Methods and Instrumentation	PHYSICS	3	3	0	0	3
20.	1920702	Medical Physics	PHYSICS	3	3	0	0	3
21.	1920703	Electronic Materials	PHYSICS	3	3	0	0	3
22.	1921701	Waste Water Treatment	CHEMISTRY	3	3	0	0	3

CATEGORY
HUMANITIES AND SOCIAL SCIENCES (HS)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	1919101	Communicative English	HS	3	3	0	0	3
2	1919201	Technical English	HS	3	3	0	0	3
3	1915001	Professional Ethics	HS	3	3	0	0	3

BASIC SCIENCES (BS)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	1918102	Engineering Mathematics – I	BS	4	3	1	0	4
2	1920103	Engineering Physics	BS	3	3	0	0	3
3	1921104	Engineering Chemistry	BS	3	3	0	0	3
4	1901108	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5	1918202	Engineering Mathematics – II	BS	4	3	1	0	4
6	1920202	Physics for Information Science	BS	3	3	0	0	3
7	1921203	Environmental Science and Engineering	BS	3	3	0	0	3
8	1901209	Applied Physics and Environmental Chemistry Laboratory	BS	4	0	0	4	2
9	1918302	Discrete Mathematics	BS	4	3	1	0	4
10	1918406	Numerical Linear Algebra	BS	4	3	1	0	4
11	1918502	Probability Random Process and Statistics	BS	4	3	1	0	4

ENGINEERING SCIENCES (ES)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	1901006	Programming in C	ES	3	3	0	0	3
2	1901007	Engineering Graphics	ES	6	2	0	4	4
3	1901010	C Programming Laboratory	ES	4	0	0	4	2
4	1901005	Problem Solving and Python Programming	ES	3	3	0	0	3
5	1901008	Basic Civil and Mechanical Engineering	ES	3	3	0	0	3
6	1901009	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
7	1901208	Engineering Practices Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	1922301	Computational Intelligence Essentials	PC	3	3	0	0	3
2	1922302	Programming and Data Structures	PC	3	3	0	0	3
3	1908302	Digital Principles and System Design	PC	3	3	0	0	3
4	1908007	Operating Systems Concepts	PC	3	3	0	0	3
5	1922303	Computational Intelligence Essentials Laboratory	PC	4	0	0	4	2
6	1922304	Programming and Data Structures Laboratory	PC	4	0	0	4	2
7	1922401	Database Management Systems and Mining	PC	3	3	0	0	3
8	1922402	Data Communication and Networks	PC	3	3	0	0	3
9	1922403	Data Science Concepts	PC	3	3	0	0	3
10	1922404	Database Management Systems and Mining Laboratory	PC	4	0	0	4	2
11	1922405	Data Science Laboratory	PC	4	0	0	4	2
12	1922501	Software Engineering and Management	PC	3	3	0	0	3
13	1922502	R Programming in Data Science	PC	3	3	0	0	3
14	1922507	Software Engineering and Management Laboratory	PC	4	0	0	4	2

15	1922508	R Programming in Data Science Laboratory	PC	4	0	0	4	2
16	1908604	Digital Image Processing	PC	3	3	0	0	3
17	1904006	Artificial Intelligence	PC	3	3	0	0	3
18	1904011	Big Data Analytics	PC	3	3	0	0	3
19	1922609	Big Data Analytics Laboratory	PC	4	0	0	4	2
20	1904009	Artificial Intelligence Laboratory	PC	4	0	0	4	2
21	1922701	Statistical Approaches for Data Science	PC	3	3	0	0	3
22	1908005	Virtual Reality	PC	3	3	0	0	3
23	1908013	Deep Learning and its Applications	PC	3	3	0	0	3
24	1922706	Statistical Approaches for Data Science Laboratory	PC	4	0	0	4	2
25	1922707	Virtual reality Laboratory	PC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	1919001	Communication Skills Laboratory – Project Based	EEC	2	0	0	2	0
2	1919002	Professional Communication	EEC	2	0	0	2	1
3	1922610	Mini Project	EEC	4	0	0	4	2
4	1922708	Project Work - Phase I	EEC	4	0	0	4	2
5	1922709	Internship	EEC	0	0	0	0	1
6	1922808	Project Work - Phase II	EEC	12	0	0	12	6

PERSONALITY AND CHARACTER DEVELOPMENT (PCD)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1		NSS / NCC / YRC / NSO	PCD	1	0	0	0	1

SUMMARY

S.NO.	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	3	3		3					9	5.42%
2.	BS	12	12	4	4	4				36	21.69%
3.	ES	9	10							19	11.45%
4.	PC			16	13	10	13	13		65	39.16%
5.	PE					3	6	3	6	18	10.84%
6.	OE					3		3		6	3.61%
7.	EEC						3	3	6	12	7.23%
8.	PCD		1							1	0.60%
	Total	24	26	20	20	20	22	22	12	166	
9.	Non Credit / Mandatory				✓						

ABBREVIATIONS:

HS	- HUMANITIES AND SOCIAL SCIENCES
BS	- BASIC SCIENCES
ES	- ENGINEERING SCIENCES
PC	- PROFESSIONAL CORE
PCD	- PERSONALITY CHARACTER DEVELOPMENT
PE	- PROFESSIONAL ELECTIVES
OE	- OPEN ELECTIVES
EEC	- EMPLOYABILITY ENHANCEMENT COURSES

SEMESTER I

	COMMUNICATIVE ENGLISH	L	T	P	C
1919101	(Common to all branches of B.E. / B.Tech. Programmes)	3	0	0	3

COURSE OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- Comprehend content-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 – short comprehension passages, practice in skimming-scanning and predicting –**Writing** – Blog/film review/quora/Twitter/Facebook– developing hints. **Listening** – short texts – short formal and informal conversations. **Speaking** – introducing oneself – exchanging personal information – **Language development** – Wh – Questions – asking and answering – yes or no questions – parts of speech. **Vocabulary development** – prefixes – suffixes – word formation: making sentences of your own.

UNIT- II: GENERAL READING AND FREE WRITING 9

Reading – Story with questions and answers – **Writing** – paragraph writing- topic sentence – main ideas – free writing, short narrative descriptions using some suggested vocabulary and structures – **Listening** – Listening to a speech – answering questions. **Speaking** – Presentation with PPT - **Language development** – prepositions, **Vocabulary development** – guessing meanings of words in contexts – articles.

UNIT- III: GRAMMAR AND LANGUAGE DEVELOPMENT 9

Reading – short texts (close reading) **Writing** – understanding text structure – use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to stories to answer questions. **Speaking** – asking about routine actions and expressing opinions. **Language development** – Adjectives, degrees of comparison – conjunctions and connectives – **Vocabulary development** – single word substitutes-adverbs.

UNIT- IV: READING AND LANGUAGE DEVELOPMENT 9

Reading – Newspaper articles- answering questions – **Writing** – letter writing, informal or personal letters – congratulating/ thanking/requesting help e-mails – forward a mail to Staff on given topic – **Listening** – listen to different sounds and differentiate the sounds with different words. **Speaking** – speaking about oneself- speaking about one's friend – **Language development** – Modals – Tenses – **Vocabulary development** – synonyms –antonyms – phrasal verbs.

UNIT- V: EXTENDED WRITING 9

Reading – longer texts – close reading – **Writing**– brainstorming -writing short essays – developing an outline – identifying main and subordinate ideas – dialogue writing – **Listening** – listening to talks- Note taking – **Speaking** – participating in conversations – short group conversations – **Language development** - correction of errors – **Vocabulary development** – collocations – fixed and semi-fixed expressions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations.
- Introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

1. Board of Editors. "Using English – A Course book for Under graduate Engineers and Technologists", Orient BlackSwan Limited, Hyderabad, 2015.
2. Richards, C. Jack. "Interchange Students' Book-2", New Delhi, CUP, 2015.

REFERENCE BOOKS:

1. Bailey, Stephen. "Academic Writing: A practical guide for students", New York: Rutledge, 2011.
2. Means, L. Thomas and Elaine Langlois, "English & Communication for Colleges", Cengage Learning, USA, 2007.
3. Redston, Chris & Gillies, Cunningham Face2Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005.
4. Comfort, Jeremy, et al. "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge: Reprint 2011.
5. Dutt P. Kiranmai and Rajeevan Geeta. "Basic Communication Skills, Foundation Books", 2013.
6. Preliminary English Test – Cambridge University Press ESOL
7. Key English Test – Cambridge University Press ESOL.
8. Pronunciation Dictionary – Daniel Jones.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	3	2	3	3	-	-	-	-	3	-	1	1	1	1	1
2	3	2	3	2	2	-	2	-	-	3	-	1	1	1	1	1
3	3	3	-	2	-	-	-	-	-	3	-	1	1	1	1	1
4	3	3	-	-	-	-	3	-	-	3	-	1	1	1	1	1
5	3	3	3	2	3	3	2	-	-	3	-	1	1	1	1	1

1918102	ENGINEERING MATHEMATICS – I	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	3 1 0 4

COURSE OBJECTIVES:

- To understand and apply matrix techniques for engineering applications.
- To familiarize the student with basic calculus and traditions of traditional calculus.
- To solve the problems in single and multivariable calculus and plays an important role in science, economics, engineering.
- To acquaint the student with mathematical tools needed in evaluating integrals.
- To familiarize the student with multiple integrals and their usage in find the area and volume of two and three dimensional objects.

UNIT- I: MATRICES 9L+3T

System of equations – consistency and inconsistency- Eigen values and Eigen vectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigen vectors - Statement and Applications of Cayley-Hamilton Theorem - Reduction of a quadratic form into canonical form by orthogonal transformation

UNIT-II: DIFFERENTIAL CALCULUS FOR FUNCTIONS OF ONE VARIABLE 9L+3T

Limit of a function - Continuity – Differentiability - Differentiation rules – Rolle’s theorem and Mean Value theorem – Taylor’s series- Maxima and Minima of functions of one variable.

UNIT- III: FUNCTIONS OF SEVERAL VARIABLES 9L+3T

Partial derivatives - Total derivatives - Jacobians and properties - Taylor’s series for functions of two variables - Maxima and Minima of functions of two variables - Lagrange’s method of undetermined multipliers.

UNIT-IV: INTEGRAL CALCULUS FOR FUNCTION OF ONE VARIABLE 9L+3T

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration by partial fractions- Improper integrals

UNIT- V: MULTIPLE INTEGRALS 9L+3T

Double integrals in Cartesian and polar coordinates - Change of order of integration - Area enclosed by plane curves - Change of variables in double integrals (Polar coordinates) - Triple integrals - Volume of solids.

TOTAL: 45L+15T PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

- To apply the idea of reducing complex problems into simple form using matrix technique.
- Basic application of calculus in Engineering problems and to tackle for different geometries.
- This course equips the students to have basic knowledge and understanding of fundamental statistics to analyze and interpret data.
- To apply Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration by partial fractions in Engineering Problems.
- Basic application of Double and Triple integrals used in Engineering real life Problems.

TEXT BOOKS:

1. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.
2. Veerarajan. T, "Engineering Mathematics", McGraw Hill Education (India) Private Limited, 2019.
3. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", S.Chand Private Ltd., 11th Edition, 2005.

REFERENCE BOOKS:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 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, 7.1 - 7.4 and 7.8].

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	2	1	-	-	-	-	-	-	-	1	-	-	-	-
2	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-
3	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-
4	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-
5	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-

UNIT- IV: QUANTUM PHYSICS 9

Black body radiation – Planck’s theory (derivation)- deduction of Wien’s and Rayleigh jeans law – 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 - three dimensional potential box– tunnelling (qualitative) - scanning tunnelling microscope.

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 structure (qualitative) - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – growth of single crystals: solution and melt growth techniques - Importance of crystal physics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course,

- The students will gain knowledge on the basics of properties of matter and its applications,
- The students will acquire knowledge on the concepts of optical devices and their applications in fibre optics,
- The students will have adequate knowledge on the concepts of thermal properties of material and their applications in heat exchanger and electrical appliances,
- The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunnelling microscopes, and
- The students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.

2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.
4. Brijlal and Subramanyam, "Properties of Matter", S .Chand publishing, 2002.

REFERENCE BOOKS:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H.Freeman, 2007.
4. Shatendra Sharma & Jyotsna Sharma, "Engineering Physics". Pearson, 2018.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	1	1	-	-	1	1	-	-	-	-	1	2	-	-	-
2	3	1	1	-	1	1	1	-	-	-	-	1	3	-	-	-
3	3	-	1	-	-	1	-	-	-	-	-	1	3	-	-	-
4	3	1	-	1	-	1	1	-	-	-	-	1	3	-	-	-
5	3	1	-	1	-	-	1	-	-	-	-	1	2	-	-	-

1921104

ENGINEERING CHEMISTRY

L T P C

(Common to all branches of B.E. / B.Tech Programmes)

3 0 0 3

COURSE OBJECTIVES:

- To make the students acquainted with boiler feed water requirements, related problems and domestic water treatment techniques.
- To understand the basic mechanism of surface phenomenon.
- To acquaint the student with the principles of electrochemical reactions, methods for corrosion prevention and protection of materials.
- To make the student conversant with the basics of polymers, cement and glass.
- To acquaint the students with the basics of nanomaterials, their properties and applications.

UNIT- I: WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units - Boiler feed water-boiler troubles - scale and sludge, priming and foaming, caustic embrittlement, boiler corrosion. Treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning). External treatment – Ion exchange process – domestic water treatment (break point chlorination) – Desalination of brackish water – Reverse Osmosis.

UNIT- II: SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms. Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – Contact theory. Kinetics of surface reactions, unimolecular reactions, Langmuir – applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – Criteria – Autocatalysis – Catalytic poison and catalytic promoters – Acid base catalysis – Applications (3 way catalytic convertor) – Enzyme catalysis– Michaelis – Menten equation.

UNIT-III: ELECTROCHEMISTRY,CORROSION AND PROTECTIVE COATINGS 9

Electrochemical cell - redox reaction, electrode potential - origin of electrode potential - oxidation potential - reduction potential, measurement and applications - Electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion – causes – factors – types - chemical, electrochemical corrosion (galvanic,

differential aeration), corrosion control – material selection and design aspects – Electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: Metallic coatings – Electroplating of Cu - electroless plating of Ni. Organic coatings: Paints - constituents and function.

UNIT- IV: ENGINEERING MATERIALS 9

Cement: Definition – classification of cement – Portland cement - manufacture and properties - setting and hardening of cement - special cement, water proof, white and sored cement – properties and uses – Glass: Manufacture, types, properties and uses (laminated, safety and flint glass) - Polymers: Classification - types of polymerization - mechanism - methods of polymerization - Engineering polymers: Nylon-6, Nylon-6,6, Teflon, Kevlar and PEEK - preparation, properties and uses - Plastic and its types - Conducting polymers: Types and applications - Polymers in medicine and surgery (applications).

UNIT- V: NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties (surface to volume ratio, melting point, optical and electrical). Nanoparticles, Nano cluster, Nano rods, Nanotube (CNT: SWNT and MWNT) and Nanowire, Synthesis - precipitation, thermolysis, hydrothermal, electrode position, chemical vapour deposition, laser ablation, sol-gel process and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Gain idea about various methods available for water treatment.
- Explain the materials surface engineering.
- Understand the process of electrochemistry and its application to corrosion.
- Appreciate the nature and novelty of engineering materials.
- Ability to understand the nature and uses of nanomaterials.

TEXT BOOKS:

1. Shikha Agarwal, “Engineering Chemistry - Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.
2. P. C. Jain and Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.

- S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCE BOOKS:

- Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
- S.S. Dara and S.S. Umare, "A Text Book of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
- B. Sivasankar, "Engineering Chemistry", Tata McGraw-Hill Publishing Company LTD, 2012

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	1	2	1	1	1	1	-	-	-	-	3	1	2	1	1
2	2	1	3	-	1	1	1	-	-	-	-	2	1	1	1	1
3	2	-	1	-	-	1	-	-	-	-	-	1	3	3	3	2
4	1	1	2	1	1	-	1	-	-	-	-	2	2	3	3	1
5	2	-	1	-	1	1	-	-	-	-	-	1	2	3	3	2

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Develop simple applications in C using basic constructs.
- Design and implement applications using arrays and strings
- Develop and implement applications in C using functions
- Develop applications in C using structures and unions
- Design applications using preprocessor to stimulate functions

TEXT BOOKS:

1. Anita Goel and Ajay Mittal, – “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Reema Thareja, – “Programming in C”, Oxford University Press, Second Edition, 2016.

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel – “C How to Program”, Seventh Edition, Pearson Publication.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	-	3	-	2	-	-	-	-	-	-	1	-	2	-	-
2	3	3	-	-	2	-	1	-	-	-	-	-	3	-	-	-
3	2	1	-	2	3	-	-	-	-	-	-	-	-	-	2	-
4	-	-	2	-	-	-	-	-	2	-	1	-	-	1	-	-
5	-	3	-	-	-	1	-	-	2	-	-	-	-	-	-	3

1901007	ENGINEERING GRAPHICS	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	2 0 4 4

COURSE OBJECTIVES:

- To draw the conics curves and special curves.
- To draw the orthographic projection of lines and plane surfaces.
- To draw the projections and solids and Isometric projection of simple solids.
- To draw projections of Section of Solids and development of surfaces.
- To draw free hand sketching of basic geometrical constructions, multiple views of objects and Perspective Projection of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT- I: PLANE CURVES AND SPECIAL CURVES 10

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid (Rolling Circle rolls on flat surface only). Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT- II: PROJECTION OF POINTS, LINES AND PLANE SURFACES 16

Orthographic projection- Principles-Principal planes - First angle projection-projection of points at First Quadrant only. 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. Projection of planes (polygonal and circular surfaces) which inclined to both the principal planes by rotating object method.

UNIT- III: PROJECTION OF SOLIDS AND ISOMETRIC PROJECTION 16

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is Inclined to one of the principal planes by rotating object method. Principles of isometric projection – isometric scale – Isometric projections of simple solids - Prisms, pyramids, cylinders, cones.

UNIT-IV: PROJECTION OF SECTIONED SOLIDS & DEVELOPMENT OF SURFACES 16

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.

UNIT- V: FREE HAND SKETCHING AND PERSPECTIVE PROJECTIONS 16

Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects. Perspective projection of simple solids-Prisms and pyramids by visual ray method.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

On Completion of the course the student will be able to,

- Draw the conics curves and special curves.
- Do orthographic projection of lines and plane surfaces.
- Draw projections of solids and Isometric Projection
- Draw projections of Section of Solids and development of surfaces.
- Draw free hand sketching of basic geometrical constructions , multiple views of objects and Perspective Projection of simple solids.

TEXT BOOKS:

1. N.D.BHATT, “Engineering Drawing (Plane and Solid Geometry)”, Charotar Publishing House. PVT. LTD. 53rd Edition : 2018 (Reprint)
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2018

REFERENCE BOOKS:

1. T. Jeyapoovan, “Engineering Graphics Using Auto CAD”, Vikas Publishing House Pvt. LTD, seventh Edition, 2015.
2. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production”, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi,

2005.

3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2011.
4. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
5. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	-	3	-	-	-	-	-	1	3	-	1	2	1	1	1
2	2	-	3	-	-	-	-	-	1	3	-	1	2	1	1	1
3	2	-	3	-	-	-	-	-	1	3	-	1	2	1	1	1
4	2	-	3	-	-	-	-	-	1	3	-	1	2	1	1	1
5	2	-	3	-	-	-	-	-	1	3	-	1	2	1	1	1

1901108	PHYSICS AND CHEMISTRY LABORATORY	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	0 0 4 2

PHYSICS LABORATORY

COURSE OBJECTIVES:

- To study the behaviour of material under shear stress.
- To learn the basics concept understanding the deformation due to linear stress
- To explore the photons to measure the physical parameters.
- To introduce experiments to test thermal conductivity of bad conductor.
- To study the spectrum of white light.

LIST OF EXPERIMENTS: (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum.
2. Determination of Young’s modulus by non-uniform bending method.
3. (a) Determination of wavelength and particle size using Laser.
(b) Determination of acceptance angle and numerical aperture in an optical Fiber.
4. Determination of thermal conductivity of a bad conductor – Lee’s Disc method.
5. Determination of velocity of sound and compressibility of liquid and Solid – Ultrasonic Interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Measure the rigidity modulus of the material.
- Calculate the deformation due to linear stress and Young’s Modulus
- Use laser to measure the physical parameters.
- Calculate the thermal conductivity of bad conductor by lees disc.
- Measure the wavelength of the mercury the spectrum.

REFERENCE BOOKS:

1. Wilson J.D. and Hernaandez Hall C.A. – “Physics Laboratory Experiments”, Houghton Mifflin Company, New York, 2005.

2. S. Srinivasan, "A Text Book of Practical Physics", S. Sultan Chand publications. 2005
3. R. Sasikumar, "Practical Physics", PHI Learning Pvt. Ltd, New Delhi, 2011.

CHEMISTRY LABORATORY

COURSE OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.
- To make the student conversant with the corrosion defects experimentally.
- To develop and understand the basic concepts of acidic and basic nature using pH.
- To make the student familiar with the properties and nature of alloys experimentally.

LIST OF EXPERIMENTS: (Any 5 Experiments)

1. Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.
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.
5. Estimation of iron content of the given solution using potentiometer.
6. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
7. Pseudo first order kinetics-ester hydrolysis.
8. Corrosion experiment-weight loss method.
9. Conductometric titration of strong acid Vs strong base.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- Obtain the hands-on knowledge in the quantitative chemical analysis of water quality related parameters.
- Understand the experimental concepts in the mixture of acids and bases.
- Appreciate the need of iodometry in the estimation of metals.

- Explore the drawbacks of corrosion by weight loss method.
- Design and carry out the scientific experiments related to boiler troubles.

TEXT BOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th Edition, 2014)

PHYSICS LABORATORY

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	1	1	1	-	1	-	1	1	-	-	-	1	-	-	-
2	3	1	1	1	-	1	-	1	1	-	-	-	1	-	-	-
3	3	1	1	1	-	2	-	1	1	-	-	-	2	-	-	-
4	3	1	1	1	-	1	-	1	1	-	-	-	2	-	-	-
5	3	1	1	1	-	1	-	1	1	-	-	-	1	-	-	-

CHEMISTRY LABORATORY

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	2	1	2	-	-	2	-	-	-	-	1	-	-	-	-
2	3	2	2	2	-	-	2	-	-	-	-	1	-	-	-	-
3	2	2	1	2	-	1	2	-	-	-	-	1	2	3	2	1
4	3	2	3	2	-	1	2	-	-	-	-	1	2	3	2	1
5	2	2	1	2	-	1	2	-	-	-	-	1	2	3	2	1

1901010	C PROGRAMMING LABORATORY	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	0 0 4 2

COURSE OBJECTIVES:

- To develop programs in C using basic constructs.
- To develop applications in C using arrays and functions.
- To develop applications in C using Strings and Structures.
- To develop various applications using array concepts
- To develop various application using function concept.

LIST OF PROGRAMS:

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Check whether a given number is odd or even?
7. Write a program to perform factorial of a number.
8. Write a C program to find out the average of 4 integers.
9. Show how to display array elements using two dimensional array.
10. Write a C program to perform swapping using function.
11. Display all prime numbers between two intervals using functions.
12. Reverse a sentence using recursion.
13. Write a program in C to get the largest element of an array using the function.
14. Write a C program to concatenate two string.
15. Write a C program to find the length of String.
16. Find the frequency of a character in a string.
17. Write a C program to Store Student Information in Structure and Display it.
18. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:
 - a) Total marks obtained by each student.

- b) The highest marks in each subject and the marks of the student who secured it.
 c) The student who obtained the highest total marks.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Develop C programs for simple applications.
- Making use of basic constructs, arrays and strings.
- Develop C programs involving functions,
- Develop program using recursion, pointers, and structures.
- Design applications using sequential and random access file processing.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	-	3	-	-	-	-	-	-	-	-	-	2	-	-	-
2	-	-	-	-	2	-	-	-	-	1	-	-	-	-	2	-
3	-	-	-	2	-	-	-	-	1	-	-	-	-	-	-	2
4	-	2	-	-	-	2	-	-	-	-	2	-	-	2	-	-
5	-	-	-	-	-	-	-	3	-	-	-	1	2	-	-	-

SEMESTER II

1919201	TECHNICAL ENGLISH	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	3 0 0 3

COURSE OBJECTIVES:

The Course prepares Second semester Engineering & Technology students to:

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

UNIT- I: INTRODUCTION / TECHNICAL ENGLISH 9

Listening – Listening to talks mostly of a scientific/technical nature and completing information – gap exercises- **Speaking** – Asking for and giving directions – **Reading** – reading short technical texts from journals- newspapers – **Writing**– purpose statements – Technical Jargons, homophones – issue – writing instructions – checklists-recommendations-**Vocabulary Development** – technical vocabulary **Language Development** – subject verb agreement – compound words.

UNIT- II: READING AND STUDY SKILLS 9

Listening – Listening to a technical conversation and filling the gaps – **Speaking** – describing a process – **Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing – Writing – interpreting charts, graphs – **Vocabulary Development** – vocabulary used in formal letters/emails and reports **Language Development** – impersonal passive voice, numerical adjectives.

UNIT- III: TECHNICAL WRITING AND GRAMMAR 9

Listening – Listening to classroom lectures/ talks on engineering/technology – **Speaking** – mechanics of presentations – **Reading** – longer texts both general and technical, practice in speed reading; **Writing** – Describing a process, use of

sequence words – **Vocabulary Development** – Misspelt words. **Language Development** – homonyms.

UNIT- IV: REPORT WRITING 9

Listening – Listening to documentaries and making notes. **Speaking** – introduction to technical presentations – **Reading** – reading for detailed comprehension – **Writing** – Product description – job application – cover letter – Résumé preparation (via email and hard copy)- Issue based essays and official circulars – **Vocabulary Development** – finding suitable synonyms – paraphrasing – **Language Development** – clauses – if conditionals.

UNIT- V: GROUP DISCUSSION AND JOB APPLICATIONS 9

Listening – TED/INK talks, answering the questions; **Speaking** – participating in a group discussion – **Reading** – reading and understanding technical articles. **Writing** – Writing reports – minutes of a meeting – Letter Writing- Letter to the Editor – Letter seeking permission for an Industrial visit/ Internship – Business Letters, asking for quotation/clarification – seeking orders, thanking for the order given, Complaint letters – **Vocabulary Development** – verbal analogies **Language Development** – reported speech.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Participate in group discussions.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of Editors. “Fluency in English – A Course book for Engineering and Technology”, Orient BlackSwan Limited, Hyderabad: 2016.
2. Sudharshana. N.P and Saveetha. C. “English for Technical Communication”, Cambridge University Press: New Delhi, 2016.

REFERENCE BOOKS:

1. Raman, Meenakshi and Sharma, Sangeetha – “Technical Communication Principles and Practice”, Oxford University Press: New Delhi, 2014.
2. Kumar, Suresh. E. “Engineering English”. Orient Blackswan: Hyderabad, 2015.
3. Booth-L. Diana, “Project Work”, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, “English for Presentations”, Oxford University Press, 2007.
5. Means, L. Thomas and Elaine Langlois, “English & Communication For Colleges”.
6. IELTS - Cambridge University Press.
7. BEC - Cambridge University Press.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	-	-	-	-	-	-	-	3	-	1	1	1	1	1
2	3	2	2	-	-	-	-	-	-	-	-	2	1	1	1	1
3	3	-	-	-	-	-	-	-	3	3	-	1	1	-	1	1
4	3	2	2	2	-	-	-	-	-	3	-	1	1	1	1	1
5	3	2	-	2	-	-	-	-	-	3	2	1	2	2	1	1

1918202	ENGINEERING MATHEMATICS – II	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	3 1 0 4

COURSE OBJECTIVES:

- This course is designed to cover topics such as Ordinary Differential equation, Vector Calculus, Complex Analysis and Laplace Transform.
- ODE is the powerful tools to solve practical problems in the field of engineering.
- Vector calculus can be widely used for modeling the various laws of physics.
- The various methods of complex analysis helps us to evaluate contour integration.
- Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering.

UNIT- I: ORDINARY DIFFERENTIAL EQUATIONS 9L+3T

First order linear Differential equations- Exact differential equations- Second order linear differential equations with constant coefficients – Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type.

UNIT- II: VECTOR CALCULUS 9L+3T

Gradient and directional derivative – Divergence and curl– Irrotational and Solenoidal vector fields – Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT- III: LAPLACE TRANSFORMS 9L+3T

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

UNIT- IV: ANALYTIC FUNCTIONS 9L+3T

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions $w = Cz, C + z, \frac{1}{z}, z^2$ Bilinear transformation

UNIT- V: COMPLEX INTEGRATION 9L+3T

Complex integration – Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s

and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour

TOTAL: 45L +15T PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

- Apply complex variables in finding ,Gradient, divergence,curl of a vector point function.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration are evaluated.
- Laplace transform and inverse transform of simple functions, properties, are studied.
- Apply various techniques in solving Ordinary differential equations with constant coefficients

TEXT BOOKS:

1. Grewal. B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Veerarajan. T, "Engineering Mathematics", McGraw Hill Education (India) Private Limited, 2019.

REFERENCE BOOKS:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	2	1	-	-	-	-	-	-	-	1	-	-	-	-
2	3	2	1	-	-	-	-	-	-	-	-	1	-	-	-	-
3	3	1	2	1	-	-	-	-	-	-	-	1	-	-	-	-
4	3	2	1	-	-	-	-	-	-	-	-	1	-	-	-	-
5	3	1	1	1	-	-	-	-	-	-	-	1	-	-	-	-

1920202

PHYSICS FOR INFORMATION SCIENCE

L T P C

(Common to CSE & IT)

3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of conductivities in the conducting material .
- To facilitate the knowledge about basics of doping, types of semiconductors.
- To enrich the idea of magnetic materials in storage devices.
- To explore the basics of interaction of photon with materials.
- To enhance the fundamental knowledge nano materials and its applications.

UNIT- I: ELECTRICAL PROPERTIES OF MATERIALS

9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity expression - Wiedemann-Franz law – Success and failures – Quantum free electron theory – degenerate states- Fermi- Dirac distribution function – Density of energy states – Electron in periodic potential – Energy bands in solids; conductors, semiconductors and insulators.

UNIT- II: SEMICONDUCTOR PHYSICS

9

Direct and indirect band gap semiconductors - Intrinsic 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 –Hall effect- Theory and experiment– Applications.

UNIT- III: MAGNETIC PROPERTIES OF MATERIALS

9

Magnetic dipole moment – origin of magnetic moments- Bohr magneton- magnetic permeability and susceptibility - Magnetic material classification – Ferromagnetism: Domain theory- Energy involved in domains - Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses saturation magnetization and Curie temperature – Magnetic hard disc (GMR sensor).

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 –

Optical data storage techniques.

UNIT- V: NANO MATERIALS AND DEVICES

9

Introduction – Size dependence of Fermi energy – Quantum confinement – Quantum structures – Density of energy states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterial – Tunnelling: single electron phenomena and single electron transistor – Quantum dot laser – Carbon nanotubes: Properties and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will able to

- Gain knowledge on classical and quantum free electron theories, and energy band Structures.
- Acquire knowledge on basics of Semiconductor Physics and its applications in various devices,
- Get knowledge on magnetic properties of materials and their applications in data storage.
- Have the necessary understanding on the functioning of optical materials for optoelectronics.
- Understand the basics of quantum structures and their applications.

TEXT BOOKS:

1. Jasprit Singh, “Semiconductor Devices: Basic Principles”, Wiley 2012.
2. Kasap, S.O., “Principles of Electronic Materials and Devices”, McGraw-Hill Education, 2007.
3. 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 Nano electronics”, Pearson Education, 2009.
3. Rogers, B., Adams, J. & Pennathur, S. “Nanotechnology: Understanding Small Systems”, CRC Press, 2014.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	2	-	1	1	1	-	-	-	-	-	3	-	-	-
2	3	2	2	-	-	1	1	-	-	-	-	-	3	-	-	-
3	3	2	2	-	-	1	1	-	-	-	-	-	1	-	-	-
4	3	2	2	-	-	1	1	-	-	-	-	-	2	-	-	-
5	3	2	2	-	1	1	1	-	-	-	-	-	3	1	-	-

1921203	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
	(Common to all branches of B.E. / B.Tech. Programmes)	3	0	0	3

COURSE OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship 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 study the dynamic processes and understand the features of the earth's interior and surface.

UNIT- I: ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the grassland ecosystem, aquatic ecosystems (lakes, oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of an ecosystems.

UNIT- II: ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial /Agricultural.

UNIT- III: NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, soil erosion and desertification, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water– Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity– 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.

UNIT- IV: SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting and watershed management – 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 – environment production 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- Public awareness.

UNIT- V: HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental protection. One will obtain knowledge on the following after completing the course.

- Gain knowledge on ecosystem, environment and biodiversity.
- Understand the process and disadvantages of environmental pollution.
- Analyze the ill effects of over exploitation of natural resources.
- Explain the social issues from unsustainable to sustainable development.
- Outline the need for decrease in population growth and its measures.

TEXT BOOKS:

1. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, 2nd Edition, Pearson Education, 2004.

REFERENCE BOOKS:

1. Dharmendra S. Sengar, “Environmental law”, Prentice Hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press (I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, “Environmental Studies - From Crisis to Cure”, Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, “Environmental Science”, Cengage Learning India PVT, LTD, Delhi, 2014.

CO	PO												PSO			
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2	2	2	3	-	-	2	3	-	1	-	-	3	1	3	3	2
3	2	1	2	-	-	2	3	-	2	-	-	3	1	1	1	1
4	1	3	2	-	-		3	-	3	-	-	2	2	3	3	1
5	1	1	1	-	-	1	2	-	-	-	-	1	1	1	1	1

1901005	PROBLEM SOLVING AND PYTHON PROGRAMMING	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	3 0 0 3

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures – lists, tuples, dictionaries.

UNIT- I: ALGORITHMIC PROBLEM SOLVING, DATA TYPES 9

Algorithms: building blocks of algorithms (statements, control flow, functions), notation (pseudo code, flow chart). Python interpreter and interactive mode; **values and types:** int, float, Boolean, string, and list; variables, operators and expressions, statements, tuple assignment, precedence of operators, comments, Illustrative programs: Algorithm for Arithmetic expression (addition and subtraction).

UNIT- II: CONTROL FLOW STATEMENTS AND FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); **Iteration:** state, while, for, break, continue, pass; functions, function definition and use. **Fruitful functions:** return values, parameters, local and global scope, recursion. Illustrative programs: exchange the values of two variables square root, printing n numbers iteratively

UNIT- III: LIST& TUPLES 9

Lists: list operations, list slices, list methods, list loop, mutability, list parameters; **Tuples:** tuple assignment, tuple as return value. Comparison of Lists and tuples. Illustrative programs: selection sort, insertion sort, Quick sort.

UNIT- IV: STRINGS, DICTIONARIES & SET 9

Strings: string slices, immutability, string functions and methods, string module. **Dictionaries:** Operations (create, access, add, remove) and methods. (insert, delete).Set operation (Access, Add, Remove).Comparison of dictionary and set.

UNIT- V: FILES, MODULES & PACKAGES 9

Files and exception: text files, reading and writing files, format operator; errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count,

copy file.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

- Develop algorithmic solutions to simple computational problems.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, Set and dictionaries.
- Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Reema Thareja, “Python Programming using Problem solving Approach” ,Oxford Higher Education,2017
2. 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/think-python/>)
3. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python” – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS:

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

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
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3	-	-	-	2	3	-	-	-	-	-	-	-	-	2	-	-
4	-	-	-	-	2	2	-	-	-	2	-	-	-	2	-	-
5	-	-	-	-	-	-	-	-	-	2	2	-	-		1	-

1901008	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
	(Common to CSE, EEE, ECE, EIE, IT & Medical Electronics)	3	0	0	3

COURSE OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures and construction methods
- To enable the students to distinguish the components and working principle of power plant units, boilers and IC engines.
- To understand the concepts and working principle of refrigeration and air conditioning system

A – OVER VIEW

UNIT- I: SCOPE OF CIVIL AND MECHANICAL ENGINEERING 7

Overview of Civil Engineering: Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering.

Overview of Mechanical Engineering: Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

UNIT- II: SURVEYING AND CIVIL ENGINEERING MATERIALS 7

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber – modern materials.

UNIT- III: BUILDING COMPONENTS AND STRUCTURES 11

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brickmasonry – stonemasonry – beams – columns – lintels – roofing– flooring – plastering – floor area, carpet area and floor space index -

Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and railway.

C – MECHANICAL ENGINEERING

UNIT- IV: INTERNAL COMBUSTION ENGINES AND POWER PLANTS 11

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Working principle of steam, Gas, Diesel, Hydro – electric and Nuclear Power plants – working principle of Cochran, Lamont, Benson Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT- V: REFRIGERATION AND AIR CONDITIONING SYSTEM 9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Knowledge of basics in various sub-disciplines of civil and mechanical engineering.
- Use the basics of surveying for calculation of area and volume in basic construction works
- Fundamental elements of civil engineering structures and construction methods.
- Understand the energy sources and working principle of power plants and apply the knowledge of power plants to diagnose and solve the Engineering problem and the working principle of IC Engines
- Understand the function of refrigeration and air conditioning system.

TEXT BOOKS:

1. Shanmugam G and Palanichamy MS, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, 2018.
2. Satheesh Gopi, “Basic Civil Engineering”, Pearson publications, 2009.

3. Basant Agrawal and C.M.Agrawal, "Basic Mechanical Engineering", Wiley Publications Pvt Ltd., New Delhi, 2018.

REFERENCE BOOKS:

1. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd, 2015.
2. Rajput R.K., "Thermal Engineering", Laxmi Publications (P) Ltd, 10th Edition, 2018.
3. Kothandaraman C.P., Domkundwar S., Dhanpat Rai, "Thermal Engineering", Publishing Co.(P) Ltd., 6th Edition, 2015.

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3	3	1	2	1	-	1	1	-	-	-	-	-	2	1	-	2
4	3	2	2	1	-	1	-	-	-	-	-	1	2	1	1	2
5	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-	1

COURSE OUTCOMES:

At the end of the course, learners will be able to:

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	-	-	-	-	-	-	1	-	-	-	3	2	3	-	-
2	-	2	2	-	-	2	-	-	-	-	2	-	-	3	-	-
3	-	-	-	1	-	-	-	-	-	-	-	-	2	-	-	-
4	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-
5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	3

1901208	ENGINEERING PRACTICES LABORATORY	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	0 0 4 2

COURSE OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
- To provide hands on training for fabrication of components using carpentry, sheet metal and welding equipment / tools
- To gain the skills for making fitting joints and assembling air conditioner
- To develop the skills for making simple electrical wiring connections using suitable tools
- To provide hands on experience for soldering and gain knowledge about the behavior of electronics components

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 15

Buildings:

- Study of plumbing and carpentry components of residential and industrial buildings safety aspects.

Plumbing Works:

- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Study of pipe connections requirements for pumps and turbines.
- Preparation of plumbing line sketches for water supply and sewage works.
- Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- Demonstration of plumbing requirements of high-rise buildings.

Carpentry Works:

- Study of the joints in roofs, doors, windows and furniture.
- Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

15

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.

Fitting:

- a) Preparation of square fitting
- b) Preparation of V – fitting models.

Machine assembly practice:

- a) Assembly of centrifugal pump
- b) Assembly of air conditioner

Demonstration on:

- a) Smithy operations, upsetting, swaging, setting down and bending.
Example – Exercise – Production of hexagonal headed bolt.
- b) Foundry operations like mould preparation for gear and step cone pulley.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

15

1. Residential house wiring using Switches, Fuse, Indicator, Lamp and Energy meter.
2. Fluorescent Lamp Wiring.
3. Staircase Wiring.
4. Measurement of Voltage, Current, Power and Power factor in electrical circuit.
5. Measurement of Energy using Analog & Digital Energy meter.
6. Measurement of Earth Resistance.

7. Study of Industrial house wiring.
8. Identification & Study of protective devices: Fuses & Fuse carriers, MCB, ELCB and Isolators with ratings and usage.

IV ELECTRONICS ENGINEERING PRACTICE

15

1. Study of Electronic components and equipments – 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.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Carry out various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering
- Fabricate carpentry components and pipe connections including plumbing works and use welding equipment's to join the structures.
- Carry out the basic machining operations, make the models using sheet metalworks. Illustrate on centrifugal pump, air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and measure the electrical quantities
- Elaborate on the electronics components, gates and soldering practices

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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 |
| 4. Models of industrial trusses, door joints, furniture joints | 5 each |

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 | One each |
| 10. Fitting tools, Hack saw frame, 12' file, hack saw blade | 15 Nos. |

ELECTRICAL

- | | |
|--|---------|
| 1. Assorted electrical components for house wiring | 15 Sets |
| 2. Fluorescent Lamp | 15 Sets |
| 3. Electrical measuring instruments | 10 Sets |
| 4. Analog & Digital energy meter | 5 Sets |
| 5. Megger | 2 |

ELECTRONICS

- | | |
|---|---------|
| 1. Soldering guns | 10 Nos. |
| 2. Assorted electronic components for making circuits | 50 Nos. |
| 3. Small PCBs | 10 Nos. |
| 4. Multimeters | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply | |

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2	-	1	2	-	3	-	-	-	-	-	1	-	-	-	-	-
3	-	-	-	3	2	-	-	-	-	-	-	1	-	-	-	-
4	-	2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
5	-	3	2	2	-	-	-	-	1	-	-	-	-	-	-	-

1901209 APPLIED PHYSICS AND ENVIRONMENTAL CHEMISTRY L T P C
LABORATORY 0 0 4 2

(Common to all branches of B.E. / B.Tech. Programmes)

(Laboratory classes on alternate weeks for Physics and Environmental Chemistry)

APPLIED PHYSICS LABORATORY

COURSE OBJECTIVES:

- To measure the band gap of given semi conductor.
- To study I-V characteristics of solar cell
- To measure electrical resistivity of metal and alloy
- To calculate the hkl planes
- To measure the paramagnetic susceptibility by Quinke's method

LIST OF EXPERIMENTS: (Any 5 Experiments)

1. Determination of band gap of a semiconductor.
2. Study of I-V characteristics of solar cell and determination of its efficiency.
3. Determination of electrical resistivity of metal and alloy –Carey foster Bridge.
4. Calculation of lattice cell parameter – X-ray diffraction method.
5. Measurement of susceptibility of paramagnetic solution by Quinke's method.
6. Study of magnetic Hysteresis-B-H curve.
7. Measurement of Temperature using LM35.

TOTAL: 30 PERIODS

DEMO:

1. Crystal growth- Low temperature solution growth.
2. Absorption and transmittance measurement of materials – UV visible spectrum.
3. Attenuation losses in optical Fiber.

COURSE OUTCOMES:

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

- Measure the band gap of semiconductors
- Measure the efficiency of solar cell
- Compare the resistivity of metals and alloys

- Calculate the lattice parameter and interplanar distance.
- Understand the susceptibility values for any paramagnetic substances

REFERENCE BOOKS

1. Wilson J.D. and Hernandez Hall C.A. – “Physics Laboratory Experiments”, Houghton Mifflin Company, New York, 2005.
2. S. Srinivasan, “A Text Book of Practical Physics”, S. Sultan Chand publications. 2005.
3. R. Sasikumar, “Practical Physics”, PHI Learning Pvt. Ltd, New Delhi, 2011.

ENVIRONMENTAL CHEMISTRY LABORATORY

COURSE OBJECTIVES:

- To determine the dissolved oxygen and chloride content in water
- To determine calcium and magnesium present in domestic water
- To estimate iron, sodium and chlorine using various techniques
- To determine the chemical oxygen demand in industrial effluent
- To determine the available chlorine in bleaching powder.

LIST OF EXPERIMENTS: (Any 5 Experiments)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of DO content of water sample by Winkler’s method.
3. Determination of chloride content of water sample by argentometric method.
4. Estimation of iron content of the water sample using spectrophotometer
5. Determination of COD value of industrial effluents
6. Estimation of sodium by flame photometry
7. Estimation of available chlorine in bleaching powder

TOTAL: 30 PERIODS

DEMO:

1. Pollution abatement by adsorption techniques
2. Scintillation Process

COURSE OUTCOMES:

- Appreciate the basic requirements for potable water.
- Understand the need of dissolved oxygen in water.
- Explore the quantity of bleaching powder to be added in water.
- Analyze the ill effects caused by the industrial effluents.
- Explore new research areas in the treatment of waste water.

TEXT BOOKS:

Vogel's Textbook of Quantitative Chemical Analysis (8th Edition, 2014)

APPLIED PHYSICS LABORATORY

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3	3	2	2	1	-	-	-	1	1	-	-	-	3	-	-	-
4	3	1	2	2	-	1	-	1	1	-	-	-	1	-	-	-
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ENVIRONMENTAL CHEMISTRY LABORATORY

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3	3	3	3	3	-	2	3	-	-	-	-	1	-	-	-	-
4	2	3	3	2	-	3	3	-	-	-	-	2	2	3	2	1
5	3	3	3	3	-	3	3	-	-	-	-	1	-	-	-	-

OUTCOMES:

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

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

TEXT BOOKS:

1. Rosen, K.H., “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCE BOOKS:

1. Grimaldi, R.P. “Discrete and Combinatorial Mathematics: An Applied Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., “Discrete Mathematics”, Schaum’s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T. “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
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2	3	3	3	-	-	-	-	-	3	-	-	-	-	-	-	-
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OBJECTIVES:

- To introduce the concept of Internet, Networks and its working principles.
- To understand the basic Networking techniques and their types.
- To know the techniques of Artificial Intelligence.
- To understand the data analysis, SQL queries and mining
- To understand various applications related to Information Technology.

UNIT- I: WEB ESSENTIALS 9

Creating a Website – Working principle of a Website – Browser fundamentals – Authoring tools – Types of servers: Application Server – Web Server – Database Server

UNIT- II: NETWORKING ESSENTIALS 9

Fundamental computer network concepts – Types of computer networks – Network layers – TCP/IP model – Wireless Local Area Network – Ethernet – WiFi – Network Routing – Switching – Network components.

UNIT- III: ARTIFICIAL INTELLIGENCE ESSENTIALS 9

Introduction to Artificial Intelligence, Search-Heuristic Search, A* algorithm-Game Playing-Alpha, Beta Pruning, Expert systems, Inference-Rules, Forward Chaining and Backward Chaining, Genetic Algorithms, Proposition Logic, First Order Predicate Logic

UNIT- IV: DATA SCIENCE ESSENTIALS 9

Introduction to Data Science, Revolution of technology, Need of Data Science, Data Science roles , Applications of data science ,Life Cycle of Data Science , Data Models in Organizations , Data types and storage , Data Resources, processes, Standards and tools, Impact of Data Science on society , Case studies on Data Science .

UNIT- V: APPLICATION ESSENTIALS 9

Creation of simple interactive applications – Simple database applications – Multimedia applications – Design and development of information systems – Personal Information System – Information retrieval system – Social networking applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design and deploy web-sites
- Understand the Artificial Intelligence Algorithms
- Create simple database applications
- Implement basic SQL queries and Data statistical foundation.
- Describe the basics of networking and the basic essential of Information Technology

TEXT BOOKS:

1. Robin Nixon, “Learning PHP, MySQL, JavaScript, CSS & HTML5” Third Edition, O’REILLY, 2014.
2. James F. Kurose, — “Computer Networking”: A Top-Down Approach, Sixth Edition, Pearson, 2012.
3. Peter Norvig and Stuart J. Russell, “Artificial Intelligence: A Modern Approach”, fourth edition, Prentice Hall, 2020

REFERENCE BOOKS:

1. Gottapu Sasibhushana Rao, “Mobile Cellular Communication”, Pearson, 2012.
2. R. Kelly Rainer, Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014.
3. it-ebooks.org.

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OBJECTIVES:

- To understand the object oriented approach of Python
- To Learn linear data structures – lists, stacks, and queues
- To Learn non- linear data structures
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

UNIT- I: OBJECT ORIENTED APPROACHES OF PYTHON 9

Basic concepts of Object Oriented Programming – From Procedural to Object approach – Properties - Classes – Methods – Attributes - Objects – Inheritance – Overloading – Overriding – Data Hiding - Exceptions – Processing Files

UNIT- II: LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists- circularly linked lists- doubly-linked lists - Stack ADT – Operations - Applications - Evaluating arithmetic expressions - - Queue ADT – Operations - Circular Queue.

UNIT- III: NON LINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap

UNIT- IV: NON LINEAR DATA STRUCTURES – GRAPHS 9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT- V: SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Implement Object Oriented concepts in Python.
- Apply the various linear data structures to problem solutions.
- Apply the different non-linear data structures to problem solutions.
- Critically analyze the various sorting, searching algorithms.
- Select appropriate data structures and hashing function as applied to specific problem definition.

TEXT BOOKS:

1. Neceise, Rance D, “Data structures and algorithms using Python”, John Wiley & Sons, 2011
2. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 1997.
3. ReemaThareja, —Data Structures Using C, Second Edition , Oxford University Press, 2011

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education.
4. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008.

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OUTCOMES:**At the end of the course, the student should be able to:**

- Simplify Boolean functions using KMap
- Design and Analyze Combinational Circuits
- Implement design using synchronous and asynchronous sequential logic Circuits
- Implement designs using Programmable Logic Devices
- Write HDL code for combinational and Sequential Circuits

TEXT BOOKS:

1. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2017.

REFERENCE BOOKS:

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010.
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013.
4. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill, 2003.

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5	2	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-

OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.

UNIT- I: PROCESSES AND THREADS 9

Introduction to operating systems – OBJECTIVES: and functions, Evolution of Operating System - operating system-structures – system calls – system programs – System Generation and system boot Processes: Process concept – Process scheduling – Operations on processes –Inter process communication – Communication in client-server systems. Threads: Multi-threading models – Threading issues. Case study: IPC in Linux, Pthreads library

UNIT- II: PROCESS SCHEDULING AND SYNCHRONIZATION 9

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multilevel Queue scheduling - Multilevel feedback Queue Scheduling-Process Synchronization: The critical-section problem – Semaphores – Classic problems of synchronization –critical regions. Deadlock: System model – Deadlock characterization –Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance –Deadlock detection – Recovery from deadlock. Case study: Process scheduling in Linux

UNIT- III: STORAGE MANAGEMENT 9

Main Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Virtual Memory: Background – Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing. Case Study: Memory management in Linux

UNIT- IV: FILE SYSTEMS 9

File-System Interface: File concept – Access methods – Directory structure – File system mounting – File Sharing- Protection. File-System Implementation: File System Structure- Allocation methods – Free-space management – efficiency and performance – recovery –

log-structured file systems. Case studies: File system in Linux

UNIT- V: I/O SYSTEMS

9

I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem - streams – performance. Mass-Storage Structure: Disk scheduling – Disk management – Swap-space management – disk attachment. Case study: I/O in Linux

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems and I/O management
- Perform administrative tasks on Linux Servers.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004.
2. Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2004.
3. Harvey M. Deitel, “Operating Systems”, Third Edition, Pearson Education, 2004.
4. RamezElmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
5. Achyut S. Godbole, AtulKahate, “Operating Systems”, McGraw Hill Education, 2016.
6. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly.

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3	3	1	-	-	-	-	-	-	-	-	-	-	-	2	-	2
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**COMPUTATIONAL INTELLIGENCE ESSENTIALS
LABORATORY**

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OBJECTIVES:

- To Understand the concept of Website development programming
- To solve the simple database problem using with MySQL queries
- To Acquire the basic concept of Artificial Intelligence
- To get the knowledge on R language
- To understand the concept of clustering.

LIST OF EXPERIMENTS:

1. Creation of interactive web sites – Design using HTML and authoring tools
2. Creation of simple PHP scripts – Dynamism in web sites
3. Handling multimedia content in web sites
4. Database applications using PHP and MySQL
5. Study of computer networking components
6. Creation of information retrieval system using web, PHP and MySQL
7. Study of Technologies associated with mobile devices
8. Creation of Personal Information System
9. Study of Prolog.
10. Write simple fact for the statements using PROLOG.
11. Calculate Basic Statistics and Visualization of data in R programming
12. Find the K-means Clustering for group of data

TOTAL: 60 PERIODS

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

1. HTML / PHP / MYSQL/ R Prog
2. Jupyter Notebook and IPython

HARDWARE:

Standalone Desktops: 30 Nos.

OUTCOMES:

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

- Understand the website development
- Implement the simple problems with MySql
- Implement intelligence agent concept
- Work with the R programming for data science
- Implement the concept of grouping techniques

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5	3	-	-	3	-	-	2	-	-	-	-	3	-	-	2	-

OBJECTIVES:

- To implement linear and non-linear data structures
- To implement non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms

LIST OF EXPERIMENTS:

1. Array and Linked list implementation of List ADT
2. Array and Linked list implementation of Stack ADT
3. Array and Linked list implementation of Queue ADT
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps.
9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

TOTAL: 60 PERIODS**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

Systems with Linux Operating System with gnu compiler, Systems with Python

HARDWARE:

Standalone desktops - 30 Nos.

OUTCOMES:

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

- Write functions to implement linear and non-linear data structure operations.
- Suggest appropriate linear data structure operations for solving a given problem.

- Appropriately use the linear / non-linear data structure operations for a given problem.
- Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.
- Apply the searching and sorting algorithms for problem solving.

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OUTCOMES:

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

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics
- Demonstrate accurate and efficient use of advanced algebraic techniques, Linear algebra.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Able to solve various types of system of linear Equations by direct and pivoting method
- Demonstrate the numerical solution of Eigen value problem and generalized inverse

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014
2. Friedberg, A.H., Insel, A.J. and Spence, L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS:

1. Burden R.L. and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. James G. "Advanced Modern Engineering Mathematics", Pearson Education, 2007
3. Kolman B. Hill, D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.
4. Kumaresan S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
5. Lay D.C., "Linear Algebra and its Applications", 5th Edition, Pearson Education, 2015.
6. O'Neil P.V., "Advanced Engineering Mathematics", Cengage Learning, 2007.

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3	3	3	3	-	-	-	-	-	-	-	-	1	-	-	-	-
4	3	3	3	-	-	-	-	-	-	-	-	1	-	-	-	-
5	3	3	3	-	-	-	-	-	-	-	-	1	-	-	-	-

OBJECTIVES:

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques recovery procedures
- To have an introductory knowledge about Query Processing.
- Be familiar with techniques of data mining

UNIT- I: INTRODUCTION TO DATABASES 9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping.

UNIT- II: SQL FUNDAMENTALS 9

Relational Algebra – SQL fundamentals – Advanced SQL features–Triggers–Nested Queries-Joins-Inner Join-Outer join-Functions.

UNIT- III: NORMALIZATION 9

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

UNIT- IV: TRANSACTION PROCESSING AND CONCURRENCY CONTROL 9

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

UNIT- V: DATA MINING 9

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data

Preprocessing.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Classify the modern and futuristic database applications based on size and complexity
- Map ER model to Relational model to perform database design effectively
- Write queries using normalization criteria and optimize queries.
- Apply data mining techniques and methods to large data sets
- Appraise how advanced databases differ from traditional databases.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2016
2. Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, Sixth Edition, Pearson, 2016
3. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

REFERENCE BOOKS:

1. C. J. Date, A.Kannan, S. Swamynathan, —An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, "Database Management Systems, Tata McGraw Hill, 2011.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007

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OBJECTIVES:

- To understand the protocol layering and physical level communication
- To understand the basic concepts of Digital communication techniques
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.
- To understand and analyze the performance of network applications

UNIT- I: INTRODUCTION 9

Networks – Network Types – TCP/IP Protocol suite – OSI Model – Transmission media – Line Configuration – Topology – Transmission Modes – Analog Communication Systems

UNIT- II: DATA COMMUNICATION 9

Analog Signals – Time and Frequency Domain – Digital Signals – Digital to Digital Conversions – Analog to Digital Conversions – Digital to Analog Conversions – Analog to Analog Conversions

UNIT- III: DATA-LINK LAYER & MEDIA ACCESS 9

Introduction – DLC Services – HDLC – PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs: IEEE 802.11, Bluetooth – Connecting Devices: Hubs, Switches- Routers.

UNIT- IV: NETWORK LAYER 9

Network Layer Services – Packet switching – IPV4 Addresses: Classful addressing- classless addressing – Network Layer Protocol: Internet Protocol (IP) – Routing Algorithms: Distance vector routing- Link State routing- Unicast routing algorithm: OSPF– Multicasting Basics – IPV6 Addressing – IPV6 Protocol

UNIT- V: TRANSPORT LAYER AND APPLICATION LAYER 9

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP).

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Understand the basic layers and its functions in computer networks.
- Understand the basics of how data flows from one node to another.
- Analyze and design routing algorithms.
- Design protocols for various functions in the network.
- Understand the working of various application layer protocols.

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Wayne Tomasi, —Advanced Electronic Communication Systems, 6th Edition, Pearson Education, 2009.

REFERENCE BOOKS:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, “Computer and Communication Networks”, Second Edition, Prentice Hall, 2014.

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OBJECTIVES:

- To Apply fundamental tidy data concepts
- To be familiar with Tools for Data Science
- Pull data from CSV or web (using API)
- To understand Data Analysis and Data reporting
- To learn working with Data

UNIT- I: INTRODUCTION 9

Overview of Data Science : Challenges in Data Science , History of Data Science, Data Science Process , Discovery and Preparation , Model Planning and Building , Introduction to Python : Variables , Data types , Strings , Conditions and statements , Classes and objects Type conversion, Functions and Packages .

UNIT- II: DATA EXPLORATION AND PROCESSING 9

Pandas - Data Structures , Series , DataFrame , NumPy - ndarray , SciPy - SciPy sub-packages ,Data Structures , Matplotlib , Seaborn , Datashader .Data Processing : Processing CSV ,JSON , XLS data , Data Wrangling ,Data Aggregation .

UNIT- III: DATA VISUALIZATION 9

Context of data Visualization , Seven stages of Data Visualization , Objectives , Mapping , Chart Properties , Chart styling ,Box plots , Heat Maps , Scatter Plots , Bubble Charts , 3D charts , Time Series , Graphical Data , Graph Data .

UNIT- IV: MACHINE LEARNING 9

Introduction to machine learning , Goals and applications of machine learning , aspects of developing a learning system , training data , concept representation , function approximation , Classification , Regression , Clustering , Decision trees , Recursive induction of decision trees .

UNIT- V: DEEP LEARNING 9

Introduction to Deep Learning, Supervised Learning With Neural Networks, Neural Network Basis: Binary Classification, Logistic Regression, Derivatives, Computation graph, Broadcasting in python, Neural Style transfer , text generation and image generation.

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Develop relevant programming abilities.
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models
- Execute statistical analyses with professional statistical software
- Demonstrate skill in data management

TEXT BOOKS:

1. Han J., Kamber M., Pei J. "Data mining concepts and techniques", Morgan Kaufmann, 2011
2. Hastie T., Tibshirani R., Friedman J. "The Elements of Statistical Learning", 2nd edition. Springer, 2009.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media

REFERENCE BOOKS:

1. F. Provost, T Fawcett, "Data Science for business", O'Reilly Media, 2013
2. Murphy, K., "Machine Learning: A Probabilistic Perspective", MIT Press, 2012

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4	2	3	2	3	2	-	-	-	-	-	2	2	3	2	-	-
5	2	3	2	3	2	-	-	-	-	-	2	2	3	2	-	-

OBJECTIVES:

- To introduce and educate the students on the concept of Human Values
- To enable the students to have awareness on Engineering Ethics theories and models.
- To make students understand the code of ethics and fundamental principles in social experiments in engineering.
- To educate on safety and risk aspects in engineering and to appreciate the rights of others.
- To create awareness about international issues related to ethics..

UNIT- I: HUMAN VALUES 9

Moral 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 – Introduction to Yoga and Meditation for professional excellence and stress management - Simple Living and High Thinking, Science and Spirituality.

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.

UNIT- III: ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters - Engineer's Responsibilities to Economically Deprived People and Environment, Corruption – Codes of Ethics- Fundamental Principles – A Balanced Outlook on Law – Challenger Case Study

UNIT- IV: SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk –Government Regulator's approach to risks - The Three Mile Island, Chernobyl & Bhopal Case Studies, Greenery Effects - Collegiality and Loyalty - Respect for Authority –

Collective Bargaining – Confidentiality – Conflicts of Interest – Unethical Behaviour at Work Place – Reporting Unethical Behaviour- Professional Rights – Employee Rights – Intellectual Property Rights (IPR).

UNIT- V: INTERNATIONAL ISSUES 9

Multinational corporations - Business ethics - Environmental ethics - Internet ethics - Role in Technological Development - Weapons development-engineers as managers - Consulting Engineers - Engineers as expert witnesses and advisors - Honesty - leadership - Sample code of conduct ethics - ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management Institution of electronics and telecommunication engineers (IETE), India – Corporate Social Responsibility, Indian and Western Culture – Cyber Crime.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Students should be able to understand human values and apply ethics in societal issues.
- Students will be able to get understanding on nuances of engineering ethics.
- Student will have an understanding of engineer's responsibility to society and code of ethics
- Students will understand risk and safety issues related to engineering.
- Students will be able to advocate on applying ethical principles in international context.

TEXT BOOKS:

1. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011.
2. R. Subramanian, 'Professional Ethics' Oxford University Press, 2nd Edition 2017
3. R. S. Nagarazan, 'A Textbook on Professional Ethics and Human Values' New Age International Publishers, 2015
4. Sekhar, R.C., Ethical Choices in Business Response Books, New Delhi, Sage Publications, 1997

REFERENCE BOOKS:

1. Langford, Duncan (EDT): Internet Ethics, London, Macmillan Press Ltd., 2000.

2. Erwann, M. David, Michele S. Shauf, Computers, Ethics and Society, Oxford University Press,2003
3. Alan Kitson and Robert Campbell:" The Ethical Organisation", Red Globe Press, 2008.
4. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Professional Ethics and Human Values", Prentice Hall of India, New Delhi, 2013.
5. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 3rd edition (2017).

CO	PO												PSO			
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5	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-

OBJECTIVES:

- Learn to create and use a database
- Be familiarized with a query language
- Have hands on experience on DDL Commands
- Have a good understanding of DML Commands and DCL commands
- Be Exposed to basic algorithms of Data Mining

LIST OF EXPERIMENTS:

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creating an Employee database to set various constraints and Creation of Views Indexes, Save point.
4. Joins and Nested Queries.
5. Study of PL/SQL block.
6. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
7. Write a PL/SQL block that handles all types of exceptions.
8. Creation of Procedures.
9. Creation of database triggers and functions
10. Creation of Database in Ms Access.
11. Database connectivity using Front End Tools (Application Development using Oracle/ Mysql)
12. Apriori Algorithm.
13. FP-Growth Algorithm.
14. Decision Tree Algorithm

Mini Project

- a) Inventory Control System.
- b) Material Requirement Processing.
- c) Hospital Management System.

- d) Railway Reservation System.
- e) Personal Information System

TOTAL: 60 PERIODS

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

Systems with MySql, Visual Studio, Systems with Oracle 11g Client, WEKA

HARDWARE:

Standalone Desktops: 30 Nos.

OUTCOMES:

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

- Use typical data definition and manipulation commands.
- Design application to test nested and join queries.
- Implement simple application that use views.
- Implement application that requires front end tools.
- Apply data mining techniques to large data sets

CO	PO												PSO			
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2	-	-	3	-	3	-	-	-	-	-	-	-	-	2	-	-
3	1	-	2	-	3	-	-	-	-	-	-	-	-	-	1	-
4	-	-	-	-	-	-	-	-	-	-	1	1	-	3	1	-
5	1	-	2	1	3	-	-	-	-	-	1	-	-	3	1	-

OBJECTIVES:**This course will enable students to**

- Develop a basic understanding of import data sets for various analytical purposes.
- Utilize the various packages available visualization, reporting, data manipulation, and statistical analysis.
- Create interactive business applications that allow for data querying and data exploration.
- Collect, explore, clean, munge and manipulate data.
- Build data science applications using Python based toolkits.

LIST OF EXPERIMENTS:

1. Write a programme in Python to predict the class of the flower based on available attributes.
2. Write a programme in Python to predict if a loan will get approved or not.
3. Write a programme in Python to predict the traffic on a new mode of transport.
4. Write a programme in Python to predict the class of user.
5. Write a programme in Python to indentify the tweets which are hate tweets and which are not.
6. Write a programme in Python to predict the age of the actors.
7. Introduction to Python Libraries-Numpy, Pandas, Matplotlib, Scikit
8. Perform Data exploration and preprocessing in Python
9. Implement regularised Linear regression
10. Mini project to predict the time taken to solve a problem given the current status of the user.

TOTAL: 60 PERIODS**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

Standalone desktops with Python 3 interpreter for Windows/Linux 30 Nos. (or) Server with Python 3 interpreter for Windows/Linux supporting 30 terminals or more.

HARDWARE:

Standalone Desktops: 30 Nos.

OUTCOMES:**At the end of the course, the student should be able to:**

- Import data sets for various analytical purposes.
- Develop an interactive business applications that allow for data querying and data exploration.
- Collect, explore, clean, munge and manipulate data.
- Develop data science applications using Python based toolkits.
- Implement models such as k-nearest Neighbours, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering

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4	2	2	3	-	3	-	-	-	-	-	2	-	3	-	2	2
5	2	2	3	-	3	-	-	-	-	-	2	-	3	-	-	2

OBJECTIVES:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities and make effective presentations.
- Improve general and academic listening skills and technical writing skills.
- Strengthen the reading skills of students of engineering.
- Provide more opportunities to develop their project and proposal writing skills.

UNIT- I: Informal Communication – An Introduction 6

Listening - Listening as a key skill- its importance- **Speaking** - give personal information - ask for personal information - express ability - enquire about ability – rephrase for clarification or emphasis - Improving pronunciation – Articulation of speaking –vowel sounds. **Reading** – Strategies for effective reading- Read and recognize different text types in a newspaper - **Writing**-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.

UNIT- II: Mechanics of Basic Communication 6

Listening - Listen to a process information- **Speaking** - asking for details formal/informal – give views, opinions and justification of a news- consonant sounds –diphthongs - .**Reading**-Read for vocabulary through scientific invention summarise the same into a paragraph- . **Writing**-compare and contrast ideas using adjectives from multiple sources stating reasons and examples to support ideas. Write a paragraph with reasons and examples- Write a Rejoint to a newspaper expressing opinions on particular news.

UNIT- III: Nuances of LSRW 6

Listening - Lexical chunking for accuracy and fluency- factors that influence fluency- listen for and follow the gist- listen for detail **Speaking** - deliver a five-minute informal talk - invite and offer - accept - decline - take leave - word stress – stress rules-ability to recognize RP sound- . **Reading**– Skimming / Scanning a text to apply both the concepts – to search – to analyze. **Writing**–Use of dictionary and usage of synonyms- editing and

proof reading.

UNIT- IV: Technical Communication – Basic presentation Skills 6

Listening - Being an active listener: giving verbal and non-verbal feedback- listening to a podcast of a native speaker and reciprocating **Speaking** - participating in a group discussion - conversational speech listening to and participating in conversations - persuade.– Sentence stress – intonations types-features of connected speech **Reading**– Genre and Organization of Ideas- note taking and summarizing **Writing**–Email writing- Job application- Blog writing.

UNIT- V: Communication Skills for Formal Occasion 6

Listening Listening to documentaries and make notes (TED talks) **Speaking** -Power point presentation - strategies for presentations and interactive communication - group/pair presentations –use stress and intonation to convey meaning and nuances of meaning clearly- **Reading**– Technical passages for comprehension- understanding how the text positions the reader- **Writing**– Statement of Purpose - analyse the situation in a picture / photo and write a suitable description with a proper title

The lab course is offered as an **Employability Enhancement Course**

The Course will have an Internal End semester exam includes a **project work**. The Students need to have **75% attendance** for the completion of the course.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Read and evaluate texts critically.
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal
- Write winning job applications.
- Display critical thinking in various professional contexts.

REFERENCE BOOKS:

1. Gramer F.Margot and Colin S.Ward 'Reading and Writing' (Level 3) Oxford University Press: Oxford, 2011.
2. Debra Daise, CharlNorloff, and Paul 'Reading and Writing' (Level 4) Oxford University Press: Oxford, 2011

3. Brooks, Margret. 'Skills for Success. Listening and Speaking.' (Level 4)Oxford University Press, Oxford: 2011.
4. Richards,C. Jack. & David Bholke. 'Speak Now'(Level 3.) Oxford University Press, Oxford: 2010
5. Davis,Jason and Rhonda Liss. 'Effective Academic Writing' (Level 3) Oxford University Press: Oxford, 2006
6. E.Suresh Kumar. 'Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
7. Petelin, Roslyn and Marsh Durham. 'The Professional Writing Guide: Knowing Well and Knowing Why'. Business & Professional Publishing: Australia, 2004.
8. Bhatnagar, Nitin and Mamta Bhatnagar. 'Communicative English for Engineers and Professionals'. Pearson: New Delhi, 2010.
9. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
10. Vargo, Mari. Speak Now (Level 4). Oxford University Press: Oxford, 2013.
11. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
12. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
13. IELTS, TOFEL testing series
14. Jack c. Richards. Tactics for Listening: Developing. Oxford University Press: Oxford, 2004
15. New Oxford Dictionary for writers and editors: The essential A-Z Guide to the Written Word 2005.

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COURSE OUTCOMES

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

- Students will be able to understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

1. T. Veerarajan, - Probability, Statistics Random Processes with Queueing Theory and Queueing Networks (Third Edition), Tata McGraw-Hill Publishers
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCE BOOKS:

1. P.Sivaramakrishna Das, C.Vijayakumari , "Probability and Statistics", Second Edition, Pearson India Education Services Pvt. Ltd, 2017
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
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.

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OBJECTIVES:

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

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-Quality management-SQA-SQA plan.

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.

UNIT- III: SOFTWARE DESIGN 9

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

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.

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 – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

TOTAL: 45 PERIODS**OUTCOMES:**

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. RajibMall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Pvt. Limited, 2009.
2. PankajJalote, “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
5. <https://nptel.ac.in/courses/106/105/106105182/>

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3	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
5	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2

OBJECTIVES:

- To Apply fundamental tidy data concepts
- Data wrangle R techniques
- Pull data from CSV or web (using API)
- Perform operations in R including sorting, data wrangling, and making plots
- Develop R notebook (reproducible report)

UNIT- I: INTRODUCTION 9

Introduction to R : R software , R packages , Data Types in R : Scalars , Vectors , Matrices ,Data frames , Lists , Variables and Logical Operations .R Matrix Create , Print , Column , Slice , Factors in R , Categorical and continuous Variables .

UNIT- II: R DATA STRUCTURES 9

Scalars -Vectors Matrices - List - Data frames-Factors -Packages - Data Reshaping – Data management with repeats, sorting, ordering, and lists - Vector indexing, factors, Data management with strings, display and formatting.

UNIT- III: DATA PREPARATIONS 9

R Data Frame : Create , Append , Select , Subset .R sort a data Frame using Order(), R Dplyr : Data manipulation and Cleaning , Merge Data Frames in R : Full and Partial Match , Functions in R programming .

UNIT- IV: DATA FRAMES 9

Data frames, import of external data in various le formats, statistical functions, compilation of data - Graphics and plots, statistical functions for central tendency, variation, skewness and kurtosis, handling of bivariate data through graphics, correlations, programming and illustration with examples.

UNIT- V: INTERFACING 9

R -CSV Files - Excel File -Binary Files - XML files - Web Data - Database - Regression - Decision Tree - Random Forest, R Random Forest ,Generalized Linear Model in R with example , K- means Clustering in R with example

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Develop relevant programming abilities.
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models
- Execute statistical analyses with professional statistical software
- Demonstrate skill in data management

TEXT BOOKS:

1. Roger D. Peng, "R programming for Data Science", Lulu.com, Version 2020.
2. Han, J., Kamber, M., Pei, J. "Data mining concepts and techniques", Morgan Kaufmann, 2011
3. Hastie, T., Tibshirani, R., Friedman, J. "The Elements of Statistical Learning", 2nd edition. Springer, 2009.

REFERENCE BOOKS:

1. Nina Zumel, John Mount. Manning, "Practical Data Science with R", 2014
2. F. Provost, T Fawcett, "Data Science for business", O'Reilly Media, 2013
3. Murphy, K., "Machine Learning: A Probabilistic Perspective", MIT Press, 2012

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2	3	1	2	-	2	-	-	-	-	-	-	-	-	2	-	-
3	3	1	2	-	-	-	-	-	-	-	-	-	-	2	-	-
4	3	2	2	-	2	-	-	-	-	-	-	-	-	2	-	-
5	3	1	1	-	2	-	-	-	-	-	-	-	-	2	-	-

OBJECTIVES:

- To understand the software engineering methodologies for project development.
- To gain knowledge about open source tools for implementing software engineering methods.
- To develop an efficient software using case tools.
- To exercise developing product-startups implementing software engineering methods.
- To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

LIST OF EXPERIMENTS:

Prepare the following documents for each experiment and develop the software using software engineering methodology.

1. **Problem Analysis and Project Planning** -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
2. **Software Requirement Analysis** - Describe the individual Phases/modules of the project and Identify deliverables.
3. **Data Modelling** - Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
4. **Software Development and Debugging** – implement the design by coding
5. **Software Testing** - Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.
6. **Project Management** – Project Scheduling, Planning and RIS

Sample Experiments:**Academic domain**

1. Course Registration System
2. Student marks analysing system

Railway domain

3. Online ticket reservation system
4. Platform assignment system for the trains in a railway station

Medicine domain

5. Expert system to prescribe the medicines for the given symptoms
6. Remote computer monitoring

Finance domain

7. ATM system
8. Stock maintenance

Human Resource management

9. Quiz System
10. E-mail Client system.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**SOFTWARE:**

Argo UML / StarUML / UMLGraph / Topcased or Equivalent.

HARDWARE:

Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more.

OUTCOMES:**At the end of the course, the student should be able to:**

- Use open source case tools to develop software.
- Analyse and design software requirements in efficient manner.
- Ability to translate end-user requirements into system and software requirements
- Ability to generate a high-level design of the system from the software requirements
- Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

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3	2	2	2	2	2	-	-	-	-	-	-	-	-	-	-	3
4	2	2	2	2	2	-	-	-	-	-	2	-	-	-	-	3
5	2	2	2	2	2	-	-	-	-	-	2	-	-	-	-	3

OBJECTIVES:**This course will enable students to**

- Understand the common data structures, variables, and data types used in R.
- Develop a basic understanding of import data sets for various analytical purposes.
- Learn how to create control structures and functions
- Utilize the various packages available visualization, reporting, data manipulation, and statistical analysis.
- Create interactive business applications that allow for data querying and data exploration.

LIST OF EXPERIMENTS:

1. Data Structures, Variables and data types - Vectors, Matrices, Arrays, Lists, Factors, Data Frames
2. Packages and scripts - Importing and Exporting Data
3. Control structures and Functions
4. Statistical Graphs - Scatter Plots, Box Plots, Whisker Plot, Histograms
5. Data exploration and visualization
6. Query Data using SQL and R
7. Simulation and profiling

TOTAL: 60 PERIODS**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

R, R Studio (Additional libraries required)

HARDWARE:

Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more

OUTCOMES:**At the end of the course, the student should be able to:**

- Learn Foundational R programming concepts such as data structures, variables and data types.
- Import a variety of data formats for analysis

- Apply programming language concepts such as control structures and functions.
- Import a variety of data formats
- Query data using SQL and R

CO	PO												PSO			
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4	3	-	2	-	2	-	-	-	-	-	-	2	-	2	-	-
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SEMESTER VI

1908604

DIGITAL IMAGE PROCESSING

L T P C

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OBJECTIVES:

- Learn digital image fundamentals
- Be exposed to simple image processing techniques
- Understand enhancement techniques in spatial and Frequency domain
- Be familiar with image compression and segmentation techniques
- Learn to represent image in form of features

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 - color models, Two-dimensional mathematical preliminaries, 2D transforms – DFT.

UNIT- II: IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters

UNIT- III: IMAGE RESTORATION AND SEGMENTATION 9

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation Morphological processing- erosion and dilation

UNIT- IV: WAVELETS AND IMAGE COMPRESSION 9

Wavelets – Sub band coding - Multi resolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards

UNIT- V: IMAGE REPRESENTATION AND RECOGNITION**9**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments-Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL: 45 PERIODS**OUTCOMES:**

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

- Understand simple image processing techniques
- Understand digital image fundamentals
- Apply image enhancement techniques
- Apply image restoration techniques
- Use image compression, segmentation Techniques and represent features in images

TEXT BOOKS:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. William K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt.Ltd., 2011.
5. <http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html>

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OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI..

UNIT- I: INTRODUCTION 9

Introduction –Foundation and history of AI. AI Problems and techniques -AI programming languages –Introduction to LISP and PROLOG –Problem spaces and searches -Blind search strategies; Breadth first -Depth first –Heuristic search techniques Hill climbing - Best first –A* algorithm AO* algorithm –game trees Minimax algorithm –Game playing – Alpha beta pruning

UNIT- II: KNOWLEDGE REPRESENTATION 9

Knowledge representation issues –Predicate logic –logic programming –Sematic nets - Frames and inheritance -constraint propagation –Representing Knowledge using rules – Rules based deduction system.

UNIT- III: REASONING UNDER UNCERTAINTY 9

Introduction to uncertain knowledge review of probability –Baye’s Probabilistic inferences and Dempster Shafer theory –Heuristic methods –Symbolic reasoning under uncertainty- Statistical reasoning –Fuzzy reasoning –Temporal reasoning-Non monotonic reasoning

UNIT- IV: PLANNING AND LEARNING 9

Planning -Introduction, Planning in situational calculus -Representation for planning – Partial order planning algorithm-Learning from examples-Discovery as learning –Learning by analogy –Explanation based learning –Introduction to Neural nets –Genetic Algorithms.

UNIT- V: APPLICATIONS 9

Principles of Natural Language Processing Rule Based Systems Architecture -Expert systems-Knowledge Acquisition concepts –AI application to robotics –Current trends in Intelligent Systems.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the apt agent strategy to solve a given problem
- Design software agents to solve a problem
- Design applications for NLP that use Artificial Intelligence

TEXT BOOKS:

1. Patrick Henry Winston," Artificial Intelligence", Addison Wesley, Books Third edition, 2000.

REFERENCE BOOKS:

1. George F Luger, Artificial Intelligence, Pearson Education, 6th edition,2009.
2. Engene Charniak and Drew Mc Dermott," Introduction to Artificial intelligence, Addison Wesley 2000.
3. Nils J. Nilsson,"Principles of Artificial Intelligence", Narosa Publishing House, 2000.

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OBJECTIVES:

- To understand the competitive advantages of big data analytics
- To understand the big data frameworks
- To learn data analysis methods
- To learn stream computing
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

UNIT- I: INTRODUCTION TO BIG DATA 9

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools..

UNIT- II: HADOOP FRAMEWORK 9

Distributed File Systems - Large-Scale File System Organization – HDFS concepts - MapReduce Execution, Algorithms using Map Reduce, Matrix-Vector Multiplication – Hadoop YARN.

UNIT- III: DATA ANALYSIS 9

Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R

UNIT- IV: MINING DATA STREAMS 9

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions

UNIT- V: BIG DATA FRAMEWORKS 9

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples –

Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand how to leverage the insights from big data analytics.
- Analyze data by utilizing various statistical and data mining approaches.
- Perform analytics on real-time streaming data.
- Understand the various NoSql alternative database models.
- To understand the Big Data framework.

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. Chris Eaton, Dirk deRoos et al. , “Understanding Big data ”, McGraw Hill, 2012.
3. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing Ltd., 2013.

REFERENCE BOOKS:

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, Second Edition, 2007.
3. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis”, O’Reilly Media, 2013

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OBJECTIVES:

- Optimize business decisions and create competitive advantage with Big Data Analytics.
- To implement Map Reduce programs for processing big data
- To realize storage of big data using H base, Mongo DB
- To analyze big data using linear models
- To analyse big data using machine learning techniques such as SVM / Decision tree classification and clustering

LIST OF EXPERIMENTS:**Hadoop**

1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset

R

4. Implement Linear and logistic Regression
5. Implement SVM / Decision tree classification techniques
6. Implement clustering techniques
7. Visualize data using any plotting framework
8. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R

TOTAL: 60 PERIODS**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

Hadoop, YARN, R Package, Hbase, MongoDB

HARDWARE:

Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more

OUTCOMES:**At the end of the course, the student should be able to:**

- Process big data using Hadoop framework

- Build and apply linear and logistic regression models
- Perform data analysis with machine learning method
- Perform graphical data analysis
- Apply tools and techniques to analyse Big data

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OBJECTIVES:

- Identify innovative research directions in Artificial Intelligence.
- Identify innovative research directions in Machine Learning and Big Data analytics
- Providing quality education and practical skills to the students and faculty
- Establish, refine and implement strategies to take the idea in to students and faculty fraternity.
- Create sustainable funding models for GRIET and related efforts.

LIST OF EXPERIMENTS:

1. Study of PROLOG. Write the following programs using PROLOG
2. Write a program to solve 8 queens problem
3. Solve any problem using depth first search.
4. Solve any problem using best first search.
5. Solve 8-puzzle problem using best first search.
6. Solve Robot (traversal) problem using means End Analysis.
7. Solve traveling salesman problem

TOTAL: 60 PERIODS**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

C / C++ / Java

HARDWARE:

Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more.

OUTCOMES:**At the end of the course, the student should be able to:**

- Develop code searching Techniques to solve the problems
- Construct code for Robotics Systems.
- Develop a code for analytical skills.
- Demonstrate the tool for problem solving.
- Develop a code for Optimization problems.

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OBJECTIVES:

- Enhance the Employability and Career Skills of students.
- Orient the students towards grooming as a professional
- To learn how to speak in group discussions
- Make them employable Graduates and help them attend interviews successfully.
- Develop their confidence and help them express views clearly

UNIT- I: General English for competitive Exams 6

English for competitive exams —General awareness of Current Affairs – multiple choice – Cloze – Vocabulary Structure

UNIT- II: Mechanics of Interpersonal Communication 6

Introduction to soft skills - Interpersonal communication - Introducing oneself to the audience — answering questions – writing a message – memo –mail – asking for comments – giving information – agreeing to requests – apologizing – Complaining – Business proposal – short report – summarizing.

UNIT- III: Basics of Group Discussion 6

Introduction to Group Discussion— participating in group discussions – questioning and clarifying –GD strategies –monologues – dialogues – discussions.

UNIT- IV: Fundamentals of Interview Skills 6

Interview etiquette –Portfolio development- attending job interviews–FAQs related to job interviews- Interview types –expressing opinions – present circumstances - past experiences – future plans

UNIT- V: Specific skills for Career advancement 6

Recognizing differences between groups and teams - networking professionally- respecting social protocols- understanding career management- developing a long- term career plan- making career changes. – organizing a larger unit of discourse – expressing and justifying opinions – negotiating – collaborating – disagreeing – speculating – decision taking.

TOTAL: 30 PERIODS

The lab course is offered as an **Employability Enhancement Course**

The course is offered as a **one credit** paper with an End Semester Examination

OUTCOMES:

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

- Make effective presentations
- Participate confidently in Group Discussions
- Attend job interviews and interacting in different situations.
- Write business reports, proposals and related correspondence.
- Develop adequate Soft Skills required for the workplace

REFERENCE BOOKS:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. Interact English Lab Manual for Undergraduate Students, Orient Black swan: Hyderabad, 2016.
3. E. Suresh Kumar et al. Communication for Professional Success. Orient Black swan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanl. Soft Skills. MJP Publishers: Chennai, 2010.
6. Successful Presentations: DVD and Student's Book. A video series teaching business communication skills for adult professionals by John Huges and Andrew Mallett- OUP 2012
7. Good heart-Will cox, "Professional Communication", First Edition , 2017. Online test book
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 edition, 2015
9. English for success in Competitive exams. Philip Sunil Solomon – OUP 2009

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OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To develop the ability to perform testing in the developed work.
- To understand the project management in an efficient way.
- To improve effective team building and good coordination.

LIST OF EXPERIMENTS:

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS**OUTCOMES:****At the end of the course, the student should be able to:**

- Analyze the literature survey in a specific domain as a team / individual in an ethical way.
- Plan an experimental design to solve engineering / societal problems using modern tools
- Develop lifelong learning to keep abreast of latest technologies.
- Analyze and implement the design to provide sustainable solutions
- Evaluate and interpret the experimental results and analyze the impact on society and environment.

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SEMESTER VII

1922701

STATISTICAL APPROACHES FOR DATA SCIENCE

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OBJECTIVES:

- To know the fundamental concepts of Data Science Statistics.
- To explore tools and practices for working with Machine learning
- To learn about Deep learning.
- To know about the research that requires the integration Visualization.
- To optimize business decisions and create competitive advantage with Data Science.

UNIT- I: INTRODUCTION TO DATA SCIENCE 9

Introduction to Data Science - Components of Data Science -Challenges in Data Science technology - History - Applications of Data Science - Data Science Process :Discovery -Preparation- Model Planning - Model Building - Operationalize - Communicate Results -Difference between Data Science with Business Intelligence

UNIT- II: STATISTICS 9

Statistics Fundamentals - Descriptive Statistics - Exploratory Data Analysis- Probability - Skewness - Percentiles and Outliers - Random Variables - Cumulative Distributive Function - Bayes Theorem - Two area of Statistics in Data Science.

UNIT- III: VISUALIZATION 9

Context of data visualization – Definition, Methodology, Visualization design objectives- Mapping - Time series - Connections and correlations - Scatterplot maps -Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools-Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization

UNIT- IV: INTRODUCTION TO MACHINE LEARNING 9

Introduction - Inductive Classification - Decision Tree Learning - Ensemble Learning - Experimental Evaluation of Learning Algorithms - Computational Learning Theory - Rule Learning :Propositional and First Order - Artificial Neural Networks - Support Vector Machines

UNIT- V: PREDICTIVE MODELING 9

Regression, Classification, Data Preprocessing, Model Evaluation and Ensembles - Data Mining Dimensionality Reduction, Clustering, Association Rules, Anomaly Detection - Network Analysis and

Recommender Systems Specialty Topics Data Engineering - Natural Language Processing, and Web Applications

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop relevant programming abilities.
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models.
- Execute statistical analyses with professional statistical software
- Demonstrate skill in data management.

TEXT BOOKS:

1. Tamhane A. C. and Dunlop D. D. (2000), "Statistics and Data Analysis: From Elementary to Intermediate", Prentice Hall: Upper Saddle River, NJ. ISBN: 0-1374-4426-5.
2. Ware C and Kaufman M "Visual thinking for design", Morgan Kaufmann Publishers, 2008

REFERENCE BOOKS:

1. Richard I. Levin. David S. Rubin, "Statistics for Management", Pearson Education, 2014
2. Anderson, Sweeney and Williams "Statistics for business and economics", Cengage Learning, 2014
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2013
4. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", Wiley and Sons, 2012.
5. Deep Learning (Adaptive Computation and Machine Learning Series) by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016

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OBJECTIVES:

- To study about basic concepts of Virtual reality
- To understand Virtual environment
- To understand geometric modeling
- To study about Virtual Hardware and Software
- To develop Virtual Reality applications

UNIT- I: INTRODUCTION TO VIRTUAL REALITY 9

Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics–Flight Simulation –Virtual environments–requirement – benefits of virtual reality- Historical development of VR : Introduction – Scientific Landmark -3D Computer Graphics :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Colour theory – Simple 3D modeling- illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism-Stereographic image.

UNIT- II: GEOMETRIC MODELLING 9

Geometric Modeling: Introduction – From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances –Picking – Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction-VR Systems.

UNIT- III: VIRTUAL ENVIRONMENT 9

Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and non- linear translation - shape & object in between ing – free from deformation – particle system- Physical Simulation - Introduction – Objects falling in a gravitational field-Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.

UNIT- IV: VR HARDWARES & SOFTWARES 9

Human factors: Introduction – the eye-the ear-the somatic senses-VR Hardware : Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated

VR systems-VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML.

UNIT- V: VR APPLICATION 9

Virtual Reality Applications: Introduction – Engineering – Entertainment – Science Training – The Future: Introduction – Virtual environments – modes of interaction.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understood the basic concept of virtual reality
- Understood 3D computer Graphics System
- Design object objects using geometric modelling
- Develop Virtual environment and Virtual Reality applications
- Apply study about Virtual Hardware and Software.

TEXT BOOKS:

1. John Vince, “Virtual Reality Systems”, Pearson Education Asia, 2007.
2. Adams, “Visualizations of Virtual Reality”, Tata McGraw Hill, 2000.

REFERENCE BOOKS:

1. Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley Inter science, 2nd Edition, 2006.
2. William R. Sherman, Alan B. Craig, “Understanding Virtual Reality: Interface, Application, and Design”, Morgan Kaufmann, 2008.

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OBJECTIVES:

- Gain in-depth knowledge of tensor flow along with its functions, operations, and the execution pipeline.
- Implement linear regression and gradient descent in tensor flow.
- Understand the concept of artificial neural networks, convolutional neural networks, and recurrent neural networks.
- Discuss how to speed up neural networks along with regularization techniques to reduce over fitting.
- Understand the use cases of implementing artificial intelligence such as image processing, natural language processing, speech recognition, deep face - facial recognition system, etc.

UNIT- I: INTRODUCTION TO MACHINE LEARNING BASICS 9

Scalars – Vectors – Matrices – Tensors – Identity and Inverse Matrices – Linear Dependence and Span – Eigen Decomposition – Probability – Random Variables – Conditional Probability – Expectation – Variance – Covariance – Bayes' Rule – Supervised Learning Algorithm – Unsupervised Learning Algorithm – Stochastic Gradient Descent.

UNIT- II: DEEP NETWORKS 9

Deep Feed Forward Network: Learning XOR – Gradient Based Learning- Hidden Units – Architecture Design – Back Propagation Algorithms. Regularization for Deep Learning: Parameter Norm Penalties – Regularization and unconstrained Problems – Dataset Augmentation – Noise Robustness – Semi supervised Learning – Challenges in Neural Network Optimization.

UNIT- III: CONVOLUTIONAL NETWORKS 9

The Convolution Operation – Motivation – Pooling – Variants of the Basic Convolution Function – Structured Outputs – Data types – Efficient Convolution Algorithm – Random or Unsupervised Features.

UNIT- IV: SEQUENCE MODELING: RECURRENT AND RECURSIVE NETS 9

Unfolding Computational Graphs – Recurrent Neural Networks – Bidirectional RNNs –

Encoder Decoder Sequence to Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – The Challenge of Long- Term Dependencies – Echo State Networks – The Long-term memory and other Gated RNNs – Optimization for Long Term Dependencies – Explicit Memory.

UNIT- V: DEEP LEARNING RESEARCH and ITS APPLICATIONS 9

Linear Factor Models – Auto Encoders - Representation Learning – Structured Probabilistic Models for Deep Learning - Monte Carlo Methods. Applications of deep learning in various technologies like Big Data, Medical Imaging, Neural network, vision, natural language processing, arbitrary object recognition, driverless cars, semantic image segmentation, deep visual residual abstraction and brain–computer interfaces .

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Understand the theory behind deep learning methods such as Convolutional Neural Networks, Auto encoders and Boltzmann Machines,
- Grasp of the open issues and trends in deep learning research,
- Feel when to use or avoid deep learning methods

TEXT BOOKS:

1. .Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning” MIT Press, Cambridge Massachusetts, London England 2016.
2. Valentina Emilia Balas , Sanjiban Sekhar Roy , Dharmendra Sharma , Pijush Samui Handbook of Deep Learning Applications (Smart Innovation, Systems and Technologies) 2019.

REFERENCE BOOKS:

1. www.deeplearningbook.org
2. Adam Gibson and Josh Patterson, “Deep Learning: A Practitioners Approach”, O'Reilly Media, 2017

3. <https://github.com/janishar/mit-deep-learning-book-pdf>
4. <https://www.guru99.com/deep-learning-tutorial.html>
5. Francois Chollet, Google AI researcher and creator of the popular Keras deep learning library, published his book, Deep Learning with Python in October 2017.

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OBJECTIVES:

This course will enable students to

- Know the fundamental concepts of Python Programming
- Learn the usage of R programming in Data structures and Data Visualization
- Explore on various statistical approaches
- Learn and implement machine learning algorithms
- Explore the usage of machine learning algorithms in cloud platform

LIST OF EXPERIMENTS:

1. Write a python program

a)To enter the elements 'v','l','a','f','e' into a list.

b)To convert the above list into dictionary

2.To Creating Data structures in R

3.To Creating Data visualization with R

4.To Creating Data Analysis with R

5.Statistical approach with Types of variablesand Measures of central tendency

6.Statistical approach with Skewness and Kurtosis

7.To Create Student's T distribution with Inferential statistics

8.To Create Missing value analysis with Data Analysis

9.The correction matrixand Outlier detection analysis with Exploratory Data Analysis

10.Design and develop Neural Network and Support Vector Machine using Machine Learning

11. Develop Machine Learning on Cloud Platform.

TOTAL : 60 PERIODS

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:**SOFTWARE:**

Python Matplotlib, Statistical tools like T-test and ANOVA, Exploratory data analysis tools like Apache Spark, Tableau, etc and Equivalent Open Source tools

HARDWARE:

Standalone desktops 30 Nos

OUTCOMES:

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

- Familiar with new Programming Languages.
- Work with frameworks based on tools like Hadoop and Apache Spark.
- Apply NLP and neural networks algorithms.
- Use AI and machine learning tools.
- Design and develop solutions with python and various forms of tools used in programming languages

CO	PO												PSO			
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2	3	3	3	-	3	-	-	-	-	-	-	-	2	-	-	-
3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
4	-	3	3	3	3	-	-	-	-	-	-	-	-	2	-	-
5	-	3	3	3	3	-	-	-	-	-	-	-	2	-	-	-

OBJECTIVES:

- To make the students understand graphics programming
- To perform 2D and 3D transformation
- To create 2D animations
- To create a 3D scenes
- To create VR architecture using mobile and WebVR/XR

LIST OF EXPERIMENTS:

1. Implementation of Algorithms for drawing 2D Primitives – Line using DDA and Bresenham's algorithm
2. Circle (Midpoint)
3. 2D Geometric transformations – Translation, Rotation, Scaling, Reflection, Shear
4. Implementation of Line Clipping Algorithm
5. 3D Transformations - Translation, Rotation, Scaling
6. Creating 3D Scenes
7. 2D Animation – To create Interactive animation using any authoring tool
8. Hand held VR mobile app development using unity
9. 3D modeling for VR
10. VR walkthrough (mobile app & WebVR /XR)
11. VR Game development (using unity/Blender)

TOTAL: 60 PERIODS**LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

C/OPENGL/Blender/Unity

HARDWARE:

Standalone desktops 30 Nos

OUTCOMES:**At the end of the course, the student should be able to:**

- Understand graphics programming
- Design two and three dimensional graphics and apply transformations

- Apply clipping techniques to graphics and To create 2D animations and 3D scenes
- To create VR architecture using mobile and WebVR/XR
- To create simple VR Game

CO	PO												PSO			
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OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To develop the ability to perform testing in the developed work.
- To understand the project management in an efficient way.
- To improve effective team building and good coordination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Prepare a literature survey in a specific domain as a team / individual to motivate lifelong learning.
- Identify the problem which needs to be provided a sustainable solution using modern tools.
- Analyze the problem definition and its impact on the society and environment.
- Analyze the design information to provide environment friendly solutions
- Document the literature, findings and results.

CO	PO												PSO			
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4	-	3	3	3	-	2	2	-	-	-	-	-	-	-	3	-
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SEMESTER VIII

1922808

PROJECT WORK - PHASE II

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OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To develop the ability to perform testing in the developed work.
- To understand the project management in an efficient way.
- To improve effective team building and good coordination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

COURSE OUTCOMES:

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

- Analyze the literature survey in a specific domain as a team / individual in an ethical way.
- Plan an experimental design to solve engineering / societal problems using modern tools
- Develop lifelong learning to keep abreast of latest technologies.
- Analyze and implement the design to provide sustainable solutions
- Evaluate and interpret the experimental results and analyze the impact on society and environment

CO	PO												PSO			
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SEMESTER V – PROFESSIONAL ELECTIVE I

1922503

COMPUTER VISION

L T P C

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OBJECTIVES:

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

UNIT- I: IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT- II: SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT- III: HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT- IV: 3D VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D

reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT- V: APPLICATIONS 9

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

TOTAL: 45 PERIODS

OUTCOMES:

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

- Implement fundamental image processing techniques required for computer vision.
- Implement boundary tracking techniques.
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Develop applications using computer vision techniques

TEXT BOOKS:

1. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
2. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.

REFERENCE BOOKS:

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

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4	1	-	2	-	3	-	-	-	-	-	-	1	-	-	-	-
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1922504

**ARTIFICIAL INTELLIGENCE BASED EMBEDDED
SYSTEM**

L T P C

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OBJECTIVES:

- To understand about intelligent agents for search and games
- To understand how to Solve AI problems through programming language.
- To understand Learning optimization and inference algorithms for model learning
- To understand about embedded basic Concepts
- To understand about Control Hardware and Interfacing

UNIT- I: INTRODUCTION 9

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

UNIT- II: SEARCH ALGORITHMS 9

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search

UNIT- III: PROBABILISTIC REASONING 9

Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model

UNIT- IV: EMBEDDED CONCEPT 9

Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software, Development and debugging Tools

UNIT- V: CONTROL HARDWARE AND INTERFACING 9

Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Build intelligent agents for search and games

- Solve AI problems through programming with Python
- Learning optimization and inference algorithms for model learning
- Understand about problem and concept of Embedded system.
- Acquire conceptual understanding in embedded systems and the ability to apply them in practical situations.

TEXT BOOKS:

1. Rajasekaran S. and Pai G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and applications, PHI New Delhi, 2017

REFERENCE BOOKS:

1. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi.
2. Craig, J.J., "Introduction to Robotics: Mechanics and Control", Pearson, New Delhi, 2009.

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3	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
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OBJECTIVES:

- To acquire knowledge on parallel and distributed databases and their applications
- To study the usage and applications of Object Oriented and Intelligent databases
- To understand the usage of advanced data models
- To learn emerging databases such as XML, Cloud and Big Data
- To acquire inquisitive attitude towards research topics in databases

UNIT- I: PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies.

UNIT- II: OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems : Object Relational features in SQL / Oracle – Case Studies.

UNIT- III: INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications-Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Data log- Recursive Rules-Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

UNIT- IV: ADVANCED DATA MODELS 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data

Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

UNIT- V: EMERGING TECHNOLOGIES 9

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop in-depth understanding of relational databases and skills to optimize database performance in practice.
- Understand and critique on each type of databases.
- Design faster algorithms in solving practical database problems.
- Implement intelligent databases and various data models.
- Design information Retrieval Techniques, Gain knowledge about databases such as XML, Cloud and Big Data

TEXT BOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, Sixth Edition, Pearson, 2011.
2. Thomas Cannolly and Carolyn Begg, —Database Systems, A Practical Approach to Design, Implementation and Management, Fourth Edition, Pearson Education, 2008

REFERENCE BOOKS:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, —Database System Concepts, Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan, S.Swamynathan, —An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass,

V.S.Subrahmanian, Roberto Zicari, —Advanced Database SystemsII, Morgan Kaufmann publishers,2006.

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4	3	2	-	-	3	3	-	-	-	-	2	2	-	3	2	-
5	3	2	2	-	3	3	-	-	-	-	2	2	-	3	2	2

OBJECTIVES:

- To understand how to accurately represent voluminous complex data set in web and from other data sources.
- To understand the methodologies used to visualize large data sets.
- To understand the various process involved in data visualization.
- To get used to with using interactive data visualization.
- To understand the different security aspects involved in data visualization

UNIT- I: INTRODUCTION 9

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

UNIT- II: VISUALIZING DATA METHODS 9

Mapping - Time series - Connections and correlations - Scatterplot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics

UNIT- III: VISUALIZING DATA PROCESS 9

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT- IV: INTERACTIVE DATA VISUALIZATION 9

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts –Geomapping – Exporting, Framework – T3, .js, tablo.

UNIT- V: SECURITY DATA VISUALIZATION 9

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization -Intrusion detection log visualization -Attacking and defending visualization

systems –Creating Security visualization system.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the representation of complex and voluminous data.
- Design and use various methodologies present in data visualization.
- Understand the various process and tools used for data visualization.
- Use interactive data visualization to make inferences.
- Discuss the process involved and security issues present in data visualization

TEXT BOOKS:

1. Scott Murray, “Interactive data visualization for the web”, O’ Reilly Media, Inc., 2013.

REFERENCE BOOKS:

1. Ben Fry, “Visualizing Data”, O’Reilly Media, Inc., 2007.
2. Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007.

CO	PO												PSO			
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3	1	2	2	-	3	-	-	-	-	-	-	-	3	-	2	-
4	1	2	-	-	3	-	-	-	-	-	-	-	3	-	-	-
5	1	2	2	-	3	-	-	-	-	-	-	-	3	1	-	2

OBJECTIVES:

- To understand the relationship between system software and machine architecture.
- To know the design and implementation of assemblers.
- To know the design and implementation of linkers and loaders.
- To have an understanding of macro processors.
- To have an understanding of system software tools.

UNIT- I: INTRODUCTION 9

System software and machine architecture – The Simplified Instructional Computer (SIC) - Machine architecture - Data and instruction formats - addressing modes - instruction sets - I/O and programming.

UNIT- II: ASSEMBLERS 9

Basic assembler functions - A simple SIC assembler – Assembler algorithm and data structures - Machine dependent assembler features - Instruction formats and addressing modes – Program relocation - Machine independent assembler features - Literals – Symbol-defining statements – Expressions - One pass assemblers and Multi pass assemblers - Implementation example - MASM assembler.

UNIT- III: LOADERS AND LINKERS 9

Basic loader functions - Design of an Absolute Loader – A Simple Bootstrap Loader - Machine dependent loader features - Relocation – Program Linking – Algorithm and Data Structures for Linking Loader - Machine-independent loader features – Automatic Library Search – Loader Options - Loader design options - Linkage Editors – Dynamic Linking – Bootstrap Loaders - Implementation example - MSDOS linker.

UNIT- IV: MACRO PROCESSORS 9

Basic macro processor functions - Macro Definition and Expansion – Macro Processor Algorithm and data structures - Machine-independent macro processor features - Concatenation of Macro Parameters – Generation of Unique Labels – Conditional Macro Expansion – Keyword Macro Parameters-Macro within Macro-Implementation example - MASM Macro Processor – ANSI C Macro language

UNIT- V: SYSTEM SOFTWARE TOOLS**9**

Text editors - Overview of the Editing Process - User Interface – Editor Structure. -
 Interactive debugging systems - Debugging functions and capabilities – Relationship with
 other parts of the system – User-Interface Criteria.

TOTAL: 45 PERIODS**OUTCOMES:**

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

- Have good knowledge about Machine architecture and Instructions.
- Gain knowledge about working of assemblers.
- Understand about Program loading & Program linking.
- Learn about implementation of Macro and functions of macro processor
- Have knowledge and idea about various system software tools.

TEXT BOOKS:

Leland L. Beck, “System Software – An Introduction to Systems Programming”, 3rd
 Edition, Pearson Education Asia, 2000.

REFERENCE BOOKS:

1. D. M. Dhamdhare, “Systems Programming and Operating Systems”, Second
 Revised Edition, Tata McGraw-Hill, 1999.
2. John J. Donovan “Systems Programming”, Tata McGraw-Hill Edition, 1972.
3. John R. Levine, “Linkers & Loaders”, Harcourt India Pvt. Ltd., Morgan Kaufmann
 Publishers, 2000

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OBJECTIVES:

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- To understand approaches to discourse, generation, dialogue and summarization within NLP
- To apply the NLP techniques to IR applications

UNIT- I: INTRODUCTION 9

Origins and challenges of NLP –Language Modeling: 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

UNIT- II: WORD LEVEL ANALYSIS 9

Unsmoothed N-grams -Evaluating N-grams – Smoothing - Interpolation and Back off –Word Classes - Part-of-Speech Tagging - Rule-based - Stochastic and Transformation-based tagging - Issues in PoS tagging –Hidden Markov and Maximum Entropy models

UNIT- III: SYNTACTIC ANALYSIS 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar –Dependency Grammar –Syntactic Parsing – Ambiguity - Dynamic Programming parsing – Shallow parsing –Probabilistic CFG - Probabilistic CYK -Probabilistic Lexicalized CFGs - Feature structures - Unification of feature structures

UNIT- IV: SEMANTICS AND PRAGMATICS 9

Requirements for representation, First-Order Logic, Description Logics –Syntax-Driven Semantic analysis, Semantic attachments –Word Senses, Relations between Senses - Thematic Roles - selectional restrictions –Word Sense Disambiguation - WSD using Supervised - Dictionary & Thesaurus - Bootstrapping methods –Word Similarity using Thesaurus and Distributional methods

UNIT- V: DISCOURSE ANALYSIS AND LEXICAL RESOURCES 9

Discourse segmentation - Coherence –Reference Phenomena - Anaphora Resolution using Hobbs and Centering Algorithm –Co reference Resolution –Resources: Porter Stemmer -

Lemmatizer, Penn Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, British National Corpus (BNC). Programming in Python - NLTK (Natural Language Toolkit)

TOTAL: 45 PERIODS

OUTCOMES:

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

- Tag a given text with basic Language features
- Design an innovative application using NLP components
- Implement a rule based system to tackle morphology/syntax of a language
- Design a tag set to be used for statistical processing for real-time applications
- Compare and contrast the use of different statistical approaches for different types of NLP applications.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python II, First Edition, O'Reilly Media, 2009.

REFERENCE BOOKS:

1. Breck Baldwin, —Language processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Java, O'Reilly Media, 2015.
3. Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

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SEMESTER VI – PROFESSIONAL ELECTIVE II

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OPTIMIZATION TECHNIQUES

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OBJECTIVES:

- To understand the basic components of Storage System Environment.
- To understand the Storage Area Network Characteristics and Components.
- To examine emerging technologies including IP-SAN.
- To describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities.
- To understand the local and remote replication technologies.

UNIT- I: STORAGE SYSTEMS 9

Introduction to Information Storage and Management: Information Storage - Evolution of Storage Technology and Architecture - Data Center Infrastructure - Key Challenges in Managing Information -Information Lifecycle. Storage System Environment - Components of the Host. RAID - Implementation of RAID -RAID Array Components - RAID Levels - RAID Comparison - RAID Impact on Disk Performance - Hot Spares.

UNIT- II: STORAGE NETWORKING TECHNOLOGIES 9

Direct-Attached Storage and Introduction to SCSI: Types of DAS, DAS Benefits and Limitations- Disk Drive Interfaces - Introduction to Parallel SCSI -SCSI Command Model.- Storage Area Networks - Fiber Channel - SAN Evolution - SAN Components - Fiber Channel Connectivity - Fiber Channel Ports - Fiber Channel Architecture – Zoning - Fiber Channel Login Types - Fiber Channel Topologies.

UNIT- III: ADVANCED STORAGE NETWORKING AND VIRTUALIZATION 9

IP SAN – iSCSI – FCIP - Content-Addressed Storage - Fixed Content and Archives - Types of Archives - Features and Benefits of CAS -CAS Architecture - Object Storage and Retrieval in CAS -CAS Examples - Storage Virtualization - Forms of Virtualization - NIA Storage Virtualization Taxonomy - Storage Virtualization Configurations - Storage Virtualization Challenges - Types of Storage Virtualization.

UNIT- IV: BUSINESS CONTINUITY 9

Introduction to Business Continuity - Information Availability - BC Terminology - BC Planning Lifecycle - Failure Analysis - Business Impact Analysis - BC Technology Solutions - Backup and Recovery - Backup Purpose – Considerations – Granularity - Recovery Considerations - Backup Methods and Process.

UNIT- V: REPLICATION 9

Local Replication - Source and Target - Uses of Local Replicas - Data Consistency - Local Replication Technologies - Restore and Restart Considerations - Creating Multiple Replicas - Management Interface.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the logical and physical components of a Storage infrastructure.
- Evaluate storage architectures, including storage subsystems, DAS, SAN, NAS, and CAS.
- Understand the various forms and types of Storage Virtualization.
- Understand the business continuity capabilities.
- Distinguish different remote replication technologies.

TEXT BOOKS:

1. EMC Corporation, Information Storage and Management, Wiley, India, 2012

REFERENCE BOOKS:

1. Robert Spalding, —Storage Networks: The Complete Reference Tata McGraw Hill, Osborne, 2003.
2. Marc Farley, —Building Storage Networks, Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, Storage Area Networks Fundamentals, Pearson Education Limited, 2002.

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OBJECTIVES:

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving
- To Study various machine learning tools

UNIT- I: INTRODUCTION 9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm –Heuristic Space Search

UNIT- II: NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search –Genetic Programming – Models of Evaluation and Learning

UNIT- III: BAYESIAN AND COMPUTATIONAL LEARNING 9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model

UNIT- IV: INSTANT BASED AND ADVANCED LEARNING 9

INSTANT BASED LEARNING: K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning. ADVANCED LEARNING: Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution –Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

UNIT- V: MACHINE LEARNING TOOLS 9

Introduction to Weka, The Explorer, The Knowledge Flow Interface, The Command-Line

Interface, Introduction to TensorFlow, Installation and Basics. Other ML Tools: AI Explainability 360, Apollo, Data Science Version Control (DVC), Espresso, EuclidesDB, Fabrik, Face_recognition, Ludwig, makesense.ai, MLflow, MLPerf, ModelDB, Netron, NLP Architect, OpenML, Orange, PySyft, RAPIDS, SHAP, Skater, Snorkel, VisualDL, What-If Tool

TOTAL: 45 PERIODS

OUTCOMES:

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

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches and various tools.
- Discuss the decision tree algorithm and identify and overcome the problem of over fitting
- Discuss and apply the back propagation algorithm and genetic algorithms to various problems
- Apply the Bayesian concepts to machine learning
- Analyze and suggest appropriate machine learning approaches for various types of problems

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.

REFERENCE BOOKS:

1. Ethem Alpaydin, —"Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press 2004.
2. Stephen Marsland, —"Machine Learning: An Algorithmic Perspective", CRC Press, 2009.
3. Maikel Mardjan, "Free and Open Machine Learning", www.github.com

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OBJECTIVES:

- To understand the principles and standards of patterns
- To understand the basic analysis of pattern regeneration and functions
- To understand the various evaluation process of a project
- To understand valuation techniques of non-parametric technique
- To understand the group based technique

UNIT- I: INTRODUCTION 8

Introduction: Basics of pattern recognition – Design principles of pattern recognition system – Learning and adaptation – Pattern recognition approaches. Mathematical foundations: Linear algebra – Probability theory – Expectation – Mean and Covariance – Normal distribution –Multivariate normal densities – Chi square test of hypothesis

UNIT- II: STATISTICAL PATTERN RECOGNITION 7

Statistical Patten Recognition: Bayesian Decision Theory – Classifiers – Normal density and discriminant functions

UNIT- III: MODELS 10

Parameter estimation methods: Maximum-Likelihood estimation – Bayesian Parameter estimation– Dimension reduction methods – Principal Component Analysis (PCA) – Fisher Linear discriminant analysis – Expectation – maximization (EM) – Hidden Markov Models (HMM) –Gaussian mixture models.

UNIT- IV: NON PARAMETRIC TECHNIQUES 10

Nonparametric Techniques: Density Estimation – Parzen Windows – K-Nearest Neighbor Estimation – Nearest Neighbor Rule – Fuzzy classification

UNIT- V: CLUSTERING TECHNIQUES 10

Unsupervised Learning and Clustering: Criterion functions for clustering – Clustering Techniques: Iterative square – Error partitional clustering – K-Means – agglomerative hierarchical clustering –Cluster validation.

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Upon completion of this course, the students will be able to apply the mathematical foundations for recognition of patterns.
- To identify the pattern Recognition models.
- To give the analyzed details of estimation of the project
- To apply the non parametric techniques and clustering techniques in pattern Recognition in real time applications.
- To implement the various clustering techniques and k- means method in project

TEXT BOOKS:

1. S. Theodoridis, K. Koutroumbas, “Pattern Recognition”, Fourth Edition, Academic Press, 2009.
2. Keinosuke Fukunaga, “Introduction to Statistical Pattern Recognition”, Second Edition, Academic Press, 2003.

REFERENCE BOOKS:

1. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, Second Edition, John Wiley, 2006.
2. Bishop, Christopher M., “Pattern Recognition and Machine Learning”, First Edition, Springer, 2009.

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OBJECTIVES:

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To understand privacy issues in online social networks.
- To learn visualization of social networks.

UNIT- I: INTRODUCTION 9

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 - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks

UNIT- II: MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data

UNIT- III: EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks

UNIT- IV: PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and predicting human behaviour for social communities - User data

REFERENCE BOOKS:

1. Guandong Xu, Yanchun Zhang and Lin Li, -Web Mining and Social Networking– Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, -Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
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.

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OBJECTIVES:

- To give an idea about IPR, registration and its enforcement.
- To acquaint the students with basics of intellectual property rights with special reference to Indian Laws and its practices.
- To provide an overview of the statutory, procedural, and case law underlining these processes and their interplay with litigation.
- To encourage and protect innovation in the form of intellectual property rights.
- To encourage research, scholarship, and a spirit of inquiry, thereby generating new knowledge.

UNIT- I: INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT- II: REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT- III: AGREEMENTS AND REGISTRATION 9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT- IV: DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT- V: ENFORCEMENT OF IPRs 9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

OUTCOMES:

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

- Understand the concept of intellectual property rights.
- Develop procedural knowledge to Legal System and solving the problem relating to intellectual property rights.
- Pursue the professional programs in Company Secretary ship, Law. Business (MBA), International Affairs, Public Administration and Other fields.
- Employability as the Compliance Officer, Public Relation Officer and Liaison Officer.
- Establishment of Legal Consultancy and service provider.

TEXT BOOKS:

1. V.Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, —Intellectual Property Rights and Copy Rights, EssEss Publications, New Delhi, 2002.

REFERENCE BOOKS:

1. Deborah E. Bouchoux, —Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

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OBJECTIVES:

- To understand basics of Cryptography and Network Security
- To understand the number theory used for network security
- To understand Cryptography Theories, Algorithms and Systems.
- To understand the design concept of cryptography and authentication
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

UNIT- I: INTRODUCTION & NUMBER THEORY 9

Services, Mechanisms and attacks-the OSI security architecture-Network security model- Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography). FINITE FIELDS AND NUMBER THEORY: Modular arithmetic- Euclid's algorithm- Prime numbers-Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem- Discrete logarithms

UNIT- II: SYMMETRIC KEY CRYPTOGRAPHY 9

SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 – Key distribution.

UNIT- III: PUBLIC KEY CRYPTOGRAPHY 9

ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT- IV: MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Authentication applications – Kerberos, X.509

UNIT- V: SECURITY PRACTICE AND SYSTEM SECURITY 9

Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM

SECURITY: Intruders – Malicious software – viruses – Firewalls.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
- Apply the different cryptographic operations of symmetric cryptographic algorithms
- Apply the different cryptographic operations of public key cryptography
- Apply the various Authentication and hash algorithms to simulate different applications.
- Understand various Security practices and System security standards.

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 4th Edition, 2006.

REFERENCE BOOKS:

1. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 2007.
2. Charlie Kaufman and Radia Perlman, Mike Speciner, “Network Security, Second Edition, Private Communication in Public World”, PHI 2002.

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SEMESTER VI – PROFESSIONAL ELECTIVE III

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REAL TIME SYSTEMS

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OBJECTIVES:

- To study issues related to the design and analysis of systems with real-time constraints.
- To learn the features of Real time OS.
- To study the various Uniprocessor and Multiprocessor scheduling mechanisms.
- To learn about various real time communication protocols.
- To study the difference between traditional and real time databases.

UNIT- I: INTRODUCTION 9

Introduction to real time computing - Concepts; Example of real-time applications – Structure of a real time system – Characterization of real time systems and tasks - Hard and Soft timing constraints - Design Challenges - Performance metrics - Prediction of Execution Time : Source code analysis, Micro-architecture level analysis, Cache and pipeline issues- Programming Languages for Real-Time Systems

UNIT- II: REAL TIME OPERATING SYSTEM 9

Real time OS – Threads and Tasks – Structure of Microkernel – Time services – Scheduling Mechanisms Communication and Synchronization – Event Notification and Software interrupt

UNIT- III: SCHEDULING 9

Task assignment and Scheduling – Task allocation algorithms – Single processor and Multiprocessor Task Scheduling – Clock-Driven and Priority-based Scheduling algorithms – Fault Tolerant Scheduling.

UNIT- IV: REAL TIME COMMUNICATION 9

Real Time Communication -Network topologies and architecture issues – protocols – contention based, token based, polled bus, deadline based protocol, Fault tolerant routing. RTP and RTCP

UNIT- V: REAL TIME DATABASES 9

Real time Databases – Transaction priorities – Concurrency control issues – Disk scheduling algorithms – Two phase approach to improve predictability

TOTAL: 45 PERIODS

COURSE OUTCOMES:**At the end of the course, the student should be able to:**

- Gain Knowledge about Schedulability analysis.
- Understand the features of Real time OS.
- Learn about the Real-time programming environments.
- Attain knowledge about real time communication
- Attain knowledge about real time Database

TEXT BOOKS:

1. C.M. Krishna, Kang G. Shin – “ Real Time Systems”, International Edition, McGrawHill Companies, Inc., New York, 1997.
2. Jane W.S. Liu, “Real-Time Systems”, Pearson Education India, 2000.

REFERENCE BOOKS:

1. Philip A. Laplante and Seppo J. Ovaska, “Real-Time Systems Design and Analysis: Tools for the Practitioner” IV Edition IEEE Press, Wiley, 2013.
2. Sanjoy Baruah, Marko Bertogna, Giorgio Buttazzo, “Multiprocessor Scheduling for Real-Time Systems “, Springer International Publishing, 2015..

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5	3	-	-	2	-	-	-	-	-	-	-	-	2	-	-	-

OBJECTIVES:

- Understand the concept of business intelligence
- Get the knowledge on architecture of business intelligence
- Acquire the knowledge on strategic level
- Know the various analytical levels
- Be exposed with different data analysis tools and techniques

UNIT- I: INTRODUCTION 9

Business Intelligence: definition, concept and need for Business Intelligence, Case studies BI Basics: Data, information and knowledge, Role of Mathematical models.

UNIT- II: ARCHITECTURES 9

Effective and timely decisions –Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

UNIT- III: STRATEGIC LEVEL 9

Business Analytics at the strategic level: Strategy and BA, Link between strategy and Business Analytics, BA supporting strategy at functional level, dialogue between strategy and BA functions, information as strategic resource.

UNIT- IV: ANALYTICAL LEVEL 9

Business Analytics at Analytical level : Statistical data mining, descriptive Statistical methods, lists, reports, automated reports, hypothesis driven methods, data mining with target variables, cluster analysis, Discriminate analysis, logistic regression, principal component analysis.

UNIT- V: BUSINESS INTELLIGENCE APPLICATIONS 9

Marketing models – Logistic and Production models – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the concept of business intelligence
- Study the architecture of business intelligence

- Get the knowledge on strategic level
- Understand the various analytical levels
- Apply business intelligence methods to various situations.

TEXT BOOKS:

1. Turban, Sharda, Delen, “Decision Support and Business Intelligence Systems”, Pearson, 9thEdition, 2014.

REFERENCE BOOKS:

1. Olivia Parr Rud, Business Intelligence Success Factors Tools for aligning your business in the global economy, John Wiley and Sons, 2009
2. Steve Williams and Nancy Williams, The Profit impact of Business Intelligence, Morgan Kauffman Publishers! Elsevier, 2007
3. Gert H.N. Laursen, Jesper Thorlund, Business Analytics for Managers: Taking Business Intelligence beyond reporting, Wiley and SAS Business Series. 2010..

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5	3	-	2	2		-	-	-	-	-	-	-	3	-	-	-

OBJECTIVES:

- To understand the basic concepts of web scraping.
- To scrap the data from web page
- To understand caching downloads.
- To understand the concept of concurrent downloading & dynamic content
- To interacting with forms & to use the popular high-level Scrapy framework

UNIT- I: INTRODUCTION TO WEB SCRAPING 9

Building Scrapers - First Web Scraper - An Introduction to BeautifulSoup -When is web scraping useful? -Is web scraping legal? -Background research-Crawling your first website-Downloading a web page- Sitemap crawler-ID iteration crawler-Link crawler.

UNIT- II: SCRAPING THE DATA 9

Analyzing a web page - Three approaches to scrape a web page-Regular expressions- BeautifulSoup- Lambda Expressions- Lxml- CSS selectors- Comparing performance - Scraping results.

UNIT- III: CACHING DOWNLOADS 9

Adding cache support to the link crawler - Disk cache : Implementation - Testing the cache - Saving disk space - Expiring stale data- Drawbacks

UNIT- IV: DATABASE CACHE 9

What is NoSQL?- Installing MongoDB - Overview of MongoDB - MongoDB cache implementation- Compression- Testing the cache.

UNIT- V: CONCURRENT DOWNLOADING & DYNAMIC CONTENT 9

Sequential crawler - Threaded crawler - Cross-process crawler- Performance.- An example dynamic web page- Reverse engineering a dynamic web page- Rendering a dynamic web page-Website interaction with WebKit

OUTCOMES:

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

- Understand web scraping and the ways to crawl a website.
- Extract data from web pages.

- Avoid re-downloading by caching results.
- To scrape data faster by downloading in parallel and to extract data from dynamic websites.
- Interacting with Forms and to work with forms to access the data Compare and contrast various memory management schemes.

TEXT BOOKS:

1. Richard Lawson,” Web Scraping with Python”, Packt Publishing Ltd,2015.
2. Ryan Mitchell,” Web Scraping with Python Collecting Data from the Modern Web”, First Edition, O’Reilly Media, Inc., 2015.

REFERENCE BOOKS:

1. Vineeth G. Nair, ”Getting Started with Beautiful Soup”, Packt Publishing Ltd.2015.
2. Katharine Jarmul, Richard Lawson, ”Python Web Scraping,” second edition, Packt Publishing,2017.
3. Al Sweigart,” Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners”,2019

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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 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT- II: VIRTUALIZATION 9

Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.

UNIT- III: CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT- IV: RESOURCE MANAGEMENT 9

Virtual Clusters and Resource Management – Physical versus Virtual Clusters – Live VM Migration steps and Performance Effects – Dynamic Deployment of Virtual Clusters - Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources

UNIT- V: SECURITY 9

Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards – Cloud Security and Trust Management

TOTAL:45 PERIODS

OUTCOMES:

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

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.

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. RajkumarBuyya, 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", O'Reilly Media, 2009

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OBJECTIVES:

- Survey of attractive applications of Artificial Neural Networks.
- To practical approach for using Artificial Neural Networks in various technical, organizational and economic applications.
- Understand the basic neural network architectures and learning algorithms, for applications in pattern recognition.
- Explore the use of Pattern and Neural Classifiers for classification applications.
- To introduce neural computing as an alternative knowledge acquisition/representation paradigm.

UNIT- I: INTRODUCTION 9

History Of Neural Networks, Structure And Functions Of Biological And Artificial Neuron, Neural Network Architectures, Characteristics Of ANN, Basic Learning Laws and Methods

UNIT- II: SUPERVISED LEARNING 9

Single Layer Neural Network and architecture, McCulloch-Pitts Neuron Model, Learning Rules, Perceptron Model, Perceptron Convergence Theorem, Delta learning rule, ADALINE, Multi-Layer Neural Network and architecture, MADALINE, Back Propagation learning, Back Propagation Algorithm

UNIT- III: UNSUPERVISED LEARNING-1 9

Outstar Learning, Kohonen Self Organization Networks, Hamming Network And MAXNET, Learning Vector Quantization, Mexican hat.

UNIT- IV: UNSUPERVISED LEARNING-2 9

Counter Propagation Network -Full Counter Propagation network, Forward Only Counter Propagation Network, Adaptive Resonance Theory (ART) -Architecture, Algorithms.

UNIT- V: ASSOCIATIVE MEMORY NETWORKS 9

Introduction, Auto Associative Memory, Hetero Associative Memory, Bidirectional Associative Memory (BAM) -Theory And Architecture, BAM Training Algorithm, Hopfield Network: Introduction, Architecture Of Hopfield Network.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Describe the neural network architecture and learning algorithms.
- Implement Pattern and Neural Classifiers for various classification applications.
- Describe the Supervised Learning process and propagation algorithm.
- Describe the Unsupervised learning and Adaptive Resonance Theory
- Implement Bidirectional Associative Memory Training Algorithm

TEXT BOOKS:

1. B.Yegnanarayana, "Artificial neural networks", PHI, New Delhi.
2. S.N.Sivanandam, S. N. Deepa, "Introduction to Neural Networks using MATLAB 6.0", TATA MCGraw- Hill publications.
3. J .M. Zurada , "Introduction to Artificial neural systems", Jaico publishing

REFERENCE BOOKS:

1. S. Rajasekaran and G. A. Vijayalakshmi Pai "Neural Networks.Fuzzy Logic and genetic Algorithms", PHI, 2013.
2. James A Freeman and Davis Skapura, "Neural Networks Algorithm, applications and programming Techniques", Pearson Education, 2002.
3. Simon Hakins, "Neural Networks", Pearson Education.

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OBJECTIVES:

- Understand Smart Objects and IoT Architectures.
- Learn about various IOT-related protocols.
- Build simple IoT Systems using Arduino and Raspberry Pi.
- Understand data analytics and cloud in the context of IoT.
- Develop IoT infrastructure for popular applications.

UNIT- I: FUNDAMENTALS OF IoT 9

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -- Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT- II: IoT PROTOCOLS 9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT- III: DESIGN AND DEVELOPMENT 9

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming

UNIT- IV: DATA ANALYTICS AND SUPPORTING SERVICES 9

. Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework –Django – AWS for IoT – System Management with NETCONF-YANG.

UNIT- V: CASE STUDIES**9**

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

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

- Understand all basic foundation of IoT
- Explain the functional block of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Raspberry Pi/Arduino.
- Apply data analytics and use cloud offerings related to IoT

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, 2015
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand.David Boyle, “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Elsevier, 2014.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
4. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O’Reilly Media, 2011.

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SEMESTER VII – PROFESSIONAL ELECTIVE IV

1922702

BIG DATA FRAMEWORK

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OBJECTIVES:

- To learn the fundamentals of big data Framework
- To understand the essential technologies of big data Architecture
- To apply big data algorithms
- To understand big data processes
- To understand big data functions

UNIT- I: BIG DATA FRAMEWORK STRUCTURE AND STRATEGY 9

Benefits of a Big Data framework- Applications on Big Data Using Pig and Hive - conceptual architecture of big data analytics - Hadoop- The Hadoop Distributed File System (HDFS)- MapReduce- Pig and PigLatin- Hive- Jaql.

UNIT- II: BIG DATA ARCHITECTURE 9

Introduction to big data components-essential technologies- Lambda Architecture- Batch Processing Speed Processing- Hadoop YARN architecture

UNIT- III: BIG DATA ALGORITHMS 9

Implementation -Recursion vs. Iterative- Design Paradigm: Brute force, divide-and-conqueror, Dynamic Programming, Greedy. Complexity : Constant, Linear, Polynomial, Non-Polynomial, Exponential algorithms..

UNIT- IV: BIG DATA PROCESSES 9

Introduction on big data and cloud computing- Introduction on data storage- Data reliability- Data consistency- Object-based storage- Distributed file system- Metadata Management- Data processing operators in Pig.

UNIT- V: BIG DATA FUNCTIONS 9

Big Data roles -roles and responsibilities in Big Data organizations- organizational culture, organizational structures and job roles -‘best practices’ in setting up a Big Data organization -Hive services — HiveQL — Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and streams.

TOTAL: 45 PERIODS

OUTCOMES:

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

- To understand the fundamentals of big data Framework
- To understand the essential technologies of big data Architecture
- To apply big data algorithms
- To understand big data processes
- To understand big data functions

TEXT BOOKS:

1. Borkar, V.R., Carey, M.J., and C. Li. Big Data Platforms: What's Next? XRDS, 19(1), 44–49, 2012
2. Ohlhorst, F. Big Data Analytics: Turning Big Data into Big Money. New York: John Wiley & Sons, 2012.
3. Sathi, A. Big Data Analytics. MC Press Online LLC, 2012.

REFERENCE BOOKS:

1. Zikopoulos, P.C., deRoos, D., Parasuraman, K., Deutsch, T., Corrigan, D., and J. Giles. Harness the Power of Big Data—The IBM Big Data Platform. New York: McGrawHill, 2013.
2. Zikopoulos, P.C., Eaton, C., deRoos, D., Deutsch, T., and G. Lapis. Understanding Big Data— Analytics for Enterprise Class Hadoop and Streaming Data. New York: McGraw-Hill, 2012.
3. Enterprise Big Data Framework Guide V1.4
4. Enterprise Big Data Analyst Guide V1.0

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OBJECTIVES:

- To understand the fundamentals of digital image processing
- To have a knowledge on image and video analysis.
- To understand the real time use of image and video analytics.
- To understand the processing of images and videos
- To demonstrate real time image and video analytics applications.

UNIT- I: INTRODUCTION 9

Digital Image Processing – Characteristics of Digital Image - Basic relationship between pixels – Fundamental operations on image - Image sampling and quantization – Image transformations - Color models.

UNIT- II: BASIC TECHNIQUES FOR IMAGE PROCESSING 9

Fundamentals of spatial filtering: spatial correlation and convolution-smoothing blurring-sharpening - Basics of filtering in the frequency domain: smoothing-blurring - sharpening-- Histograms and basic statistical models of image.

UNIT- III: TRANSFORMATIONS AND SEGMENTATIONS 9

Color models and Transformations – Image and Video Segmentation-Image and video demonizing- Image and Video enhancement- Image and Video compression.

UNIT- IV: DETECTIONS AND CLASSIFICATIONS 9

Object detection and recognition in image and video-Texture models Image and Video classification models - Object tracking in Video.

UNIT- V: APPLICATIONS AND CASE STUDIES 9

Industrial- Transportation & Travel- Remote Sensing-Video Analytics in WSN: IoT Video Analytics Architectures.

TOTAL: 45 PERIODS**OUTCOMES:**

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

- Describe the fundamental principles of image analysis
- Have an idea of various image processing techniques.
- Apply pattern recognition techniques.

- Apply image analysis in real world problem
- Extend the technologies for analyzing and processing of videos.

TEXT BOOKS:

1. Rafael C Gonzalez, Richard E Woods, Digital Image Processing, Pearson Education, 4th edition, 2018. 2.
2. A.K. Jain, Fundamentals of Digital Image Processing, PHI, New Delhi, 1995

REFERENCE BOOKS:

1. Rick Szelisk, “Computer Vision: Algorithms and Applications”, Springer 2011.
2. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.

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OBJECTIVES:

- Understand the fundamentals of web framework
- Know the concept of Java web framework
- Learn the technologies of Python web framework
- Be exposed to the concepts of Web framework
- Be familiar with Web framework

UNIT- I: FUNDAMENTALS OF WEB FRAMEWORK 9

Web framework-History-Types of framework architectures-Model–view–controller (MVC)-
Three-tier organization-Introduction to frameworks-Framework applications -General-
purpose website frameworks-Server-side-Client-side-Features

UNIT- II: JAVA WEB FRAMEWORK 9

Java Web Frameworks-Struts-The Struts Framework- The Struts Tag Libraries- - Struts
Configuration Files- Applying Struts

UNIT- III: STRUTS2 9

Struts and Agile Development -Basic Configuration.-Actions and Action Support.-Results
and Result Types.-OGNL, the Value Stack, and Custom Tags-Form Tags-Form Validation
and Type Conversion- Exceptions and Logging-Getting Started with JavaScript-Advanced
JavaScript, the DOM, and CSS- Themes and Templates-Rich Internet Applications

UNIT- IV: PYTHON WEB FRAMEWORKS. 9

Introduction to Python Frameworks-Web 2.0, Python, and Frameworks-The Role of AJAX
in Web 2.0- Web 2.0 with Traditional Python-Introducing the Frameworks-Web Application
Frameworks-MVC in Web Application Frameworks-Common Web Application Framework
Capabilities

UNIT- V: TURBOGEARS WEB FRAMEWORK 9

Introduction to TurboGears-TurboGears History-Main TurboGears Components-Alternate
Components-MVC Architecture in TurboGears-Creating an Example Application-The
Controller and View-Introduction to Django-Django History-Django Components-Alternate
Components-MVC Architecture in Django-Creating an Example Application

TOTAL:45 PERIODS

OUTCOMES:

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

- Analyze the fundamentals of web framework
- Use the concept of Java web framework
- Implement the concept using Struts framework
- Apply the concept of python web framework to the problem solutions.
- Critically analyze the various Web frameworks.

TEXT BOOKS:

1. James Holmes, 'Struts The Complete Reference', 2ndEdition,Mc.GrawHill Professional 2006
2. Donald Brown,Chad Michael Davis, Scott Stanlick,"Struts2 In Action", Dreamtech press2008
3. Dana Moore, Raymond Budd, William Wright, "Professional Python Frameworks Web 2.0 Programming with Django and TurboGears", John wiley & sons, 2008
4. Carlos De LaGuardia, "Python Web Frameworks", O'Reilly

REFERENCE BOOKS:

1. Sue Spielman, "The Struts Framework1: A Practical guide for Java Programmers", 1st Edition, Elsevier 2002
2. Adrian Holovaty, Jacob Kaplan-Moss, "The Definitive Guide to Django: Web Development Done Right", Apress,2009
3. Mark Ramm, "Rapid Web applications with Turbo Gears", Prentice Hall.2009

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OBJECTIVES:

- To learn the concepts of big data analytics
- To learn the concepts about Internet of things
- To understand and implement smart systems
- To apply the use of data analytics in IoT.
- To develop applications of IoT in Industrial contexts.

UNIT- I: BIG DATA PLATFORMS FOR THE INTERNET OF THINGS 9

Big Data Platforms for the Internet of Things: network protocol- data dissemination – current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context.

UNIT- II: RFID FALSE AUTHENTICATIONS 9

On RFID False Authentications: YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self ware Internet of Things: self-healing systems- Role of adaptive neural network Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and Models.

UNIT- III: FOG COMPUTING 9

Fog Computing: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids:semantic inconsistencies – role of metadata

UNIT- IV: WEB ENHANCED BUILDING 9

Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements-

UNIT- V: SUSTAINABILITY DATA AND ANALYTICS 9

Sustainability Data and Analytics in Cloud-Based M2M Systems – potential stakeholders and their complex relationships to data and analytics applications –Social Networking

Analysis - Building a useful understanding of a social network

TOTAL:45 PERIODS

OUTCOMES:

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

- Explain the underlying architectures and models in IoT.
- Analyse different connectivity technologies for IoT.
- Analyze applications of IoT in real time scenario
- Apply data analytics techniques to IoT.
- Study the needs and suggest appropriate solutions for Industrial applications.

TEXT BOOKS:

1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.,” Big Data and The Internet of Things Enterprise Information Architecture for A New Age”, Apress, 2015.
2. Dr. John Bates , “Thingalytics - Smart Big Data Analytics for the Internet of Things”, john Bates, 2015.

REFERENCE BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, 2013.

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OBJECTIVES:

- To learn the security issues in network layer and transport layer.
- To understand the e-mail security and fire walls.
- To learn about basics of computer forensics.
- To know the evidence collection and forensics tools.
- To analyze and validate forensics data.

UNIT- I: NETWORK LAYER SECURITY & TRANSPORT LAYER SECURITY 9

IP Sec Protocol – IP Authentication Header – IP ESP – Key Management Protocol For IP Sec. Transport Layer Security: SSL Protocol, Cryptographic Computations – TLS Protocol.

UNIT- II: E-MAIL SECURITY & FIREWALLS 9

PGP – S/MIME – Internet Firewalls For Trusted System: Roles Of Firewalls – Firewall Related Terminology- Types of Firewalls – Firewall Designs – SET For E-Commerce Transactions.

UNIT- III: INTRODUCTION TO COMPUTER FORENSICS 9

Introduction To Traditional Computer Crime, Traditional Problems Associated With Computer Crime- Introduction To Identity Theft & Identity Fraud. Types Of CF Techniques – Incident And Incident Response Methodology – Forensic Duplication And Investigation. Preparation For IR: Creating Response Tool Kit And IR Team. – Forensics Technology And Systems – Understanding Computer Investigation – Data Acquisition.

UNIT- IV: EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing Crime And Incident Scenes – Working With Windows And DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT- V: ANALYSIS AND VALIDATION 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone And Mobile Devices Forensics.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the security issues in network layer and transport layer.
- Apply Security protocols in transport layer and network layer.
- Understand the e-mail security, firewalls and its types.
- Able to understand computer forensics and its types.
- Use forensics tools , evidence collection to analyse and validate forensics data.

TEXT BOOKS:

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
2. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.

REFERENCE BOOKS:

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005.
2. Richard E.Smith, "Internet Cryptography", 3rd Edition Pearson Education, 2008.
3. MarjieT.Britz, "Computer Forensics And Cyber Crime: An Introduction", 3rd Edition, Prentice Hall, 2013

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OBJECTIVES:

- To understand the need and evolution of quality concepts, contribution of quality gurus.
- To understand the TQM Principles and Models.
- To learn and apply the traditional tools and techniques of TQM.
- To educate students to apply the modern tools and techniques in TQM.
- To understand and apply QMS and EMS in any organization.

UNIT- I: INTRODUCTION**9**

Introduction - Definition of quality - Need for quality - Evolution of quality - Dimensions of product and service quality - Definition of TQM - Basic concepts of TQM – Principles of TQM - TQM Framework- Barriers to TQM – Benefits of TQM – Cost of Quality.

UNIT- II: TQM PRINCIPLES**9**

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning- Hoshin Planning - Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward - Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Sourcing, Supplier selection, Supplier Rating and Relationship development

UNIT- III: TQM TOOLS & TECHNIQUES I**9**

The seven traditional tools of quality – New management tools – Six-sigma Process Capability–Bench marking – Reasons to bench mark, Bench marking process, Criticisms of Bench Marking – FMEA –FMEA Documentation, Stages.

UNIT- IV: TQM TOOLS & TECHNIQUES II**9**

Quality Circles – Quality Function Deployment (QFD) – House of Quality – QFD Process, Benefits – Total Productive Maintenance – Concepts, Benefits – Business Process Reengineering – Concepts, Process and Applications – Business Process Improvement.

UNIT- V: QUALITY MANAGEMENT SYSTEM**9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific

Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--Environmental Management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001 -Requirements of ISO 14001—Benefits of EMS – National and International Awards.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course:

- Students would understand the basic concepts, contribution of quality guru's and TQM framework.
- Students would become acquainted with TQM Principles.
- Student would be able to apply the tools and techniques of quality management.
- Students will be able to apply Quality philosophy to facilitate business processes and understand customer requirements.
- Students can apply QMS and EMS in any organisation.

TEXT BOOKS:

1. Dale Besterfield, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal.R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,7 th Print 2011.
4. Itay Abuhav, ISO 9001: 2015 - A Complete Guide to Quality Management Systems, CRC Press; 1st edition(2017)ISO 9001-2015 standard

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SEMESTER VIII – PROFESSIONAL ELECTIVE V

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GENETIC ALGORITHM

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OBJECTIVES:

- To understand concept of genetic search and essential theoretical basis of Gas.
- To implement genetic algorithm along with number of extensions.
- To apply historical account of genetic algorithms together with current application
- To examine more advanced genetic operators.
- To apply genetic algorithms in machine learning systems

UNIT- I: INTRODUCTION

9

Introduction to genetic algorithms: A simple genetic algorithm, A simulation by hands, similarity templates (Schemata), Mathematical foundations: Schema Processing at work, The two- armed and k-armed Bandit Problem, The building block hypothesis, The minimal Deceptive Problem.

UNIT- II: COMPUTER IMPLEMENTATION OF GENETIC ALGORITHM

9

Data Structures, Reproduction, Cross over and Mutation, Time to reproduce and time to Cross, Mapping objective function to fitness form, Fitness scaling.

UNIT- III: APPLICATIONS

9

De Jong and Function Optimization, Improvement in basic techniques, Current Applications of Genetic Algorithm

UNIT- IV: ADVANCED OPERATORS AND TECHNIQUES IN GENETIC SEARCH

9

Dominance, Diploidy, Abeyance, Niche and Speciation, Multi objective Optimization, Knowledge-Based Techniques, Genetic Algorithms and Parallel Processors.

UNIT- V: GENERICS BASED MACHINE LEARNING

9

Introduction to Genetics based machine learning, Applications of genetic based machine learning

TOTAL:45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Understand basis of genetic search and essential theoretical .
- Understand computer implementation of genetic algorithm along with number of extensions.
- Apply genetic algorithms together with current application
- Evaluate more advanced genetic operators .
- Apply genetic algorithms in machine learning systems.

TEXT BOOKS:

1. David E Goldberg, “Genetic Algorithms in search, Optimization and Machine Learning”, Addison wesley
2. Eugene Charniak, Drew McDermott, “Introduction to Artificial Intelligence”, Addison Wesley

REFERENCE BOOKS:

1. Bart Kosko, “Neural Networks and fuzzy systems A dynamical systems approach to machine Intelligence”, PHI
2. Pieter Adriaans and DolfZantinge , “Data Mining”, Pearson Education Asia
3. Sam Anahory and Dennis Murray, “Data Warehousing in the Real World”, Addison – Wesley

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OBJECTIVES:

- To describe web mining and understand the need for web mining
- To differentiate between Web mining and data mining
- To understand the different application areas for web mining
- To understand the different methods to introduce structure to web-based data
- To describe Web mining, its objectives, and its benefits

UNIT- I: INTRODUCTION**9**

Introduction to Web Data Mining and Data Mining Foundations, Introduction – World Wide Web (WWW), A Brief History of the Web and the Internet, Web Data Mining-Data Mining, Web Mining. Data Mining Foundations – Association Rules and Sequential Patterns – Basic Concepts of Association Rules, Apriori Algorithm- Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports – Extended Model, Mining Algorithm, Rule Generation, Mining Class Association Rules, Basic Concepts of Sequential Patterns, Mining Sequential Patterns on GSP, Mining Sequential Patterns on PrefixSpan, Generating Rules from Sequential Patterns.

UNIT- II: CLASSIFICATIONS**9**

Supervised and Unsupervised Learning Supervised Learning – Basic Concepts, Decision Tree Induction – Learning Algorithm, Impurity Function, Handling of Continuous Attributes, Classifier Evaluation, Rule Induction – Sequential Covering, Rule Learning, Classification Based on Associations, Naïve Bayesian Classification , Naïve Bayesian Text Classification – Probabilistic Framework, Naïve Bayesian Model . Unsupervised Learning – Basic Concepts , K-means Clustering – K-means Algorithm, Representation of Clusters, Hierarchical Clustering – Single link method, Complete link Method, Average link method, Strength and Weakness.

UNIT- III: INFORMATION RETRIEVAL**9**

Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Methods – Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page

Preprocessing – Stopword Removal, Stemming, Web Page Preprocessing, Duplicate Detection, Inverted Index and Its Compression – Inverted Index, Search using Inverted Index, Index Construction, Index Compression, Latent Semantic Indexing – Singular Value Decomposition, Query and Retrieval, Web Search, Meta Search, Web Spamming.

UNIT- IV: LINK ANALYSIS AND WEB CRAWLING 9

Link Analysis – Social Network Analysis, CoCitation and Bibliographic Coupling, Page Rank Algorithm, HITS Algorithm, Community Discovery-Problem Definition, Bipartite Core Communities, Maximum Flow Communities, Email Communities. Web Crawling – A Basic Crawler Algorithm Breadth First Crawlers, Preferential Crawlers, Implementation Issues – Fetching, Parsing, Stopword Removal, Link Extraction, Spider Traps, Page Repository, Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts..

UNIT- V: GENERICS BASED MACHINE LEARNING 9

Opinion Mining and Web Usage Mining Opinion Mining – Sentiment Classification – Classification based on Sentiment Phrases, Classification Using Text Classification Methods, Feature based Opinion Mining and Summarization – Problem Definition, Object feature extraction, Feature Extraction from Pros and Cons of Format1, Feature Extraction from Reviews of Format 2 and 3, Comparative Sentence and Relation Mining, Opinion Search and Opinion Spam. Web Usage Mining – Data Collection and Preprocessing- Sources and Types of Data, Key Elements of Web usage Data Preprocessing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web usage Patterns -Session and Visitor Analysis, Cluster Analysis and Visitor Segmentation, Association and Correlation Analysis, Analysis of Sequential and Navigation Patterns.

TOTAL:45 PERIODS

OUTCOMES:

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

- Understand basis of genetic search and essential theoretical .
- Understand computer implementation of genetic algorithm along with number of extensions.
- Apply genetic algorithms together with current application
- Evaluate more advanced genetic operators.
- Apply genetic algorithms in machine learning systems.

TEXT BOOKS:

1. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data by Bing Liu
(Springer Publications)

REFERENCE BOOKS:

1. Data Mining: Concepts and Techniques, Second Edition Jiawei Han, Micheline Kamber (Elsevier Publications)
2. Web Mining:: Applications and Techniques by Anthony Scime
3. Mining the Web: Discovering Knowledge from Hypertext Data by Soumen Chakrabart

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OBJECTIVES:

- To understand the basic data science
- To analyze to data's using data science
- To understand the data science concept with open source tools
- To perform operation on data science concept using problem solving concept
- To implement the data science with python programming

UNIT- I: INTRODUCTION TO DATA SCIENCE 9

Python NLP on Twitter API, Distributed Computing Paradigm, MapReduce/Hadoop& Pig Script, SQL/NoSQL, Relational Algebra, Experiment design, Statistics, Graphs, Amazon EC2.

UNIT- II: DATA SCIENCE 9

Data wrangling, data management, exploratory data analysis to generate hypotheses and intuition, prediction based on statistical methods such as regression and classification, communication of results through visualization, stories, and summaries

UNIT- III: DATA SCIENCE AND OPEN SOURCE TOOLS 9

Visualizing Data, Estimation, Models from Scaling Arguments, Arguments from Probability Models, What you Really Need to Know about Classical Statistics, Data Mining, Clustering, PCA, Map/Reduce, Predictive Analytics

UNIT- IV: PROBLEM SOLVING METHOD WITH DATA SCIENCE 9

Linear algebra and programming, convex optimization, Differential equation with data science, Problem solving heuristic, Distributed Computing Paradigms, Databases and Data mining

UNIT- V: DATA SCIENCE WITH PYTHON PROGRAMMING 9

Data Structures & Analysis Packages, Machine Learning Packages, Networks Packages, Statistical Packages, Natural Language Processing & Understanding, Data APIs, Visualization Packages, iPython Data Science Notebooks.

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Implement the basic concept of Data Science
- Analysis basic data are using data science concept
- Understood the open-source tools for data science
- Understood the problem-solving methods with data science
- Implemented data science with python programming

TEXT BOOKS:

1. Wes McKinney, “Python for Data Analysis”, O’Reilly
2. Davis Beaskey and Brain K Jones, “Python cookbook”, O’REILLY publication

REFERENCE BOOKS:

1. Al Sweigart, “Automate the boring stuff with python : Practical Programming for Total Beginners”, No Starch Press
2. J. H. Wilkinson, “The Algebraic Eigenvalue Problem (Numerical Mathematics and Scientific Computation)”, Clarendon Press, 1988

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4	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-
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OBJECTIVES:

- To Get the knowledge on business analytics basics
- To Acquire the knowledge about Regression
- To study about challenges in big data analytics
- To understand learning techniques for analytics
- To know more about web and google analytics

UNIT- I: INTRODUCTION TO BUSINESS ANALYTICS 9

What is Analytics? - Overview of different Analytic Areas-Introduction to Descriptive analytics, Descriptive Statistics, Probability Distributions, Statistics through hypothesis tests, Permutation & Randomization Test.

UNIT- II: REGRESSION 9

Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours, Regression & Classification, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant analysis, Regression and classification tree, support vector machine.

UNIT- III: CHALLENGES FOR BIG DATA ANALYTICS 9

Supervised Learning with Regression and Classification techniques- Unsupervised Learning and Challenges for Big Data Analytics- Clustering, Associative Rule Mining, Challenges for big data analytics.

UNIT- IV: LEARNING TECHNIQUES 9

Prescriptive analytics Creating data for analytics through designed experiments, creating data for analytics through Active learning, creating data for analytics through Reinforcement learning, Graph Visualization, Data Summaries, Model Checking & Comparison

UNIT- V: CASE STUDY 9

Web Analytics: Understanding the metrics - Basic & Advanced Web Metrics - Google Analytics: Demo & Hands on- Campaign Analytics - Text Mining.

TOTAL :45 PERIODS

OUTCOMES :

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

- Get the knowledge on business analytics basics
- Acquire the knowledge about Regression
- Study about challenges in big data analytics
- Understand learning techniques for analytics
- Know more about web and google analytics

TEXT BOOKS:

1. Hastie, Trevor, et al., "The elements of statistical learning", Vol.2. No. 1. New York: springer, 2009.

REFERENCE BOOKS:

1. Montgomery, Douglas C., and George C. Runger, "Applied statistics and probability for engineers", John Wiley & Sons, 2010
2. Bekkerman et al, "Scaling up Machine Learning", Cambridge University Press, 2012
3. Tom White, "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. Vincent Granville, Developing Analytic Talent: Becoming a Data Scientist, wiley, 2014.
6. Jeffrey Stanton & Robert De Graaf, Introduction To Data Science, Version 2.0, 2013.

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OBJECTIVES:

- The objective of this course is to provide conceptual understanding of how blockchain technology can be used to innovate and improve business processes.
- The course covers the technological underpinning of blockchain operations.
- To learn the practical implementation of solutions using blockchain technology.
- To understand the critical evaluation of existing “smart contract” capabilities and platforms, and examines their future directions, opportunities, risks and challenges.
- To develop familiarity of current technologies, tools, and implementation strategies.

UNIT- I: INTRODUCTION 9

Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain, Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

UNIT- II: UNDERSTANDING BLOCKCHAIN WITH CRYPTO CURRENCY 9

Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hash cash PoW, Bit coin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool

UNIT- III: UNDERSTANDING BLOCKCHAIN FOR ENTERPRISES 9

Permissioned Blockchain: Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned blockchain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems

UNIT- IV: ENTERPRISE APPLICATION OF BLOCK 9

Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain

UNIT- V: BLOCKCHAIN APPLICATION DEVELOPMENT 9

Hyper ledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyper ledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand block chain technology.
- Develop block chain based solutions and write smart contract using Hyper ledger Fabric and Ethereum frameworks.
- Build and deploy block chain application for on premise and cloud based architecture.
- Integrate ideas from various domains and implement them using block chain technology in different perspectives.
- Analyze the incentive structure in a block chain based system and critically assess its functions, benefits and vulnerabilities

TEXT BOOKS:

1. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015.
2. Josh Thompsons, “Blockchain: The Blockchain for Beginners- Guide to Blockchain Technology and Leveraging Blockchain Programming”, 2017

REFERENCE BOOKS:

1. Daniel Drescher, “Blockchain Basics”, Apress; 1st edition, 2017.
2. AnshulKaushik, “Blockchain and Crypto Currencies”, Khanna Publishing House, Delhi, 2018
3. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, 2018
4. RiteshModi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing, 2018

5. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Blockchain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018.

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OBJECTIVES:

- To gain basic knowledge about fundamentals of green computing.
- To know about green assets and models.
- To minimize the inclusion of harmful materials.
- To use as many biodegradable materials as possible.
- To explore green frame work and compliance

UNIT- I: FUNDAMENTALS 9

Green IT Fundamentals: Business, IT, and the Environment –Green computing: carbon foot print, scoop on power –Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics

UNIT- II: GREEN ASSETS AND MODELING 9

Green Assets: Buildings - Data Centers - Networks, and Devices - Green Business Process Management: Modeling, Optimization, and Collaboration –Green Enterprise Architecture –Environmental Intelligence Green Supply Chains –Green Information Systems: Design and Development Models.

UNIT- III: GREEN FRAMEWORK 9

Virtualizing of IT systems –Role of electric utilities – Telecommuting - teleconferencing and teleporting –Materials recycling –Best ways for Green PC –Green Data center – Green Grid framework.

UNIT- IV: GREEN COMPLIANCE 9

Socio-cultural aspects of Green IT –Green Enterprise Transformation Roadmap –Green Compliance: Protocols - Standards - and Audits –Emergent Carbon Issues: Technologies and Future.

UNIT- V: CASE STUDIES 9

The Environmentally Responsible Business Strategies (ERBS) –Case Study Scenarios for Trial Runs – calculating the carbon footprint – greening mobile devices - CASE STUDIES –Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TOTAL:45 PERIODS

OUTCOMES:

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

- Gain basic knowledge about fundamentals of green computing.
- Minimize the inclusion of harmful materials.
- Apply changing government policy to encourage recycling.
- Preserve resources which use less energy to produce use and dispose of product.
- Understand save resources and environment.

TEXT BOOKS:

1. Bhuvan Unhelkar, “Green IT Strategies and Applications-Using Environmental Intelligence”, CRC Press, June 2011
2. Woody Leonhard, Katherrine Murray, Green Home computing for dummies, August 2009.

REFERENCE BOOKS:

1. Alin Gales, Michael Schaefer, Mike Ebbers, “Green Data Center: steps for the Journey”, Shoff / IBM rebook, 2011.
2. John Lamb, “The Greening of IT”, Pearson Education, 2009.
3. Jason Harris, “Green Computing and Green IT-Best Practices on regulations & industry”, Lulu.com, 2008.
4. Carl Speshocky, “Empowering Green Initiatives with IT”, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), “Green computing: Large Scale energy efficiency”, CRC Press, 2012

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SEMESTER VIII – PROFESSIONAL ELECTIVE VI

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DATA QUALITY AND TRANSFORMATIONS

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OBJECTIVES:

The student should be made:

- To understand the basics of data quality
- To learn the data quality dimensions
- To learn the models of data quality
- To recognize the methodologies for data quality improvement and measurement.
- To understand the concepts of data transformations.

UNIT- I: INTRODUCTION

9

Introduction to the concept of Data Quality-Data Quality and Types of Data-Data Quality and Types of Information Systems-Research Issues and Application Domains in Data Quality: Research Issues in Data Quality-Application Domains in Data Quality-Research Areas Related to Data Quality.

UNIT- II: DATA QUALITY DIMENSIONS

9

Accuracy-Completeness: Completeness of Relational Data and Web Data- Time-related Dimensions: Currency, Timeliness and Volatility-Consistency: Integrity Constraints-Data Edits. Other Data Quality Dimensions-Approaches to the Definition of Data Quality Dimensions- Schema Quality Dimensions.

UNIT- III: MODELS FOR DATA QUALITY

9

Introduction-Extensions of Structured Data Models: Conceptual Models-Logical Models for Data Description-The Polygen Model for Data Manipulation-Data Provenance. Extensions to Semi-structured Data Models-Management Information System Models: IP-MAP model-Extensions of IP-MAP-Data Models.

UNIT- IV: DATA QUALITY MEASUREMENT AND IMPROVEMENT

9

Basics on Data Quality Methodologies: Inputs and Outputs-Classification of Methodologies-Comparison among Data-driven and Process-driven strategies. Assessment Methodologies-Comparative Analysis of general purpose methodologies-CDQM Methodology.

UNIT- V: DATA TRANSFORMATION

9

Introduction-Benefits and Challenges-Functions of data transformations: Extraction and parsing-Translation and mapping-Filtering, aggregation, and summarization-Enrichment

and imputation-Indexing and ordering - Anonymization and encryption - Modeling, typecasting, formatting, and renaming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply data quality measures for data science.
- Identify the dimensions of data quality.
- Choose the model for measuring data quality.
- Apply the data quality methodologies for improvement
- Understand data transformation concepts.

TEXT BOOKS:

1. Carlo Batini and Monica Scannapieco, “Data Quality-Concepts, Methodologies and Techniques” Springer.
2. Arthur D. Chapman, “Principles of Data Quality”, Global Biodiversity Information Facility, 2005.

REFERENCES:

1. Rajesh Jugulum “Competing with High Quality Data-Concepts, Tools, and Techniques for Building a Successful Approach to Data Quality”, Wiley, 2014.
2. Rupa Mahanti “Data QualityDimensions, Measurement, Strategy, Management, and Governance”, ASQ Quality Press, 2019.

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5	3	2	-	-	-	2	-	2	-	-	-	3	2	-	-	-

OBJECTIVES:

- To introduce importance and applications of AR
- To understand working principle of head up and head mounted display systems
- To use computer vision to develop AR systems
- To integrate different sensors with AR/VR systems
- To understand different interaction modalities

UNIT- I: INTRODUCTION 9

Difference between augmented and virtual reality, basics of computer vision and multimodal interaction, AR system for fault inspection ,Digital Twin, Head up and head mounted systems in automotive and aviation domains, rendering real time sensor data in VR model

UNIT- II: 3D INTERFACE 9

3D user interface input hardware: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home-Brewed Input Devices, Choosing Input Devices for 3D Interfaces..

UNIT- III: HUMAN FACTORS 9

Human factors: Introduction – the eye-the ear-the somatic senses-VR Hardware : Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated VR systems-VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML.

UNIT- IV: TRACKING 9

Tracking for Augmented Reality - Collaborative Augmented Reality- Heterogeneous user interfaces -Mobile Augmented Reality-AR applications-case studies.

UNIT- V: APPLICATION 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understood the basic concept of virtual reality
- Understood 3D computer Graphics System
- Design object objects using geometric modelling
- Develop Virtual environment and Virtual Reality applications
- Apply study about Virtual Hardware and Software.

TEXT BOOK:

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Dieter Schmalsteg and Tobias Hollerer, Augmented Reality: principles & Practice Pearson Education India,2016

REFERENCE BOOKS:

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

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OBJECTIVES:

- Remember the fundamental concepts of Fog.
- Understand the architecture and components of Fog.
- Analyze the protocols of Fog.
- Understand the data management and Fog security principles.
- Apply the case studies related to Fog Computing

UNIT- I: INTRODUCTION TO FOG COMPUTING 9

Fog Computing-Definition-Characteristics- Application Scenarios - Issues -Fog Computing and Internet of Things–Fog Computing Components - Fog Computing and Cloud Computing- Simple Case Studies (STLS and Wind Farm) –High Level and Software Architecture

UNIT- II: ARCHITECTURE 9

Fog Computing Fundamentals: Introduction – Background and Motivation of Fog Computing – Fog Computing Basics – Fog Computing Services. IoT Resource Estimation Challenges and Modeling in Fog: Fog Resource estimation and its challenges.

UNIT- III: FOG PROTOCOLS 9

Tackling IoT Ultra Large Scale Systems: Fog Computing in Support of Hierarchical Emergent Behaviors : Introduction – Fog Computing – Hierarchical Emergent Behaviors, a Fresh Approach for ULSS - Two Autonomous Vehicles Primitives Case Study.

UNIT- IV: FOG SECURITY PRINCIPLES. 9

Self-aware Fog Computing in Private and Secure Sphere: Cloud, Fog and Mist Computing Networks- Self-aware Data Processing - Urban IoT Edge Analytics: Design challenges – Edge-assisted Architecture – Information Acquisition and Compression – Content-aware wireless networking – Information availability.

UNIT- V: IMPLEMENTATION OF REAL TIME APPLICATIONS AS SERVICES 9

Control-as-a-Service in Cyber-Physical Energy Systems over Fog Computing: Power Grid and Energy Management - Energy Management Methodologies - Cyber-Physical Energy Systems - Internet-of-Things and Fog Computing - Control-as-a-Service - Residential

Cyber Physical Energy System. Leveraging Fog Computing for Healthcare IoT: Introduction – Healthcare Services in the Fog Layer - Personalization – Privacy and Security – System Architecture of Healthcare IoT.

TOTAL:45 PERIODS

OUTCOMES:

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

- Discuss the fundamental concepts in Fog.
- Analyze the architectures available in Fog.
- Know and explain the Protocols related to Fog.
- Comprehend the Data Management and Security Principles.
- Examine the case studies of Fog.

TEXT BOOKS:

1. Amir Vahid Dastjerdi and Rajkumar Buyya, "Fog Computing: Helping the Internet of Things Realize its Potential", University of Melbourne.
2. Shanhe Yi, Cheng Li, Qun Li, "A Survey of Fog Computing: Concepts, Applications and Issues", Mobidata'15, ACM 978-1-4503-3524-9/15/06, DOI: 10.1145/2757384.2757397, June 21, 2015, Hangzhou, China.
3. Amir M. Rahmani ,Pasi Liljeberg, Preden, Axel Jantsch, "Fog Computing in the Internet of Things - Intelligence at the Edge", Springer International Publishing, 2018.

REFERENCE BOOKS:

1. Ivan Stojmenovic, Sheng Wen, "The Fog Computing Paradigm: Scenarios and Security Issues", Proceedings, Federated Conference on Computer Science and Information Systems, pp. 1–8, 2014.
2. Flavio Bonomi, Rodolfo Milito, Preethi Natarajan and Jiang Zhu, "Fog Computing: A Platform for Internet of Things and Analytics", Big Data and Internet of Things: A Roadmap for Smart Environments, Studies in Computational Intelligence 546, DOI: 10.1007/978-3-319- 05029-4_7, © Springer International Publishing Switzerland 2014.
3. Hazar, Yanru Zhang, Nguyen H. Tran, Dusit Niyato, and Zhu Han, "Multi – Dimensional payment Plan in Fog Computing with Moral", IEEE, 2016.

4. Farhoud Hosseinpour, Juha Plosila, Hannu Tenhunen, “An Approach for Smart management of Big Data in the Fog Computing Context”, IEEE 8th International Conference on Cloud Computing Technology and Science, 2016.

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OBJECTIVES:

- Understand the basics of Information Security
- Know the legal, ethical and professional issues in Information Security
- Know the aspects of risk management
- Become aware of various standards in this area
- Know the technological aspects of Information 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.

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.

UNIT- III: SECURITY ANALYSIS 9

Risk Management - Identifying and Assessing Risk - Assessing and Controlling Risk - Systems - Access Control Mechanisms - Information Flow and Confinement Problem.

UNIT- IV: LOGICAL DESIGN 9

Blueprint for Security - Information Security Policy - Standards and Practices - ISO 17799/BS 7799 - NIST Models - VISA International Security Model - Design of Security Architecture -Planning for Continuity.

UNIT- V: PHYSICAL DESIGN 9

Security Technology - IDS, Scanning and Analysis Tools – Cryptography - Access Control Devices - Physical Security -Security and Personnel.

TOTAL: 45 PERIODS**OUTCOMES:****At the end of the course, the student should be able to:**

- Discuss the basics of information security

- Illustrate the legal, ethical and professional issues in information security
- Demonstrate the aspects of risk management.
- Become aware of various standards in the Information Security System
- Design the Security Techniques

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw-Hill, 2003.
3. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002

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OBJECTIVES:

- To understand and analyze Information security threats & counter measures
- To perform security auditing & testing To understand issues relating to ethical hacking
- To study & employ network defense measures To understand penetration and security testing issues
- To understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
- To perform penetration & security testing

UNIT- I: ETHICAL HACKING OVERVIEW & VULNERABILITIES 9

Understanding the importance of security, Concept of ethical hacking and essential Terminologies Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking.

UNIT- II: FOOTPRINTING & PORT SCANNING 9

Foot printing - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.

UNIT- III: SYSTEM HACKING 9

Aspect of remote password guessing, Role of eavesdropping - Various methods of password cracking - Keystroke Loggers - Understanding Sniffers -Comprehending Active and Passive Sniffing - ARP Spoofing and Redirection.

UNIT- IV: HACKING WEB SERVICES & SESSION HIJACKING 9

Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass - web services and related flaws - protective http headers Understanding Session Hijacking - Phases involved in Session Hijacking - Types of Session Hijacking.

UNIT- V: HACKING WIRELESS NETWORKS 9

Introduction to 802.11, Role of WEP, Cracking WEP Keys - Sniffing Traffic - Wireless DOS attacks - WLAN Scanners - WLAN Sniffers - Hacking Tools - Securing Wireless Networks.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand and analyze Information security threats & Router measures
- Perform security auditing & testing To understand issues relating to ethical hacking
- Employ network defense measures.
- Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
- Perform penetration & security testing

TEXT BOOKS:

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010

REFERENCE BOOKS:

1. RajatKhare, "Network Security and Ethical Hacking", Luniver Press, 2006
2. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011
3. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

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5	2	-	3	-	-	-	-	-	-	-	-	-	2	-	-	-

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 understand the different components of an Information retrieval system
- To learn different techniques of recommender system.

UNIT- I: INTRODUCTION**9**

Information Retrieval –Early Developments –The IR Problem –The User's Task – Information versus Data Retrieval -The IR System –The Software Architecture of the IR System –The Retrieval and Ranking Processes -The Web –The e-Publishing Era –How the web changed Search –Practical Issues on the Web –How People Search –Search Interfaces Today –Visualization in Search Interfaces.

UNIT- II: MODELING AND RETRIEVAL EVALUATION**9**

Basic IR Models -Boolean Model -TF-IDF (Term Frequency/Inverse Document Frequency) Weighting -Vector Model –Probabilistic Model –Latent Semantic Indexing Model –Neural Network Model –Retrieval Evaluation –Retrieval Metrics –Precision and Recall –Reference Collection –User-based Evaluation –Relevance Feedback and Query Expansion –Explicit Relevance Feedback.

UNIT- III: TEXT CLASSIFICATION AND CLUSTERING**9**

A Characterization of Text Classification –Unsupervised Algorithms: Clustering –Naïve Text Classification –Supervised Algorithms –Decision Tree –k-NN Classifier –SVM Classifier – Feature Selection or Dimensionality Reduction –Evaluation metrics –Accuracy and Error – Organizing the classes –Indexing and Searching –Inverted Indexes –Sequential Searching – Multi-dimensional Indexing

UNIT- IV: EVOLUTIONARY AND GRAPHICAL MODELS**9**

The Web –Search Engine Architectures –Cluster based Architecture –Distributed Architectures –Search Engine Ranking –Link based Ranking –Simple Ranking Functions – Learning to Rank –Evaluations --Search Engine Ranking –Search Engine User Interaction – Browsing –Applications of a Web Crawler –Taxonomy –Architecture and Implementation –

Scheduling Algorithms –Evaluation

UNIT- V: RECOMMENDER SYSTEM 9

Recommender Systems Functions –Data and Knowledge Sources –Recommendation Techniques –Basics of Content-based Recommender Systems –High Level Architecture – Advantages and Drawbacks of Content-based Filtering –Collaborative Filtering –Matrix factorization models –Neighborhood models

TOTAL: 45 PERIODS

OUTCOMES:

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

- Use an open source search engine framework and explore its capabilities
- Apply appropriate method of classification or clustering.
- Apply the data structures like Inverted Indices used in Information retrieval systems
- Implement the basics of web search
- Design and implement a recommender system.

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.

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OPEN ELECTIVE I

OBJECTIVES:

- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.
- To understand the ecological context of agriculture and its concerns.
- To study the context of climate change and emerging global issues.
- To gain knowledge on water balance.
- To understand the importance of virtual water

UNIT- I: ENVIRONMENTAL CONCERNS 9

Environmental basis for agriculture and food – Land use and landscape changes – Water quality issues – Changing social structure and economic focus – Globalization and its impacts – Agro ecosystems.

UNIT- II: ENVIRONMENTAL IMPACTS 9

Irrigation development and watersheds – mechanized agriculture and soil cover impacts – Erosion and problems of deposition in irrigation systems – Agricultural drainage and downstream impacts – Agriculture versus urban impacts.

UNIT- III: CLIMATE CHANGE 9

Global warming and changing environment – Ecosystem changes – Changing blue green-grey water cycles – Water scarcity and water shortages – Desertification.

UNIT- IV: ECOLOGICAL DIVERSITY AND AGRICULTURE 9

Ecological diversity, wild life and agriculture – GM crops and their impacts on the environment – Insects and agriculture – Pollination crisis – Ecological farming principles – Forest fragmentation and agriculture – Agricultural biotechnology concerns.

UNIT- V: EMERGING ISSUES 9

Global environmental governance – alternate culture systems – Mega farms and vertical farms – Virtual water trade and its impacts on local environment – Agricultural environment policies and its impacts – Sustainable agriculture.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Students may be able to know how the environment and agriculture are related and the changes in the environmental due to agriculture.
- Students will be able to gather idea on about how the mechanization helps and impacts of soil erosion due to agricultural activities.
- Students will have a wide knowledge of changing environment due to global warming and climate change and its impact on water.
- Students are exposed to the ecological diversity in agriculture and different technologies used in farming activities.
- Students are able to understand the global governance system and agricultural policies involved in the sustainable agricultural systems.

TEXT BOOKS:

1. M.Lakshmi Narasaiah, Environment and Agriculture, Discovery Pub. House, 2006.
2. Arvind Kumar, Environment and Agriculture, ABH Publications, New Delhi, 2005

REFERENCE BOOKS:

1. T.C. Byerly, Environment and Agriculture, United States Dept. of Agriculture, Economic Research Service, 2006.
2. Robert D. Havener, Steven A. Breth, Environment and agriculture: rethinking development issues for the 21st century: proceedings of a symposium, Winrock International Institute for Agricultural Development, 1994.
3. Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium, Bangkok, Thailand. 1989.

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**PRODUCTION TECHNOLOGY OF AGRICULTURAL
MACHINERY**

L T P C

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OBJECTIVES:

- To understand the mechanical properties of engineering materials and
 - their classifications
- To understand the basic principles of lathe and the corresponding machines.
- To gain knowledge on various welding techniques available.
- To understand the importance of advanced manufacturing process.
- To emphasize on the importance of accuracy on machine operation.

UNIT- I: ENGINEERING MATERIALS

9

Engineering materials - their classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

UNIT- II: MACHINING

9

Basic principles of lathe - machine and operations performed on it. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

UNIT- III: WELDING

9

Introduction, classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

UNIT- IV: ADVANCED MANUFACTURING PROCESS

9

Abrasive flow machining - abrasive jet machining - water jet machining - Electro Discharge Machining (EDM) - Wire cut EDM - Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD) - Electron Beam Machining (EBM) - Laser Beam Machining (LBM).

UNIT- V: CNC MACHINE**9**

Numerical control (NC) machine tools - CNC: types, constitutional details, special features - design considerations of CNC machines for improving machining accuracy - structural members - slide ways - linear bearings - ball screws - spindle drives and feed drives. Part programming fundamentals - manual programming.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of this course,

- Students can able to apply the different manufacturing process and use this in industry for component production.
- Students will be able to understand the working principle of lathe and various operations done on it.
- Students will be able to gather idea on welding and soldering process.
- Students will gain wide knowledge on various advance manufacturing process.
- Students will gain knowledge in CNC machine and improving the machining accuracy.

TEXTBOOKS:

1. "Manufacturing Engineering and Technology", Kalpakjian and Schmid, Pearson, 2010.
2. Hajra Choudry, "Elements of workshop technology - Vol II", Media promoters, 2002.

REFERENCE BOOKS:

1. Gupta. K.N., and Kaushik, J.P., 1998, Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi.
2. Arthur. D., et. al. 1998, General Engineering Workshop Practice, Asia Publishing House, Bombay.
3. Chapman W.A.J., Workshop Technology, 1992, Part I, II, III, E.L.B.S. and Edward Arnold Publishers Ltd, London.

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OBJECTIVES:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
- To gain knowledge of characteristics of air pollution and noise pollution.
- To create awareness among the sources and effects of air pollution.
- To gain knowledge on air pollution control equipments.
- To develop a knowledge on air quality standards.

UNIT- I: INTRODUCTION 9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards – Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT- II: METEOROLOGY 9

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT- III: CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT- IV: CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

UNIT- V: INDOOR AIR QUALITY MANAGEMENT 9

Air quality standards - Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness - Town planning regulations of industries-Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

OUTCOMES:

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

- An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management.
- Ability to identify, formulate and solve air and noise pollution problems.
- Ability to design stacks and particulate air pollution control devices to meet applicable standards.
- Ability to select control equipments.
- Ability to control effects of noise pollution and indoor air pollution.

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science , science media LLC,2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press,Inc 2017.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCE BOOKS:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited,2007.

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programmes — People’s participation – Entry point activities - Evaluation of watershed management measures.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Gain knowledge on various processes involved in participatory water resource management.
- Understand farmer's participation in water resources management.
- Aware of the issues related to water conservation and watershed Development.
- Get knowledge in participatory water conservation.
- Understand concept, principle and approach of watershed management.

TEXT BOOKS:

1. Sivasubramaniyan, K. “Water Management”, SIMRES Publication, Chennai, 2011.
2. Uphoff.N, “Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and Management”, No.11, West view press, Boulder, CO, 1986.
3. Tideman E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.

REFERENCE BOOKS:

1. Chambers Robert, “Managing canal irrigation”, Cambridge University Press, 1989.

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OBJECTIVES:

- To introduce the fundamentals and components of Geographic Information System.
- To provide details of spatial data structures and input, management and output processes.
- To provide details about raster input data structures.
- To be familiar with network topologies.
- To Analyze data analytics and various applications of GIS.

UNIT- I: FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - geographical data types - Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT- II: SPATIAL DATA MODELS 9

Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models TIN and GRID data models - OGC standards - Data Quality.

UNIT- III: DATA INPUT AND TOPOLOGY 9

Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser – Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.

UNIT- IV: DATA ANALYSIS 9

Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation.

UNIT- V: APPLICATIONS 9

GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Have basic idea about the fundamentals of GIS.
- Understand the types of data models.
- Get knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Understand data management functions and data output.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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OBJECTIVES:

- Understand and analyse the energy data of industries.
- Carryout energy accounting and balancing.
- Conduct energy audit and suggest methodologies for energy savings.
- Utilise the available resources in optimal ways
- Understand and analyse of Energy Economics.

UNIT- I: INTRODUCTION 9

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT- II: ELECTRICAL SYSTEMS 9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT- III: THERMAL SYSTEMS 9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories.

UNIT- IV: ENERGY CONSERVATION IN MAJOR UTILITIES 9

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets.

UNIT- V: ECONOMICS 9

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Can able to analyse the energy data.
- Can carry out energy accounting and balancing.
- Can suggest methodologies for energy savings.
- Can carry out Energy Conservation in Major Utilities.
- Can suggest methodologies for Energy Economics.

TEXT BOOKS:

1. Energy Manager Training Manual (4 Volumes) available at www.energymanagertraining.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004

REFERENCE BOOKS:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford,1981.
3. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982.
4. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths, London 1987.

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1	1	1	-	1	-	3	-	-	-	2	-	-
2	-	-	2	-	1	-	-	-	2	-	-	1
3	-	1	-	3	-	2	-	-	-	-	-	-
4	3	-	-	-	-	3	-	2	-	-	2	-
5	-	2	-	3	2	-	1	2	-	-	-	2

OBJECTIVES:

- To get exposure on solar radiation and its environmental impact to power.
- To know about the various collectors used for storing solar energy.
- To know about the various applications in solar energy.
- To learn about the wind energy and biomass and its economic aspects.
- To know about geothermal energy with other energy sources.

UNIT- I: PRINCIPLES OF SOLAR RADIATION 10

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT- II: SOLAR ENERGY COLLECTION 8

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT- III: SOLAR ENERGY STORAGE AND APPLICATIONS 8

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT- IV: WIND ENERGY 10

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT- V: GEOTHERMAL ENERGY 9

Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC-Magneto Hydro Dynamic power generation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understanding the physics of solar radiation.
- Ability to classify the solar energy collectors and methodologies of storing solar energy.
- Knowledge in applying solar energy in a useful way.
- Knowledge in wind energy and biomass with its economic aspects.
- Knowledge in capturing and applying other forms of energy sources like wind, biogas and geothermal energies.

TEXT BOOKS:

1. Rai G.D., "Non-Conventional Energy Sources", Khanna Publishers, 2011.
2. Twidell & Wier, "Renewable Energy Resources", CRC Press (Taylor & Francis), 2011.

REFERENCE BOOKS:

1. Tiwari and Ghosal, "Renewable energy resources", Narosa Publishing House, 2007.
2. Ramesh R & Kumar K.U, "Renewable Energy Technologies", Narosa Publishing House, 2004.
3. Mittal K M, "Non-Conventional Energy Systems", Wheeler Publishing Co. Ltd, New Delhi, 2003.

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4	2	-	-	-	3	2	3	2	-	-	1	2
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OBJECTIVES:

- To provide knowledge about the SCADA system and its architecture
- To provide knowledge about SCADA system components
- To provide knowledge about SCADA communication protocols
- To provide knowledge about SCADA monitoring and control in power system
- To provide knowledge about SCADA applications in power system

UNIT- I: INTRODUCTION 9

Evolution of SCADA, SCADA definitions, SCADA Functional requirements and Components, SCADA Hierarchical concept, SCADA architecture, General features, SCADA Applications, Benefits

UNIT- II: SCADA SYSTEM COMPONENTS 9

Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels

UNIT- III: COMMUNICATION 9

SCADA Communication requirements, Communication protocols: Past, Present and Future, Structure of a SCADA Communications Protocol, Comparison of various communication protocols, IEC61850 based communication architecture, Communication media like Fiber optic, PLCC etc. Interface provisions and communication extensions, synchronization with NCC, DCC.

UNIT- IV: MONITORING AND CONTROL 9

Online monitoring the event and alarm system, trends and reports, Blocking list, Event disturbance recording. Control function: Station control, bay control, breaker control and disconnecter control.

UNIT- V: APPLICATIONS IN POWER SYSTEM 9

Applications in Generation, Transmission and Distribution sector, Substation SCADA system Functional description, System specification, System selection such as Substation configuration, IEC61850 ring configuration, SAS cubicle concepts, gateway interoperability list, signal naming concept. System Installation, Testing and Commissioning.

TOTAL: 45 PERIODS

OUTCOMES:

- This course gives knowledge about SCADA SYSTEM and its architecture
- This course gives knowledge about various system components of SCADA System
- This course gives knowledge about various communication protocols of SCADA System
- This course gives knowledge about SCADA monitoring and control in power System
- This course gives knowledge about SCADA system applications

TEXT BOOKS:

1. Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications,USA,2004
2. Gordon Clarke, Deon Reynders: Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes Publications, Oxford, UK,2004
3. William T. Shaw, Cyber security for SCADA systems, PennWell Books, 2006

REFERENCE BOOKS:

1. David Bailey, Edwin Wright, Practical SCADA for industry, Newnes3 William T. Shaw, Cybersecurity for SCADA systems, PennWell Books, 2006, 2003
2. Michael Wiebe, A guide to utility automation: AMR, SCADA, and IT systems for electric Power, PennWell 1999
3. Dieter K. Hammer, Lonnie R. Welch, Dieter K. Hammer, “Engineering of Distributed Control Systems”, Nova Science Publishers, USA, 1st Edition, 2001

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OBJECTIVES:

- To understand the basics of display devices.
- To enhance the student knowledge in Audio broadcasting systems.
- To enable the student to learn about Television systems.
- To develop the student knowledge in Interactive Gaming Applications.
- To apply the knowledge of Consumer Electronic Applications.

UNIT- I: DISPLAY DEVICES 9

Introduction – Underlying technologies of displays -Types of Electronic displays – Segment displays –Two dimensional displays: Liquid Crystal display, Light emitting diode display – Three dimensional displays: Laser display, Holographic display – Applications.

UNIT- II: AUDIO BROADCASTING SYSTEMS 9

Loud Speakers: construction, working principles and applications of crystal, condenser and dynamic loudspeakers – Tweeters, Squawkers & Woofers - Public address system - Requirements of Public Addressing system -Microphones: construction, working principles and applications of Carbon, Moving coil and Crystal microphones. Headphones: Principle of operation of crystal and dynamic and Bluetooth based headphones.

UNIT- III: TELEVISION SYSTEMS 9

Basics of Television: Television standards, frequency bands, Scanning method, interlacing and synchronization, bandwidth, Advanced TV systems: LCD, LED, HDTV,3DTV, Smart TV. Color concepts, concepts of luminance, Hue and Saturation, Color TV (PAL Systems). Cable TV concepts, Closed Circuit Television.

UNIT- IV: INTERACTIVE GAMING APPLICATIONS 9

Fundamental of game design - Gaming scenarios – Interfaces- Multi player interactive gaming – Programming concepts – educational games – Privacy and security in games – Introduction to Android games and its development – Online games.

UNIT- V: CONSUMER ELECTRONIC APPLICATIONS 9

Principle of operation of digital clocks, electronic calculator, cellular phones- smart phones microwave ovens, washing machines, air conditioners, ATMs and set-top-boxes – Compact Ultrafast Fiber lasers for Consumer electronics – Virtual reality applications,

Alexa.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basic applications of display devices.
- Analyze the operation of Audio devices and its applications.
- Know the basic TV Standards and the basics of Television.
- Design the Gaming scenarios and knowing programming concepts.
- Apply the Knowledge of applications of Consumer electronics.

TEXT BOOKS:

1. Shoichi Matsumoto, "Electronic display devices", Wiley, 1990.
2. Ajay Sharma, "Audio video and TV Engineering-Consumer Electronics", Dhanpat Rai and co, 2003.
3. R.G. Gupta, "Audio and Video systems", Tata Mc Graw Hill Publishing Co.Ltd, 2010

REFERENCE BOOKS:

1. R. Gulati, "Monochrome and Color Television", New Age International (P) Ltd, New Delhi, 2014
2. S P Bali, "Consumer Electronics", Pearson,.2007

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OBJECTIVES:

- To enable the students to manifest the components used in the optical system, propagation of signals and their impairments in optical fiber.
- To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs.
- To familiarize the students about the optical network architectures and the protocol stack in use.
- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue.
- To expose the student to the advances in networking and switching domains and the future trends.

UNIT- I: OPTICAL SYSTEM COMPONENTS 9

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT- II: OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; Wavelength Division Multiplexing, optical add/drop multiplexer, SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture.

UNIT- III: WAVELENGTH ROUTING NETWORKS 9

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations- Linear Light wave networks, Logically Routed Networks.

UNIT- IV: WAVELENGTH ROUTING NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks, Contention Resolution Access Networks – Network Architecture overview, Optical Access Network Architectures and

OTDM networks, OTDR.

UNIT- V: NETWORK DESIGN AND MANAGEMENT 9

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Elucidate the components in an optical system.
- Use the backbone infrastructure for our present and future communication needs.
- Analyze the architectures and the protocol stack,
- Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods.
- Annotate the network management and protection methods in vogue.

TEXT BOOKS:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, Second Edition, Harcourt Asia Pte Ltd., 2004.
2. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, 1st Edition, Prentice Hall of India, 2002.

REFERENCE BOOKS:

1. John M. Senior, “Optical Fiber Communication”, 3rd edition, Prentice Hall, 2009.
2. Uyles N. Black, “Optical Networks, Third Generation Transport Systems”, 1st Edition, Prentice hall of India, 2002.
3. Biswanath Mukherjee, “Optical WDM Networks”, Springer Series, 2006.
4. Govind P. Agrawal, “Fiber Optic Communication Systems”, 3rd Edition, Wiley India (P) Ltd, 2002.
5. Gerd Keiser, “Optical Fiber Communication”, 5th Edition, McGraw Hill Education (India) Pvt. Ltd., 2013.

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OBJECTIVES:

- To understand the concept of network management standards.
- To design the common management information service element model.
- To understand the various concept of information modelling.
- To analyze the concept of SNMPv1 and SNMPv2 protocol.
- To explore the concept of examples of network management

UNIT- I: BASIC FOUNDATIONS AND NETWORK**9****MANAGEMENT APPLICATIONS**

Network management standards–Network management model– Organization model– Information model - Abstract syntax notation One (ASN.1) – Encoding structure– Macros –Functional model. Network management applications functional requirements: Configuration management– Fault management–Performance management–Error correlation technology– Security management–Accounting management– Common management–report management– Policy based management – Service level management– Management service– Community definitions– capturing the requirements– simple and formal approaches–semi formal and formal notations.

UNIT- II: COMMON MANAGEMENT INFORMATION SERVICE**9****ELEMENT**

CMISE model–service definitions–errors–scoping and filtering features–synchronization–functional units– association services– common management information protocol specification

UNIT- III: INFORMATION MODELING FOR TMN**9**

Rationale for information modeling–management information model–object oriented modeling paradigm– structure of management information–managed object class definition–management information base.

UNIT- IV: SIMPLE NETWORK MANAGEMENT PROTOCOL**9**

SNMPv1: Managed networks–SNMP models– organization model– Information model–SNMPv1 communication model–functional model. SNMPv2-major changes in

SNMPv2–structure of management information, MIB–SNMPv2 protocol–compatibility with SNMPv1. SNMPv3– architecture–applications–MIB- security, SNMP Management: remote monitoring–SMI and MIB– RMON1 and RMON2.

UNIT- V: NETWORK MANAGEMENT EXAMPLES 9

ATM integrated local management interface–ATM MIB–M1– M2–M3–M4–interfaces– ATM digital exchange interface management–digital subscriber loop and asymmetric DSL technologies–ADSL configuration management–performance management Network management tools: Network statistics management–network management system–management platform case studies: OPENVIEW–ALMAP.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design and analyze of fault management.
- Analyze the common management information protocol specifications.
- Recognize the management information model.
- Realize the simple network management protocol.
- Apply various types of network management tools

TEXT BOOKS:

1. Mani Subramanian, “Network Management: Principles and Practice” Pearson Education, Second edition, 2010.
2. Lakshmi G Raman, “Fundamentals of Telecommunications Network Management”, Wiley, 1999.

REFERENCE BOOKS:

1. Henry Haojin Wang, “Telecommunication Network Management”, Mc- Graw Hill, 1999.
2. Salah Aidarous & Thomas Plevyak, “Telecommunication Network Management: Technologies and Implementations”, Wiley, 1997.
3. Singh B, “Network Security and Management”, Eastern Economy Edition, 2012.

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3	3	3	3	2	-	-	-	-	-	-	-	2
4	3	3	2	3	-		2	2		-	-	2
5	2	2	1	1	-	2	2	2	2	-	-	2

OBJECTIVES:

- To understand the concepts of measurement technology.
- To learn the applications and working of motion and ranging sensors.
- To explore the latest sensor technologies like MEMS & nano sensors, smart sensors
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT- I: INTRODUCTION 9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT- II: MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT- III: FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclometers.

UNIT- IV: OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT- V: SIGNAL CONDITIONING and DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel

and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain various calibration techniques and signal types for sensors.
- Understand the basic principles of various smart sensors.
- Illustrate the basic principles of various smart sensors.
- Apply the various sensors in the Automotive and Mechatronics applications
- Implement the DAQ systems with different sensors for real time applications

TEXT BOOKS:

1. Ernest O Doebelin, Dhanesh N.Manik “Measurement Systems – Applications and Design”, seventh Edition McGraw-Hill, 2019.
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCE BOOKS:

1. Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2010.
2. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.
3. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd edition, CRC Press, 2015.

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4	-	-	-	-	-	2	2	-	-	-	-	1
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OBJECTIVES:

- To study about the different bio potential 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 the different measurement techniques for non-physiological parameters.
- To familiarize the different biochemical measurements.

UNIT- I: BIO POTENTIAL GENERATION AND ELECTRODES 9
TYPES

Origin of bio potential and its propagation. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes

UNIT- II: BIOSIGNAL CHARACTERISTICS AND ELECTRODE 9
CONFIGURATIONS

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.

UNIT- III: SIGNAL CONDITIONING CIRCUITS 9

Need for bio-amplifier - differential bio-amplifier, Impedance matching circuit, isolation amplifiers, Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT- IV: MEASUREMENT OF NON-ELECTRICALPARAMETERS 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, ultrasound blood flow measurement

UNIT- V: BIO-CHEMICAL MEASUREMENT 9

Blood gas analyzers and Non-Invasive monitoring, colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the different bio potential and its propagation.
- Explain the different electrode placement for various physiological recording
- Design bio amplifier for various physiological recording
- Understand various technique of non electrical physiological measurements
- Understand the different biochemical measurements

TEXT BOOKS:

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, New York, 2004.

REFERENCE BOOKS:

1. Myer Kutz, “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.(Units II & IV)
3. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2004.

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4	-	-	2	1	1	1	-	-	-	-	-	-
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OBJECTIVES:

- Product design and development
- Apply the concept of prototyping in a real life problem.
- Reduce the waste by using product architecture.
- Understand the concepts of industrial design.
- Understand the concepts of DFM

UNIT- I: INTRODUCTION 9

Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements.

UNIT- II: CONCEPT GENERATION AND SELECTION 9

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT- III: PRODUCT ARCHITECTURE 9

Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions.

UNIT- IV: INDUSTRIAL DESIGN 9

Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT- V: DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of

prototyping – planning for prototypes – Economic Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the product design and concepts.
- Apply the concept of prototyping in a real life problem.
- Reduce the waste by using product architecture.
- Understand the concepts of industrial design.
- Understand the concepts of DFM.

TEXT BOOKS:

1. Kari T.Ulrich and Steven D.Eppinger, "Product Design and Development", McGraw-Hill International Edn.2017.

REFERENCE BOOKS:

1. Kemnneth Crow, "Concurrent Engg./Integrated Product Development", DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal, "Effective Product Design and Development", Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.

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in enclosures, sound energy absorption, sound transmission through barriers.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply the fundamental concepts of vibration.
- Apply the fundamentals of noise.
- Describe the various sources of noise for automotive applications.
- Determine the natural frequencies and mode shapes of the two degree freedom systems.
- Describe the different types of noise and its control measures

TEXT BOOKS:

1. Singiresu S.Rao, "Mechanical Vibrations", 6th Edition, Pearson Education, 2016.

REFERENCE BOOKS:

1. Balakumar Balachandran and Edward B. Magrab, "Fundamentals of Vibrations", 1st Edition, Cengage Learning, 2009
2. Benson H. Tongue, "Principles of Vibrations", 2nd Edition, Oxford University, 2007

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5	3	2	2	2	-	-	1	-	-	-	-	1

OBJECTIVES:

- Identify unsafe conditions and recognize unsafe alerts.
- Interpret the rules and regulations for safety operations.
- Capable of solving problem of accidents.
- Capable of solving the present for criticizing the present for improved safety.
- Collaborate and modify processes / procedures for safety.

UNIT- I: INTRODUCTION 9

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT- II: CHEMICAL HAZARDS 9

Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT- III: ENVIRONMENTAL CONTROL 9

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT- IV: HAZARD ANALYSIS 9

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

UNIT- V: SAFETY REGULATIONS 9

Explosions – Disaster management – catastrophe control, hazard control , Factories Act, Safety regulations Product safety – case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify and prevent chemical, environmental mechanical, fire hazard.
- Collect, analyze and interpret the accidents data based on various safety techniques.
- Apply proper safety techniques on safety engineering and management.
- Able to perform hazard analysis.

- Aid to design the system with environmental consciousness by implementing safety regulation.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. David L.Goetsch, "Occupational Safety and Health for Technologists", Engineers and Managers, Pearson Education Ltd. 5th Edition, 2005.
2. Deshmukh L M, "Industrial Safety Management", Tata McGraw-Hill Publishing Company Ltd.,2005
3. Safety Manual, "EDEL Engineering Consultancy", 2000.

CO	PO											
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1	2	1	2	-	-	2	1	-	-	-	-	1
2	2	1	2	-	-	2	1	-	-	-	-	1
3	2	1	2	-	-	2	1	-	-	-	-	1
4	2	1	2	-	-	2	1	-	-	-	-	1
5	2	1	2	-	-	2	1	-	-	-	-	1

OBJECTIVES:

- To learn about the shelf life of food products.
- To gain knowledge on the storage of food products.
- To know about the thermal processing methods of food products.
- To design different types of Dryers.
- To understand the non thermal methods of food preservation.

UNIT – I: FOOD PRESERVATION AND ITS IMPORTANCE 9

Introduction to food preservation. Wastage of processed foods; Shelf life of food products; Types of food based on its perishability. Traditional methods of preservation.

UNIT - II: METHODS OF FOOD HANDLING AND STORAGE 9

Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods. retort pouch packing, Aseptic packaging.

UNIT - III: THERMAL METHODS 9

Newer methods of thermal processing; batch and continuous; In container sterilization-canning; application of infra-red microwaves; ohmic heating; control of water activity; preservation by concentration and dehydration; osmotic methods.

UNIT - IV: DRYING PROCESS FOR TYPICAL FOODS 9

Rate of drying for food products; design parameters of different type of dryers; properties of air-water mixtures. Psychrometric chart, freezing and cold storage. freeze concentration, dehydro-freezing, freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages.

UNIT - V: NON-THERMAL METHODS 9

Super Critical Technology for Preservation - Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology

TOTAL: 45 PERIODS

OUTCOMES:

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

- Be aware of the different thermal processing methods of food products.
- Understand the concept of food storage.
- Be familiarize with shelf life of food products.
- Recognize the different types of dryers.
- Acquire knowledge on non thermal methods of food preservation.

TEXT BOOKS:

1. Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.
2. VanGarde, S.J. and Woodburn. M “Food Preservation and Safety Principles and Practice”. Surbhi Publications, 2001.
3. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
4. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

REFERENCE BOOKS:

1. Rahman, M. Shafiur. “Handbook of Food Preservation”. Marcel & Dekker, 2006.
2. Zeuthen, Peter and Bogh-Sarensen, Leif. “Food Preservation Techniques”. CRC / Wood Head Publishing, 2003.
3. Ranganna, S. “Handbook of Canning and Aseptic Packaging”. Tata McGraw-Hill, 2000.

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2	2	3	1	2	-	-	-	2	-	-	-	2
3	3	2	1	2	-	1	1	-	-	-	-	2
4	3	2	1	2	-	1	1	-	-	-	-	2
5	3	1	2	-	-	1	1	-	-	-	-	2

X-ray Photoelectron Spectroscopy (XPS) -Auger electron spectroscopy (AES).

UNIT - V: APPLICATIONS 9

Solar energy conversion and catalysis -Molecular electronics and printed electronics – Nanoelectronics -Polymers with a special architecture -Liquid crystalline systems -optical properties, Applications in displays and other devices -Photonics, Plasmonics-Chemical and biosensors –Nanomedicine and Nanobiotechnology –Nanotoxicology challenges.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Able to understand the basics of nanoscience.
- Able to differentiate the materials based on their structures.
- Ability to understand the different synthesis techniques of nanomaterials.
- Ability to identify various fabrication techniques and characterization of nanostructures.
- Able to apply them for suitable applications.

TEXT BOOKS:

1. Bhusan, Bharat (Ed), “Springer Handbook of Nanotechnology”, 2nd Edition, 2007.
2. Hari Singh Nalwa, “Nanostructured Materials and Nanotechnology”, Academic Press, 2002.
3. Pradeep T., “A Textbook of Nanoscience and Nanotechnology”, Tata McGraw Hill Education Pvt. Ltd., 2012.

REFERENCE BOOKS:

1. Charles P. Poole Jr., Frank J. Ownes, ‘Introduction to Nanotechnology’, Wiley Interscience, 2003.
2. Dupas C., Houdy P., Lahmani M., “Nanoscience: Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mark Ratner and Daniel Ratner, “Nano Technology”, Pearson Education, New Delhi, 2003.
4. Nabok A., “Organic and Inorganic Nanostructures”, Artech House, 2005.

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3	2	-	3	3	3	-	-	-	-	-	-	1
4	2	-	3	3	3	1	1	-	-	-	-	1
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OBJECTIVES:

- To introduce the basic principles of optical and electron microscopy.
- To elucidate the different microscopic techniques.
- To explore the knowledge on electron microscopy
- Make the students to learn the sample preparation techniques for the microstructural analysis.
- To investigate on different chemical analysis techniques.

UNIT – I: INTRODUCTION 9

History of Microscopy, Overview of current microscopy techniques. Light as particles and waves, Fundamental of optics: Diffraction and interference in image formation, real and virtual images, Resolution, Depth of field and focus, Magnification, Numerical aperture, Aberration of lenses. Components of Light Microscopy, Compound light microscopy and its variations.

UNIT - II: MICROSCOPY 9

Phase contrast microscopy: optical design, theory, image interpretation, Dark-field microscopy: optical design, theory, image interpretation, Polarization Microscopy: Polarized light, optical design, theory, image interpretation, Differential Interference Contrast (DIC): equipment and optics, image interpretation, Modulation contrast microscopy: contrast methods using oblique illumination.

UNIT - III: ELECTRON MICROSCOPY 9

Interaction of electrons with matter, elastic and inelastic scattering, secondary effects, Components of electron microscopy: Electron sources, pumps and holders, lenses, apertures, and resolution. Scanning Electron and Transmission Electron Microscopy: Principle, construction, applications and limitations.

UNIT - IV: SAMPLE PREPARATION FOR MICROSTRUCTURAL ANALYSIS 9

Optical Microscopy sample preparation: Grinding, polishing and etching, SEM sample preparation: size constrains, TEM sample preparation: Disk preparation, electro polishing, ion milling, lithography, storing specimens.

UNIT - V: CHEMICAL ANALYSIS**9**

Surface chemical composition (Principle and applications) - Mass spectroscopy and X-ray emission spectroscopy - Energy Dispersive Spectroscopy- Wave Dispersive Spectroscopy. Electron spectroscopy for chemical analysis (ESCA), X ray Photoelectron Spectroscopy (XPS), Auger Electron Spectroscopy (AES)- Applications.

TOTAL: 45 PERIODS**OUTCOMES:****At the end of the course, the student should be able to:**

- Able to understand the physics behind the microscopy.
- Ability to describe the principle, construction and working of light microscopy.
- Ability to describe electron microscopy.
- Ability to understand about the important of sample preparation technique.
- Ability to identify the appropriate spectroscopy technique for chemical analysis.

TEXT BOOKS:

1. Douglas B. Murphy, Fundamentals of light microscopy and electronic imaging, 2001, Wiley- Liss, Inc. USA
2. David B. Williams and C. Barry Carter, Transmission Electron Microscopy-A Textbook for Materials Science, Springer US, 2nd edition, 2009.

REFERENCE BOOKS:

1. Brandon D. G, "Modern Techniques in Metallography", Von Nostrand Inc. NJ, USA, 1986.
2. Whan R E (Ed), ASM Handbook, Volume 10, Materials Characterization", Ninth Edition, ASM international, USA, 1986.
3. Thomas G., "Transmission electron microscopy of metals", John Wiley, 1996.

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4	3	2	3	1	3	2	-	-	-	-	-	1
5	3	3	2	2	3	2	-	-	-	-	1	1

OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To develop and understand the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.

UNIT – I: POLYMERS AND SPECIALITY POLYMER 9

Polymers – Types of polymerization – Degree of polymerization – Plastics and types – Mechanism of polymerization (free radical mechanism) properties of polymers - T_g and tacticity – Compounding of plastics – Fabrication of plastics – Blow and extrusion mouldings. Speciality polymers-Conducting polymers: Polyacetylene, polyaniline, synthesis, mechanism of conduction – Applications of conducting polymers. Biodegradable polymers: Requirements, factors affecting degradation – PLA– preparation, properties –applications.

UNIT - II: ENERGY SOURCES AND STORAGE DEVICES 9

Solar energy conversion – Solar cells: Types – Wind energy. Batteries: Types of batteries – Primary battery (alkaline battery), secondary battery (lead acid battery, NICAD battery, lithium, lithium-ion & lithium-sulphur battery), fuel cells – H_2 - O_2 fuel cell.

UNIT - III: PHOTOCHEMISTRY & ANALYTICAL TECHNIQUES 9

Photochemistry: Laws of photochemistry - Grothuss–Draper law, Stark–Einstein law and Beer-Lambert's Law. Quantum efficiency – determination - Photophysical processes (Jablonski diagram) - photosensitization - Chemiluminescence and bioluminescence. Analytical techniques: IR, UV – principle, Instrumentation and applications. Thermal

analysis: TGA & DTA - principle, instrumentation and applications. Chromatography: Basic principles of column & TLC – principles and applications.

UNIT - IV: THERMODYNAMICS 9

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; Entropy of phase transitions; Clausius inequality. Free energy and work function- Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore.

UNIT - V: 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, Zn-Mg System. Alloys: Introduction- Definition- properties of alloys- Significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Gain knowledge on polymer chemistry and its developments.
- Understand the process of advanced energy storage devices.
- Analyze the materials using spectroscopic techniques.
- Explain the various state of thermodynamics.
- Outline the nature of alloys by drawing phase rule.

TEXT BOOKS:

1. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2016.
2. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2015.
3. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., 2012.

REFERENCE BOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2019.
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
3. B. K. Sharma, "Engineering Chemistry", Krishna Prakashan Media (P) Ltd, Meerut, 2012.

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2	1	1	-	2	-	-	-	-	-	-	-	1
3	1	-	-	2	-	-	1	-	-	-	-	1
4	-	-	1	-	-	-	2	-	1	-	-	1
5	3	2	2	3	1	-	2	-	-	-	-	1

OBJECTIVES:

- To elucidate on advantages of nanotechnology based applications in each industry
- To provide instances of contemporary industrial applications of nanotechnology
- To provide an overview of future technological advancements and increasing role of nanotechnology in each industry
- To provide an awareness on the nanomaterial synthesis for electronic materials
- To make the student conversant with the latest characterization techniques

UNIT – I: NANO ELECTRONICS 9

Micro and Nano electromechanical systems – Sensors, Actuators, Data memory –Lighting and Displays – Applications of piezoelectric and ferroelectric materials- Nano for energy systems - Fuel cells and Photo-voltaic cells – Electric double layer capacitors –Nanoparticle coatings for electrical products

UNIT - II: BIONANOTECHNOLOGY 9

Nanoparticles in bone substitutes and dentistry – Implants and Prosthesis – Nanorobotics in Surgery –Nanosensors in Diagnosis– Neuro-electronic Interfaces– Therapeutic applications

UNIT - III: NANOTECHNOLOGY IN CHEMICAL INDUSTRY 9

Nanocatalysts – Smart materials – Heterogeneous nanostructures and composites – Nanostructures for Molecular recognition (Quantum dots, Nanorods, Nanotubes) – Molecular Encapsulation and its applications – Nanoporous zeolites – Self-assembled Nanoreactors

UNIT - IV: NANOTECHNOLOGY IN AGRICULTURE AND FOOD TECHNOLOGY 9

Nanotechnology in Agriculture -Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry

UNIT - V: CHARACTERIZATION TECHNIQUES 9

X-ray Diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including High-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyze the nanoparticle coatings for electrical products.
- Define various therapeutic applications of bionanotechnology.
- Explain the process of molecular encapsulation and nanoreactors.
- Ability to understand the uses of nanotechnology in food industry.
- Outline the nanofiber production and formulation of gels.

TEXT BOOKS:

1. V.A. Rai and J.A. Bai, Nanotechnology Applications in the Food Industry, CRC Press, 2018.
2. S. Thomas, Y. Grohens and Y.B. Pottathara, Industrial Applications of Nanomaterials, Elsevier Press, 2019.
3. N John Dinardo, Nanoscale Characterization of surfaces & Interfaces, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCE BOOKS:

1. Neelina H. Malsch, Biomedical Nanotechnology, CRC Press, 2005.
2. Udo H. Brinker, Jean-Luc Mieusset, Molecular Encapsulation: Organic Reactions in Constrained Systems, Wiley Publishers, 2010.
3. Jennifer Kuzma and Peter VerHage, Nanotechnology in Agriculture and Food Production, Woodrow Wilson International Center, 2006.
4. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, 2007.
5. Y-W. Mai, Polymer Nano composites, Woodhead Publishing Limited, 2006.
6. W.N. Chang, Nanofibres fabrication, performance and applications, Nova Science Publishers Inc, 2009.

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1	2	2	2	-	2	1	1	-	1	-	-	1
2	1	2	3	-	1	3	1	-	1	-	-	1
3	2	1	2	-	1	1	1	-	1	-	-	1
4	3	2	1	-	2	1	1	-	1	-	-	1
5	2	2	1	2	1	1	1	-	1	-	-	1

OPEN ELECTIVE II

OBJECTIVES:

- To develop buildings which use the natural resources to the minimal at the time of construction as well as operation.
- To ensure minimum negative impact on the environment by the construction and operation of a building.
- To gain knowledge on natural lighting and temperature control.
- To develop a design to further reduce the carbon footprint as well as reduce cost of operation.
- To preserve the external environment to the building location.

UNIT – I: ENVIRONMENTAL IMPLICATIONS OF BUILDINGS 9

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.

UNIT - II: IMPLICATIONS OF BUILDING TECHNOLOGIES 9
EMBODIED ENERGY OF BUILDINGS

Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

UNIT - III: COMFORTS IN BUILDING 9

Thermal Comfort in Buildings – Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings – Implications of Geographical Locations.

UNIT - IV: UTILITY OF SOLAR ENERGY IN BUILDINGS 9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT - V: GREEN COMPOSITES FOR BUILDINGS 9

Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and

Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Describe the concepts of sustainable design and green building techniques including energy efficiency and indoor environmental quality management.
- Create drawings and models of their own personal green building project.
- Reducing waste, pollution and environmental degradation.
- Efficiently using energy, water, and other resources.
- Protecting occupant health and improving employee productivity.

TEXT BOOKS:

1. K.S.Jagadish, B. U. Venkatarama Reddy and K. S. Nanjunda Rao. "Alternative Building Materials and Technologies". New Age International, 2007.
2. "Low Energy Cooling For Sustainable Buildings". John Wiley and Sons Ltd, 2009.
3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE BOOKS:

1. Osman Attmann, Green Architecture Advanced Technologies and Materials, McGraw Hill, 2010.
2. Jerry Yudelson, Green building Through Integrated Design, McGraw Hill, 2009.
3. Fundamentals of Integrated Design for Sustainable Building by Marian Keeler, Bill Burke.

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1	3	-	-	-	-	-	3	-	-	-	-	-
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3	-	-	2	1	2	-	-	1	2	2	-	-
4	-	-	-	-	-	3	-	-	-	-	-	2
5	-	-	-	-	-	-	-	-	-	-	2	3

OBJECTIVES:

- To impart the knowledge of screening of environmental and social assessment.
- To gain the knowledge of methods for impact assessment.
- To mitigate the environmental and social impacts of developmental projects.
- To develop knowledge on Assessment of Impact on land, water, air, noise and energy, flora and fauna.
- To study on report preparation of EIA.

UNIT – I: INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development
Environmental Impact Assessment (EIA) – OBJECTIVES: – Historical development – EIA
Types – EIA in project cycle –EIA Notification and Legal Framework–Stakeholders and
their Role in EIA– Selection & Registration Criteria for EIA Consultants

UNIT – II: ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring,
Prediction and Assessment of Impact on land, water, air, noise and energy, flora and
fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact
prediction – Analysis of alternatives.

UNIT – III: ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and
fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA
Reports – Addressing the issues related to the Project Affected People -Environmental
Clearance Post Project Monitoring.

UNIT – IV: SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected
Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental
impacts – Cost benefit Analysis.

UNIT – V: CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads
and Bridges – Multi-storey Buildings Mass Rapid Transport Systems - Ports and Harbor –

Airports - Dams and Irrigation projects - Power plants – Water supply and drainage projects- Waste water treatment plants, STP – Mining Projects.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Carry out scoping and screening of developmental projects for environmental and social assessments.
- To explain different methodologies for environmental impact prediction and assessment.
- Plan environmental impact assessments and environmental management plans.
- Evaluate environmental impact assessment reports.
- Analyze case studies on various projects.

TEXT BOOKS:

1. Canter, R.L, "Environmental impact Assessment", 2nd Edition, McGraw Hill Inc, New Delhi, 1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. E
3. veritt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.
4. Peter Morris, RikiTherivel "Methods of Environmental Impact Assessment", Routledge Publishers, 2009.

REFERENCE BOOKS:

1. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment" conceptual and methodological advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

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4	-	-	2	2	-	-	1	-	-	-	-	2
5	-	-	-	-	-	-	1	-	-	-	2	3

OBJECTIVES:

- To understand the Tamil grammar and programming basics for Tamil computing.
- To understand the various types of Tamil Computing applications.
- To make the students understand the use of Tamil computing tools and Resources.
- To strengthen the students' ability to carry out the Computational Linguistics in Tamil computing.
- To understand the concepts of Tamil text processing using open – Tamil python library.

UNIT – I: TAMIL GRAMMAR 9

Alphabets: Classification & Properties - Words: classification and components - Sentences: Structures and word ordering.

UNIT - II: PROGRAMMING BASICS FOR TAMIL COMPUTING 9

History of Tamil Computing - Standards & Fonts - UNICODE - Object Oriented Tamil Computing -Tamil text processing using open-tamil python library.

UNIT - III: COMPUTATIONAL LINGUISTICS 9

Basic linguistics - Phonology – Phonology computing – Tholkappiar's Morphological pattern– lexicography – syntax – semantics – pragmatics, Languages for specific purpose & disconise computing

UNIT - IV: TAMIL COMPUTING TOOLS & RESOURCES 9

POS Tagger - Morphological Analyser - Morphological Generator - Sentence Parser - Named Entity Recognizer - Word Sense Disambiguator - Ontologies – Universal Networking Language & UNL Enconvertor.

UNIT - V: TAMIL COMPUTING APPLICATIONS 9

Machine Translation – Speech : Synthesis & Processing - Information : retrieval & Extraction – Question Answering – Text Summarization – Automatic Indexing – Text Mining – Conceptual Search.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain classification of Tamil grammar and properties
- Adopt a suitable process for tamil computing tools.
- Analyze the different types of computational linguistics such as phonology, Morphology, lexicography.
- Perform and analyze the Tamil computing applications.
- Analyze and process the Tamil python library.

TEXT BOOKS:

1. The Oxford Handbook of Computational Linguistics, Edited by RuslanMitkov, Oxford University Press, 2014.

REFERENCE BOOKS:

1. Translation - Theory and Application, Valarmathi, International Institute of Tamil Studies, First Edition, 2001.
2. Tholkaappiyam - Thodariyal, Shanmugam, International Institute of Tamil Studies, First Edition, 2004.
3. Tholkaappiyam: Phonology & Morphology, Albert, International Institute of Tamil Studies, First Edition, 1985.
4. Natural language processing and computational linguistics, Bhargav Srinivasa-Desikan Packt Publishing, first edition 2018.
5. The Phonology and morphology of tamil chrisdas Prathima, 2016.
6. Pos Tasser R Morphological Analzser Shodhganga inflibnet.ac.in
7. A Tamil Programming language ayxiv.org, Muthiah Annamalai.

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4	3	2	-	-	-	3	-	-	-	2	-	-
5	2	-	-	-	3	3	-	-	-	2	-	-

OBJECTIVES:

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

UNIT – I: BASIC CIRCUITS ANALYSIS 9

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchhoff's laws – Mesh current and node voltage - methods of analysis.

UNIT - II: NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS 9

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenin's and Norton Theorems – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem – Millman's theorem.

UNIT - III: AC CIRCUITS 9

Introduction to AC circuits, inductance reactance, capacitive reactance, Phasor diagrams, real power, reactive power, apparent power, power factor, R-L R-C , RLC networks, Network reduction: voltage and current division, source transformation – mesh and node analysis, Thevenin's and Norton Theorems – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem – Millman's theorem.

UNIT - IV: THREE PHASE CIRCUITS 9

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.-Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT - V: RESONANCE AND COUPLED CIRCUITS 9

Series and parallel resonance – their frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits – SMPS.

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CO	PO											
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2	1	3	2	1	-	-	-	1	-	-	-	1
3	1	-	-	2	1	1	-	-	2	-	-	2
4	1	-	-		2	2	1	2	-	-	1	1
5	1	3	2	1		1	2	1	-	-	1	1

OBJECTIVES:

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

UNIT – I: INTRODUCTION 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT – II: ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9

Reference theory fundamentals-principle of operation and analysis: IG and PMSG.

UNIT - III: POWER CONVERTERS 9

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers

UNIT - IV: ANALYSIS OF WIND AND PV SYSTEMS 9

Standalone operation of fixed and variability speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system.

UNIT - V: HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

OUTCOMES:

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

- Ability to understand and analyze power system operation, stability, control and protection.

- Ability to handle the engineering aspects of electrical energy generation and utilization.
- Ability to understand the stand alone and grid connected renewable energy systems.
- Ability to design of power converters for renewable energy applications.
- Ability to acquire knowledge on wind electrical generators and solar energy systems.

TEXTBOOKS

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company New Delhi, 2009.

REFERENCE BOOKS:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variability speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993.
4. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.
5. Andrzej M. Trzynadlowski, „Introduction to Modern Power Electronics”, Second edition, wiley India Pvt. Ltd, 2012.

CO	PO											
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2	3	2	2	1	-	1	-	-	2	-	3	1
3	3	2	1	2	2	2	1	-	1	-	-	-
4	3	3	3	2	2	1	-	-	2	-	2	1
5	3	2	1	1	1	2	2	-	1	-	-	2

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ELECTRIC VEHICLES AND POWER MANAGEMENT

L T P C

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OBJECTIVES:

- To understand the concept of electrical vehicles and its operations.
- To provide knowledge about Power train components.
- To understand the various Control strategies in AC and DC drives.
- To understand the need for energy storage in hybrid vehicles.
- To provide knowledge about alternative energy storage technologies that can be used in electric vehicles.

UNIT – I: ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics – EV Testing.

UNIT - II: ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV) - Standards - Power train components and sizing, Gears, Clutches, Transmission and Brakes.

UNIT - III: CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor-based vector control operation – Switched reluctance motor (SRM) drives.

UNIT - IV: BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries, Energy management system in Electric vehicle – Battery Management Systems.

UNIT - V: ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra Capacitors

TOTAL: 45 PERIODS

OUTCOMES:

- Learners will understand the operation of Electric vehicles and Hybrid Electric vehicles.
- Learners will gain knowledge on Power train components.
- Learners can analyze the control strategies in AC and DC drives.
- Learners will gain knowledge on various energy storage technologies for electrical vehicles.
- Learners know about alternative energy storage technologies for electric vehicles.

TEXT BOOKS:

1. Iqbal Hussain, “Electric and Hybrid Vehicles: Design Fundamentals, Second Edition” CRC Press, Taylor & Francis Group, Second Edition (2011).
2. Ali Emadi, Mehrdad Ehsani, John M.Miller, “Vehicular Electric Power Systems” , Special Indian Edition, Marcel dekker, Inc 2010
3. James Larminie and John Lory, “Electric Vehicle Technology – Explained”, John Wiley & Sons Ltd, 2003.

REFERENCE BOOKS:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel cell Vehicles” CRC Press, Taylor & Francis Group, Second Edition (2010).
2. Emanuele Crisostomi, Robert Shorten, Sonja Studli & Fabian Wirth “Electric and Plug-in Hybrid Vehicle Networks” Taylor & Francis group 2018.
3. Ronald K Jurgen, “Electric and Hybrid – Electric Vehicles”, SAE, 2002.

CO	PO											
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1	3	-	1	-	2	2	2	-	-	-	1	2
2	2	-	2	-	1	-	1	-	2	-	2	-
3	3	2	1	-	2	-	-	-	2	-	-	-
4	3	2	2	-	1	-	2	-	-	-	2	
5	3	2	1	-	1	-	-	-	1	-	2	2

OBJECTIVES:

- To learn the origin of sound.
- To understand the knowledge in sound propagation.
- To enhance the concepts in Sound analysis.
- To acquire basic knowledge in Physiological acoustics.
- To enable the student to understand the analysis of acoustics.

UNIT – I: INTRODUCTION 9

Origin of sound. Objective and subjective sound. Sound vibrations, Amplitude, form, and period. Sound waves and their wavelength and speed. Sound pressure level. Energy parameters of sound. Dynamical range. Sound envelope, Sound frequency, Relation between frequency and period.

UNIT - II: PROPAGATION OF SOUND 9

Sound propagation. Spherical and plane waves. Change of intensity of a propagating sound wave. Sound reflections, echo, absorption, diffraction, refraction. Relation between pitch and frequency. Pitch standard. Sound spectrum. Types of Public Addressing system. Hi.fi speakers. Microphones: types and its applications.

UNIT - III: SOUND ANALYSIS 9

Natural scales. Origin of musical scale. Tonal material and modal scale. Pythagorean tuning, Temperaments. Non-equal temperaments. Equal temperaments. Relation of musical scale and kind of music. Sound Pre-Processing and analysis, Audio analysis tools.

UNIT - IV: PHYSIOLOGICAL ACOUSTICS 9

Physiological and psychological acoustics. Loudness. Loudness level. Fletcher-Munson diagram. Range of hearing. Masking. Compression of sound information, Pitch, timbre, subjective duration. Absolute pitch. Acoustics instruments. Peripheral auditory system.

UNIT - V: ACOUSTICAL ANALYSIS 9

Sound phenomena in rooms. Direct sound. Early reflections. Reverberation and its formation, Criteria for good acoustics of a room and methods of their realization, Reverberation time. Dependence of reverberation time on room volume and surfaces

(area and absorption), Evaluation of reverberation time. Optimal reverberation times for various types of music and room sizes.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyze the basic parameters of sound.
- Understand the effects of propagation.
- Know the basic functions of sound analysis.
- Derive the output using Physiological acoustics.
- Understand the Applications of acoustics.

TEXT BOOKS:

1. Rossing T. D., Moore R. F., Wheeler P. A., "The Science of Sound" 3rd edition San Francisco: Addison Wesley, 2002.
2. Hall D. E., "Musical Acoustics" 3rd edition Pacific Grove, CA: Brooks/Cole, 2001
3. Howard D. M., Angus J. A. S., "Acoustics and psychoacoustics" 5th edition New York, London: Routledge 2017.

REFERENCE BOOKS:

1. Everest F. A., Pohlmann K. C., "Master Handbook of Acoustics" 5th edition New York: McGraw-Hill, 2001.
2. Rossing T. D., ed., "Springer Handbook of Acoustics" 2nd edition Berlin, Heidelberg: SpringerVerlag 2014.
3. Chakrabarti, Pradip Kumar and Chowdhury, Satyabrata, "A Textbook on Waves and Acoustics", New Central book agency, 2010.

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1	3	-	-	-	-	2	2	-	-	-	-	-
2	2	2	-	2	-	2	3	-	-	-	-	-
3	2	2	2	-	-	2	3	-	-	-	-	-
4	2	3	2	2	-	2	2	-	-	-	-	-
5	2	2	1	2	-	2	-	2	-	-	-	-

OBJECTIVES:

- To know about the basics of communication.
- To learn and acquire the art of visual communication.
- To understand and relate the importance of visual communication
- To gain knowledge about the basic of Visual Communication.
- To acquire idea and concepts of various forms of Media

UNIT – I: INTRODUCTION 9

Need for and the Importance of Human and Visual Communication. Communication a expression, skill and process, Understanding Communication: SMRC-Model.

UNIT - II: PROCESS IN COMMUNICATION 9

Communication as a process. Message, Meaning, Connotation, Denotation Culture/Codes etc Levels of communication: Technical, Semantic, and Pragmatic. The semiotic landscape: language and visual communication, narrative representation

UNIT - III METHODOLOGY 9

Fundamentals of Design: Definition. Approaches to Design, Centrality of Design, Elements/Elements of Design: Line, Shape, Space, Color, Texture. Form Etc. Principles of Design: Symmetry. Rhythm, Contrast, Balance Mass/Scale etc. Design and Designers (Need, role, process, methodologies etc.).

UNIT - IV: DESIGN PROCESS 9

Principles of Visual and other Sensory Perceptions. Color psychology and theory (some aspects) Definition, Optical / Visual Illusions Etc Various stages of design process- problem identification, search for solution refinement, analysis, decision making, Implementation.

UNIT - V: GRAPHIC DESIGN 9

Basics of Graphic Design. Definition, Elements of GD, Design process-research, a source of concept, the process of developing ideas-verbal, visual, combination & thematic, visual thinking, associative techniques, materials, tools (precision instruments etc.) design execution, and presentation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Learn about the history & evolution of Communication.
- Understand Nature & functions of Visual Communication.
- Acquire knowledge on different types of perception & illusion.
- Gain knowledge on semiotics.
- Remember the world of ideation creating.

TEXT BOOKS:

1. Lester, E Visual Communications: Images with Messages. Thomson Learning, 2013.

2. Jonathan Baldwin, "Visual Communication: From Theory to Practice", AVA publishing, 2006.

REFERENCE BOOKS:

1. Schildgen, T., "Pocket Guide to color with digital applications", Thomson Learning, 2000.
2. Palmer, Frederic, "Visual Elements of Art and Design", Longman, 1990.
3. Carter, "Typographic Design : Form and Communication", 6/e, John Wiley, 2014.

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1	3	2	1	1	1	-	-	-	-	-	-	1
2	3	2	3	2	3	-	-	-	-	-	-	1
3	3	2	1	2	-	-	-	-	-	-	-	-
4	3	3	3	3	-	-	-	-	-	-	-	-
5	3	-	2	2	3	-	-	-	-	-	-	2

OBJECTIVES:

- To introduce the concepts of micro and nano electromechanical devices.
- To know the fabrication process of Microsystems.
- To know the design concepts of micro sensors
- To understand the design of various micro actuators.
- To introduce the concepts of quantum mechanics and nano systems.

UNIT – I: INTRODUCTION TO MEMS AND NEMS 9

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT - II: MEMS FABRICATION TECHNOLOGIES 9

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA, Micromolding.

UNIT - III: MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- Case Study: Piezo-resistive pressure sensor.

UNIT - IV: MICRO ACTUATORS 9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch.

UNIT - V: NANO DEVICES 9

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

- Interpret the basics of micro/nano electromechanical systems including their applications and advantages.
- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
- Analyze the key performance aspects of electromechanical sensors.
- Illustrate the design of micro actuators using various actuations.
- Comprehend the theoretical foundations of quantum mechanics and Nano systems.

TEXT BOOKS:

1. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
2. Stephen D. Senturia, "Micro system Design", Kluwer Academic Publishers, 2001.

REFERENCES BOOKS:

1. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata McGraw Hill, 2002.
2. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006.
3. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures", CRC Press, 2002.

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2	3	-	3	3	-	2	1	-	-	2	-	-
3	3	-	3	3	-	-	1	-	-	2	-	-
4	3	2	3	3	-	-	-	1	-	2	-	-
5	3	2	3	3	-	-	-	1	-	2	-	-

OBJECTIVES:

- To make the students to know the methods of measurement, classification of transducers and to analyze error.
- To make the students to understand the behavior of transducers under static and dynamic conditions and hence to model the transducer.
- To expose the students to different types of resistive transducers and their application areas.
- To make the students to acquire knowledge on capacitive and inductive transducers.
- To impart knowledge on variety of transducers and get introduced to MEMS and Smart transducers.

UNIT – I: SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS 9

Units and standards – Static calibration – Classification of errors–Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

UNIT - II: CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics: - Accuracy, precision, resolution, sensitivity, linearity. Dynamic characteristics: Mathematical model of transducer, Zero, I and II order transducers, Response to impulse, step, ramp and sinusoidal inputs.

UNIT - III: VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezo-resistive sensor and humidity sensor.

UNIT - IV: VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 9

Inductive transducers: – Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer – Variable reluctance transducers – EI pickup— Principle of operation, construction details, characteristics of capacitive

transducers - Capacitor microphone, Proximity sensor.

UNIT - V: OTHER TRANSDUCERS

9

Piezoelectric transducer – Hall Effect transducer – Magneto elastic sensor – Digital transducers – Smart transducers - Fiber optic sensors – Thick & Thin Film sensors (Bio sensor & Chemical Sensor) – Nano sensors

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Apply the mathematical knowledge and science & engineering fundamentals gained to solve problems pertaining to measurement applications.
2. Analyze the problems related to sensors & transducers.
3. Select the right sensor/transducer for a given application.
4. Determine the static and dynamic characteristics of transducers
5. Understand fiber optic sensor, smart transducers and their applications.

TEXT BOOKS:

1. Doebelin E.O. and Manik D.N., “Measurement Systems”, 7th Edition, McGraw-Hill Education Pvt. Ltd., 2019.
2. A.K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Co, New Delhi, 2015.

REFERENCE BOOKS:

1. Bela G.Liptak, Instrument Engineers' Handbook, Process Measurement and Analysis, 4th Edition, Vol. 1, ISA/CRC Press, 2003.
2. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2010.
3. E.A. John P. Bentley, Principles of Measurement Systems, 4th Edition, Pearson Education, 2004.
4. W.Bolton, Engineering Science, Elsevier Newnes, Fifth edition, 2006.
5. Murthy, D.V.S., Transducers and Instrumentation, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
6. S.Ranganathan, "Transducer Engineering", Allied Publishers Pvt. Ltd. 2003.

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3	-	-	1	-	2	3	-	-	-	-	-	1
4	-	-	-	-	2	2	-	-	-	-	-	-
5	-	-	-	1	1	1	-	-	-	-	-	1

OBJECTIVES:

- To give an overview of various methods of process modeling, different computational techniques for simulation.
- To analyze the simulation for steady state lumped system.
- To analyze the simulation for unsteady state lumped system.
- To analyze the simulation for steady state distributed system.
- To analyze the simulation for unsteady state distributed system.

UNIT – I: INTRODUCTION 9

Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

UNIT - II: STEADY STATE LUMPED SYSTEMS 9

Degree of freedom analysis, single and network of process units, systems yielding linear and nonlinear algebraic equations, flow sheeting – sequential modular and equation oriented approach, tearing, partitioning and precedence ordering, solution of linear and non-linear algebraic equations.

UNIT - III: UNSTEADY STATE LUMPED SYSTEMS 9

Analysis of liquid level tank, gravity flow tank, jacketed stirred tank heater, reactors, flash and distillation column, solution of ODE initial value problems, matrix differential equations, simulation of closed loop systems.

UNIT - IV: STEADY STATE DISTRIBUTED SYSTEM 9

Analysis of compressible flow, heat exchanger, packed columns, plug flow reactor, solution of ODE boundary value problems.

UNIT - V: UNSTEADY STATE DISTRIBUTED SYSTEM & OTHER MODELLING APPROACHES 9

Analysis laminar flow in pipe, sedimentation, boundary layer flow, conduction, heat exchanger, heat transfer in packed bed, diffusion, packed bed adsorption, plug flow reactor. Empirical modeling, parameter estimation, population balance and stochastic modeling.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop the process models based on Conservation principles and Process data.
- Understand the characteristics of state lumped systems.
- Understand the characteristics of state distributed lumped systems.
- Carry out the analysis and design empirical modeling of systems.
- Apply computational techniques to solve the process models..

TEXT BOOKS:

1. Ramirez, W.; "Computational Methods in Process Simulation ", 2nd Edn, Butterworths Publishers, New York, 2000.
2. Luyben, W.L., " Process Modelling Simulation and Control ",2nd Edn, McGraw-Hill Book Co.,1990

REFERENCE BOOKS:

1. Felder, R. M. and Rousseau, R. W., "Elementary Principles of Chemical Processes ", John Wiley, 2000.
2. Franks, R. G. E., "Mathematical Modelling in Chemical Engineering ", John Wiley, 1967.
3. Amiya K. Jana,"Process Simulation and Control Using ASPEN", 2nd Edn, PHI Learning Ltd 2012.
4. Amiya K. Jana,"ChemicalProcess Modelling and Computer Simulation", 2nd Edn, PHI Learning Ltd, 2012.

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2	3	3	2	3	2	-	-	-	-	-	-	1
3	3	3	2	3	3	-	-	-	-	-	-	1
4	3	3	2	3	3	-	-	-	-	-	-	1
5	3	3	2	3	3	-	-	-	-	-	-	1

OBJECTIVES:

- To provide knowledge on design in state variable form.
- To study the design of state variable.
- To study the design of state estimator.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter.

UNIT – I: STATE FORMULATION 9

Formulation of state variable model, non-uniqueness, controllability, observability, stability.

UNIT - II: STATE VARIABLE DESIGN 9

Modes, controllability of modes -effect of state and output Feedback- pole placement Design

UNIT - III: STATE ESTIMATION 9

Need for state estimation - design of state Observers - full and reduced order - disturbance estimation - separation principle

UNIT - IV: OPTIMAL CONTROL 9

Introduction - Time varying optimal control - LQR steady state optimal control - Solution of Ricatti's equation - Application examples.

UNIT - V: OPTIMAL ESTIMATION 9

Optimal estimation - Kalman Bucy Filter-Solution by duality principle - Discrete systems - Kalman Filter - Application examples.

TOTAL: 45 PERIODS**OUTCOMES:**

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

- Apply advanced control theory to practical engineering problems.
- Understand and analyse state variable design.
- Understand and analyse state estimation.
- Understand and analyse optimal controller.

- Understand and analyse optimal estimator.

TEXT BOOKS:

1. K. P. Mohandas, “Modern Control Engineering”, 2nd Edition, Sanguine Technical Publishers, 2016.
2. G. J. Thaler, “Automatic Control Systems”, Jaico Publishing House 1993.
3. M.Gopal, “Modern Control System Theory”, 3rd Edition, New Age International Publishers, 2014.

REFERENCE BOOKS:

1. William S Levine, “Control System Fundamentals,” The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
2. Ashish Tewari, “Modern Control Design with Matlab and Simulink”, John Wiley, New Delhi, 2002.
3. K. Ogata, “Modern Control Engineering”, 5th Edition, PHI, New Delhi, 2002.
4. T. Glad and L. Ljung,, “Control Theory –Multivariable and Non-Linear Methods”, Taylor & Francis, 2002.
5. D.S.Naidu, “Optimal Control Systems” First Indian Reprint, CRC Press, 2009.

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4	-	2	-	2	-	-	-	-	-	-	-	-
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OBJECTIVES:

- Understand the functions of robots and review the need and application of robots in different engineering fields.
- Exemplify the different types of robot drive systems as well as robot end effectors.
- Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
- Develop robotic programs for different tasks and analyze the kinematics motions of robot.
- Implement robots in various industrial sectors and interpolate the economic analysis of robots.

UNIT – I: FUNDAMENTALS OF ROBOT 9

Robot - Definition - Robot Anatomy - Co ordinate 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.

UNIT - II: ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingere and Three Fingere Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT - III: SENSORS AND MACHINE VISION 9

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

Visual Servicing and Navigation.

UNIT - IV: ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

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

UNIT - V: IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV, AGV; Implementation of Robots in Industries -Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the functions of robots and review the need and application of robots in different engineering fields.
- Exemplify the different types of robot drive systems as well as robot end effectors.
- Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
- Develop robotic programs for different tasks and analyze the kinematics motions of robot.
- Implement robots in various industrial sectors and interpolate the economic analysis of robots.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.

2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 1994.
3. Koren Y., "Robotics for Engineers", McGraw Hill Book Co., 1992.
4. Fu.K.S., Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.
5. Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	-	1	2	-	-	-	-	-	-	-	-
2	3	-	2	2	-	-	-	-	-	-	-	1
3	3	3	2	2	-	-	-	-	-	-	-	1
4	3	-	2	3	-	-	-	-	-	-	-	1
5	3	-	3	3	-	-	-	-	-	-	-	1

OBJECTIVES:

- Apply the concept of testing to various materials and result analysis.
- Apply various mechanical testing procedures to different materials.
- Apply different nondestructive testing procedures to different materials.
- Apply material characterization testing for analysis.
- Apply advanced testing techniques for thermal and chemical fields.

UNIT – I: INTRODUCTION TO MATERIALS TESTING 9

Overview of materials, Classification of material testing, Purpose of testing, Selection of material, Development of testing, Testing organizations and its committee, Testing standards, Result Analysis, Advantages of testing.

UNIT - II: MECHANICAL TESTING 9

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT - III: NON DESTRUCTIVE TESTING 9

Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT - IV: MATERIAL CHARACTERIZATION TESTING 9

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

UNIT - V: OTHER TESTING 9

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo-mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled

Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply the concept of testing to various materials and result analysis.
- Apply various mechanical testing procedures to different materials.
- Apply different nondestructive testing procedures to different materials.
- Apply material characterization testing for analysis.
- Apply advanced testing techniques for thermal and chemical fields.

TEXT BOOKS:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Cullity, B. D., “Elements of X-ray diffraction”, 3rd Edition, Addison-Wesley Company Inc., New York, 2000.

REFERENCE BOOKS:

1. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7th Edition, Cousens Press, 2007.
2. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.
3. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA.
4. Brandon D.G., “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA, 1986.

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	2	2	1	1	-	-	-	-	-	-	-	1
2	3	2	1	1	-	-	-	-	-	-	-	1
3	2	2	1	1	-	-	-	-	-	-	-	1
4	3	2	1	1	-	-	-	-	-	-	-	1
5	3	2	1	1	-	-	-	-	-	-	-	1

OBJECTIVES:

- Understand about electric vehicle technology.
- Understand the load distribution and stability of vehicles.
- Analyze the handling characteristics of road vehicles.
- Analyze the steering, suspension and designing of breaks
- Understand hybrid vehicles, power electronics and fuel cell vehicles.

UNIT – I: INTRODUCTION TO ELECTRIC VEHICLES 9

Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar.

UNIT - II: STABILITY OF VEHICLES 9

Load distribution for three wheeler and four wheeler-Stability of vehicle running on slope, banked road and during turn-calculation of Tractive effort, maximum acceleration and reaction forces for different drives.

UNIT - III: HANDLING CHARACTERISTICS OF ROAD VEHICLES 9

Steering geometry-Steady state handling characteristics- Steady state response to steering input-Testing of handling characteristics-Transient response characteristics- Directional stability.

UNIT - IV: STEERING, SUSPENSION AND BRAKE 9

Steering System - Ackerman Principle of Steering - Front End Geometry - Steering Gearbox- Types-Recirculating Ball - Rack and Pinion - Power Steering. Suspension - Front and Rear Forks - Springs for Suspension - Telescopic Suspension - Monoshock Suspension - Hydraulic Shock Absorber - Dampers. Design Consideration – Brake - Drum Brakes - Disc Brakes - ABS.

UNIT - V: POWER ELECTRONICS AND CONTROL FOR HYBRID AND FUEL CELL VEHICLES 9

Series Hybrid Vehicle Propulsion System, Parallel Hybrid Vehicle Propulsion System, Fuel Cell Vehicles, Power Electronics Requirements, Propulsion Motor Control Strategies,

APU Control System in Series Hybrid Vehicles, Fuel Cell for APU Applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand about electric vehicle technology.
- Understand the load distribution and stability of vehicles.
- Analyze the handling characteristics of road vehicles.
- Analyze the steering, suspension and designing of breaks.
- Understand hybrid vehicles, power electronics and fuel cell vehicles.

TEXT BOOKS:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Rajesh Rajamani, "Vehicle Dynamics and Control", 1st edition, Springer, 2005

REFERENCE BOOKS:

1. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc, 1992.
2. Dr.Kirpal Singh, 'Automobile Engineering' - Vol. I and II, Standard Publishers, New Delhi, 2011.
3. V. Ganesan, 'Internal Combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2010.
4. Ali Emadi, "Handbook of Automotive Power Electronics and Drives", Taylor & Francis Group, First Edition, USA, 2005.

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1	-	2	1	1	-	1	-	1	-	-	1	2
2	2	-	-	1	2	-	-	-	1	-	-	-
3	1	-	1	-	-	1	-	-	-	-	1	-
4	-	2	2	1	-	-	2	-	-	-	-	-
5	2	2	-	1	-	-	-	-	-	-	2	-

OUTCOMES:**At the end of the course, the student should be able to:**

- Explain key concepts in the design of clinical trials.
- Describe study designs used in data management for clinical trials.
- Identify key issues and determine alternate trial designs.
- Recognize the roles of regulatory affairs in clinical trials.
- Provide the overview of reporting trials to the students.

TEXT BOOKS:

1. Lawrence M. Friedman, “Fundamentals of Clinical Trials”, Springer Science & Business Media, Fifth Edition, 2015.
2. Stuart J. Pocock, “Clinical Trials: A Practical Approach”, John Wiley & Sons, 2013.

REFERENCE BOOKS:

1. David Machin, Simon Day, Sylvan Green, “Textbook of Clinical Trials”, Second Edition, John Wiley & Sons, 2007.
2. Duolao Wang, Ameet Bakhai, “Clinical trials, A practical guide to design, analysis and reporting”, First Edition, Remedica, 2006.
3. T.A. Durham, J Rick Turner, “Introduction to statistics in pharmaceutical clinical trials”, First Edition, Pharmaceutical Press, 2008.
4. Tom Brody, “Clinical Trials: Study Design, Endpoints and Biomarkers, Drug Safety, and FDA and ICH Guidelines”, Second Edition, Academic Press, 2016.

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1	3	-	-	-	-	-	-	2	-	-	-	2
2	3	2	2	-	-	-	-	2	-	-	-	2
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4	3	3	-	-	-	-	2	3	-	-	-	2
5	3	-	-	-	-	-	-	3	-	-	-	2

aspects of pharmacy products.

- Describe the process of patenting activities.
- Assess the different types of patents and filling process.
- Explore the quality guidelines followed for pharmaceutical products.
- Enumerate the aspects involved in document preparation for pharmaceutical product registration.

TEXT BOOKS:

1. C.V.SSubrahmanyam & J.Thimmasetty, Pharmaceutical regulatory affairs, 1stEdn., vallabhPrakashan, New Delhi, 2012.
2. Willig, H., Tuckeman, M.M. and Hitchings, W.S., “Good Manufacturing Practices for Pharmaceuticals”, 5th Edition, Marcel Dekker Drugs and the Pharmaceutical Sciences, by CRC Press, New York, 2000.
3. N Udupa, Krishnamurthy Bhat, A Concise Textbook of Drug Regulatory Affairs, Manipal University Press (MUP); First Edition, 2015.

REFERENCE BOOKS:

1. Ira R. Berry, The Pharmaceutical Regulatory Process, marcel dekker Series: Drugs and the Pharmaceutical Sciences, by CRC Press, Newyork, 2004.
2. Mindy J. Allport-Settle, Current Good Manufacturing Practices: Pharmaceutical, Biologics, and Medical Device Regulations and Guidance Documents Concise Reference, Pharmalogika Inc., USA, 2009.
3. Sharma, P.P., “How to Practice GMPs”, 3rd Edition, Vandana Publications, 2006.

CO	PO											
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1	2	-	-	-	-	-	3	3	-	-	-	3
2	2	3	-	-	-	2	3	3	-	-	-	2
3	2	2	3	2	-	2	3	3	-	-	-	2
4	2	-	-	-	-	2	3	3	-	-	-	2
5	2	-	-	-	-	2	3	3	-	-	-	2

OBJECTIVES:

- To understand the principles of Microbiology.
- To emphasize the structure and biochemical aspects of various microbes.
- To learn about the Nutritional classification of microorganisms.
- To gain knowledge on the physical and chemical control of microorganisms.
- To acquire knowledge about the preservation of food.

UNIT – I: INTRODUCTION TO MICROBIOLOGY 9

Classification and nomenclature of microorganisms, microscopic examination of microorganisms: light, fluorescent, dark field, phase contrast, and electron microscopy.

UNIT - II: MICROBES- STRUCTURE AND REPRODUCTION 9

Structural organization and multiplication of bacteria, viruses (TMV, Hepatitis B), algae (cyanophyta, rhodophyta) and fungi (Neurospora), life history of actinomycetes (Streptomyces), yeast (Sacharomyces), mycoplasma (M. pneumoniae) and bacteriophages (T4 phage, λ phage)

UNIT - III: MICROBIAL NUTRITION, GROWTH AND METABOLISM 9

Nutritional classification of microorganisms based on carbon, energy and electron sources
Definition of growth, balanced and unbalanced growth, growth curve and different methods to quantify bacterial growth:(counting chamber, viable count method, counting without equipment, different media used for bacterial culture (defined, complex, selective, differential, enriched) the mathematics of growth-generation time, specific growth rate.

UNIT - IV: CONTROL OF MICROORGANISMS 9

Physical and chemical control of microorganisms Definition of sterilization, dry and moist heat, pasteurization, tyndalization; radiation, ultrasonication, filtration. Disinfection sanitization, antiseptics sterilants and fumigation. mode of action and resistance to antibiotics; clinically important microorganisms

UNIT - V: INDUSTRIAL MICROBIOLOGY 9

Microbes involved in preservation (Lactobacillus,bacteriocins), spoilage of food and food borne pathogens (E.coli, S.aureus, Bacillus, Clostridium). Industrial use of microbes (production of penicillin, alcohol, vitamin B-12); biogas; bioremediation(oil spillage

leaching of ores by microorganisms ,pollution control); biofertilizers, biopesticides. Biosensors.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the fundamentals of Microbiology.
- Explore the scope of Microbiology.
- Apply knowledge to solve the problems in microbial infection and their control.
- Analyze the concept of food preservation.
- Describe the industrial use of microbes..

TEXT BOOKS:

1. Ananthanarayanan, R. and C.K. Jayaram Paniker, “Textbook of Microbiology”, University Press, Ninth Edition, 2015.
2. Prescott L.M., Harley J.P., Klein DA, “Microbiology”, Eleventh Edition, McGraw -Hill Inc., 2020.

REFERENCE BOOKS

1. Pelczar, M.J. “Microbiology”, Fifth Edition, Tata McGraw-Hill, 1993.
2. Talaron K, Talaron A, Casita, Pelczar and Reid. Foundations in Microbiology, W.C. Brown Publishers, 1993.
3. Schlegel, H.G. “General Microbiology”, Seventh Edition, Cambridge University Press, 1993.

CO	PO											
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1	3	-	-	-	-	-	-	-	-	-	-	2
2	3	2	-	-	-	-	-	-	-	-	-	2
3	3	2	2	2	-	2	1	2	-	-	-	2
4	3	-	-	2	-	1	2	2	-	-	-	2
5	3	-	-	-	-	3	2	-	-	-	-	2

OBJECTIVES:

- Make the students understand the basics of spectrometry
- To explore the knowledge on molecular spectroscopy.
- To introduce the NMR and MASS spectrometry.
- To elucidate the various separation methods in chromatography.
- To gain knowledge on potentiometry and surface microscope.

UNIT – I: SPECTROMETRY 9

Properties of electromagnetic radiation- wave properties – components of optical instruments– Sources of radiation – wavelength selectors – sample containers – radiation transducers – Signal process and read outs – signal to noise ratio - sources of noise – Enhancement of signal to noise - types of optical instruments – Applications.

UNIT - II: MOLECULAR SPECTROSCOPY 9

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beer's law – Instrumentation - Applications -Theory of fluorescence and Phosphorescence –Theory of Infrared absorption spectrometry – IR instrumentation – Applications – Theory of Raman spectroscopy – Instrumentation – applications.

UNIT - III: NMR AND MASS SPECTROMETRY 9

Theory of NMR – chemical shift- NMR-spectrometers – applications of ^1H and ^{13}C NMR- Molecular mass spectra – ion sources.Massspectrometer.Applications of molecular mass - Electron paramagnetic resonance- g values – instrumentation.

UNIT - IV: SEPARATION METHODS 9

General description of chromatography – Band broadening and optimization of column performance-Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography- principles of GC and applications – HPLC- Capillary electrophoresis – Applications.

UNIT - V: ELECTRO ANALYSIS AND SURFACE MICROSCOPY 9

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ionselective and molecular selective electrodes – Instrument for

potentiometric studies – Voltametry – Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probemicroscopes – AFM and STM.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Ability to understand the concept of spectrometry
- Ability to know the operations of various instruments.
- Able to apply molecular spectroscopy concepts in NMR and MASS spectrometry.
- Ability to understand surface microscopy and its applications.
- Ability to acquire knowledge on surface microscopic techniques and voltametric applications.

TEXT BOOKS:

1. Skoog, D.A. F. James Holler, and Stanky, R.Crouch “Instrumental Methods of Analysis”.Cengage Learning , 2007.
2. Willard, Hobart, etal, “Instrumental Methods of Analysis”. VIIth Edition, CBS, 1986.
3. Braun, Robert D. “Introduction to Instrumental Analysis”. Pharma Book Syndicate, 1987.
4. Ewing,G.W. “Instrumental Methods of Chemical Analysis”, Vth Edition, McGraw-Hill, 1985

REFERENCE BOOKS:

1. Sharma, B.K. “Instrumental Methods of Chemical Analysis : Analytical Chemistry” GoelPublishing House, 1972.
2. Haven, Mary C., etal., “Laboratory Instrumentation “. IVth Edition, John Wiley, 1995.

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	-	3	2	2	-	-	3	-	3	2	1
2	2	2	3	2	2	-	-	2	2	3	2	1
3	2	2	3	3	3	-	2	2	2	3	3	1
4	3	2	3	3	3	-	-	3	2	3	3	1
5	3	-	3	2	2	-	-	3	-	3	2	1

UNIT - IV: INTERACTION OF RADIATION WITH MATTER 9

Interaction of charged particles with matter –Specific ionization, Linear energy transfer, range, Bremsstrahlung, Annihilation - Interaction of X and Gamma radiation with matter: Photoelectric effect, Compton Scattering, Pair production- Attenuation of Gamma Radiation - Interaction of neutron with matter and their clinical significance- Radionuclide used in Medicine and Technology.

UNIT - V: RADIATION EFFECTS AND REGULATIONS 9

Classification of Radiation Damage, Stochastic and Deterministic Effects, Acute Effects of Total Body Irradiation, Long-Term Effects of Radiation, Risk Versus Benefit in Diagnostic Radiology and Nuclear Medicine, Risk of Pregnant Women, Nuclear Regulatory Commission, ALARA Program, Medical Uses of Radioactive Materials, Survey for Contamination and Exposure Rate, Dose Calibrators and Survey Meters, Bioassay, Radioactive Waste Disposal.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyze the low frequency and high frequency effects of non-ionizing radiation and physics of light.
- Define various clinical applications based on ultrasound wave.
- Explain the process of radioactive nuclide production using different techniques.
- Analyze radiation mechanics involved with various physiological systems.
- Outline the detrimental effects of radiation and regulations for radiation safety.

TEXT BOOKS:

1. B H Brown, R H Smallwood, D C Barber, P V Lawford and D R Hose, Medical Physics and Biomedical Engineering, 2nd Edition, IOP Publishers.2001.
2. Gopal B. Saha, Physics and Radiobiology of Nuclear Medicine, 4th Edition, Springer, 2013.
3. R.Hendee and Russell Ritenour “Medical Imaging Physics”, Fourth Edition William, Wiley-Liss, 2002.

REFERENCE BOOKS:

1. S.Webb “ The Physics of Medical Imaging”, Taylor and Francis,1988
2. HyltonB.Meire and Pat Farrant “Basic Ultrasound” John Wiley & Sons,1995
3. John R Cameran , James G Skofronick “Medical Physics” John-Wiley & Sons.1978.

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1	1	-	-	2	1	-	-	-	-	3
2	3	1	2	2	1	-	1	-	-	-	-	3
3	3	1	2	-	-	2	2	-	-	-	-	2
4	2	1	1	-	1	1	1	-	-	-	-	1
5	3	2	3	-	2	1	3	-	-	-	-	3

OBJECTIVES:

- To Understand the various materials and its properties towards electrical and electronics field.
- To cover the properties of conducting materials.
- Make the students to understand various semiconducting and magnetic materials and their properties.
- To give an idea on dielectric and insulating materials.
- To explore the knowledge on optoelectronic and nano materials

UNIT – I: INTRODUCTION 7

Structure: atomic structures and bonding, types of bonding, band formation. Defects and imperfections in solids: Point, Line and Planar defects; Interfacial defects and volume defects. Classification of materials based on bonding: conductors, semiconductors and insulators.

UNIT - II: CONDUCTING MATERIALS 9

Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (manganin, constantan, nichrome, tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

UNIT - III: SEMICONDUCTING AND MAGNETIC MATERIALS 10

Semiconductors: Introduction, types of semiconductors, temperature dependence of semiconductors, compound semiconductors, basic ideas of amorphous and organic semiconductors. Magnetic Materials: classification of magnetic materials, ferromagnetism- B-H curve (Qualitative), hard and soft magnetic materials, magneto materials applications.

UNIT - IV: DIELECTRIC AND INSULATING MATERIALS 9

Dielectric Materials: Introduction, classification, temperature dependence on polarization, properties, dielectric loss, factors influencing dielectric strength and capacitor materials, applications. Insulators: Introduction, thermal and mechanical properties required for insulators, Inorganic materials, organic materials, liquid insulators, gaseous insulators and

ageing of insulators, applications.

UNIT - V: OPTOELECTRONIC AND NANO ELECTRONIC MATERIALS 10

Optoelectronic materials. Introduction, properties, factor affecting optical properties, role of optoelectronic materials in LEDs, LASERs, photo detectors, solar cells. Nano electronic Materials: Introduction, advantage of nanoelectronic devices, materials, fabrication, challenges in Nano electronic materials.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Ability to understand the fundamentals of conducting materials
- Able to define various applications of semiconducting and magnetic materials
- Able to explain the concepts of dielectrics and insulating materials
- Ability to explain various optoelectronic devices and nano electronic materials

TEXT BOOKS:

1. S.O. Kasap “Principles of Electronic Materials and Devices”, 3rd edition, McGraw-Hill Education (India) Pvt. Ltd., 2007.
2. W D Callister, “Materials Science & Engineering – An Introduction”, Jr., John Willey & Sons, Inc, New York, 7th edition, 2007.

REFERENCE BOOKS:

1. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 6th edition, PHI Learning, 2009.
2. Eugene A. Irene, Electronic Materials Science, Wiley, 2005
3. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineers, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd., 2011.

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	2	1	1	1	1	-	-	-	-	-
2	2	2	2	1	2	-	-	-	-	-	-	-
3	3	3	3	-	3	2	-	-	-	-	-	-
4	2	3	3	1	3	3	-	-	-	-	-	-
5	2	3	2	1	3	3	-	-	-	-	-	-

OBJECTIVES:

- To make the student conversant with the water treatment methods including adsorption and oxidation process.
- To provide basic understandings about the requirements of water and its preliminary treatment.
- To study the dynamic processes and understand the features of corrosion and its effects
- To develop and understand the waste water treatment process
- To provide a broad view about the water quality and its standards

UNIT – I: WATER QUALITY AND PRELIMINARY TREATMENT 9

Water Quality-physical-chemical and biological parameters of water-Water quality requirement - potable water standards-Wastewater effluent standards-water quality indices. Water purification systems in natural systems- physical processes-chemical processes and biological processes-Primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification-sedimentation; Types-aeration and gas transfer-coagulation and flocculation, coagulation processes.

UNIT - II: INDUSTRIAL WATER TREATMENT 9

Filtration-size and shape characteristics of filtering media-sand filters hydraulics of filtration-design considerations-radial, upflow, highrate and multimedia filters, pressure filter. Water softening-lime soda, zeolite and demineralization processes – Boiler troubles-scale, sludge, priming, foaming, caustic embrittlement and boiler corrosion.

UNIT - III: CONVENTIONAL TREATMENT METHODS 9

Taste and odour control-Adsorption-activated carbon treatment-removal of color-iron and manganese removal-aeration, oxidation, ion exchange and other methods-effects of fluorides-fluoridation and defluoridation-desalination-Corrosion prevention and control-factors influencing corrosion-Langelier index-Corrosion control measures.

UNIT - IV: WASTEWATER TREATMENT 9

Wastewater treatment-pre and primary treatment-equalization neutralization-screening and grid removal-sedimentation-oil separation gas stripping of volatile organics-biological

oxidation-lagoons and stabilization basins-aerated lagoons-activated sludge process-trickling filtration-anaerobic decomposition-Break point chlorination.

UNIT - V: ADSORPTION AND OXIDATION PROCESSES 9

Chemical process-Adsorption-theory of adsorption-Ion exchange process-chemical oxidation- advanced oxidation process-sludge handling and disposal-Miscellaneous treatment processes.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Gain idea about various methods available for water treatment.
- Appreciate the necessity of water and acquire knowledge of preliminary treatment.
- Interpret the nature of corrosion and its harmful effects.
- Value the various waste water treatment methods.
- Understand about adsorption and oxidation process.

TEXT BOOKS:

1. Metcalf and Eddy, "Wastewater Engineering", 4th ed., McGraw Hill Higher Edu, 2002.
2. G.L.Karia and R.A. Christian, Waste Water Treatment, Concepts and Design Approach, Prentice Hall, 2013.
3. Joanne E. Drinon and Frank Spellman, Water and Waste Water Treatment, CRC Press, 2012.

REFERENCE BOOKS:

1. S.P. Mahajan, "Pollution control in process industries", 27th Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, "Green Chemistry: An Introductory Text", 2nd edition, RSC publishing, 2010.
3. C.S. Rao, "Environmental Pollution Control Engineering", New Age International, 2007.
4. M.J. Hammer and M.J. Hammer (Jr.), Water and Waste Water Technology, Pearson, 2011.

CO	PO											
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1	2	1	1	1	-	1	-	-	2	-	-	1
2	1	2	1	1	-	-	-	-	1	-	-	1
3	3	1	1	-	3	1	-	-	-	-	-	1
4	2	-	-	-	1	-	-	-	-	-	-	1
5	3	-	-	-	1	-	-	-	-	-	-	1